Advanced Hybrid Solar and wind Power Generation

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Abstract— Under current acute power shortage scenario with increasing cost of natural gas, coal and other power generator turbine fuel, there is an urgent and great need of finding alternate source of energy to generate electricity. With new technological development energy generation from solar panel and windmill is easy, convenient and eco-friendly. Generation of Solar and Wind energy from solar panel and windmill respectively is possible. Basically we are using solar panel & wind mill are the main sources. This paper mainly deals with the hybrid generation of energy. Both the sources can be used in one system for production of energy. As both the sources are easily available in the atmosphere round the clock, so implementation of such kinds of projects will fulfill the requirements of each consumer with very low cost. In the day solar and wind is available whereas in the night wind is available so there will be continuous flow of generation of energy. After studying and working on this paper generation of energy from both the sources at a time is possible. Basically from solar cell & wind mill DC voltage obtained which is store in the battery & through inverter circuit it gives 230V AC output which can be used for building surrounding lights & stair case lights & as well as main load.

Key words: Hybrid Solar, wind Power

I. INTRODUCTION

Under current acute power shortage scenario with increasing cost of natural gas, coal and other power generator turbine fuel, there is a very urgent and great need of finding alternate source of energy to generate electricity. There are some natural and eco-friendly sources of generating power, which requires more R&D by using latest technologies to make them more cheap, efficient and easy to use and maintain for non-technical person .

In this project we are using solar panel & wind mill are the main sources of energy generation. Basically solar cell & wind mill gives the DC and AC voltage output which is store in the battery & by using inverter circuitry it gives 230V AC output which can use for building surrounding lights & stair case lights & as well as main load.

Along with this government is also providing help and subsidies in set up of hybrid solar-wind power plant. This all things together provide a great new platform for setup and generation of new hybrid solar and wind power plant for individual customer. This project will try to bring all component and aspects of generating energy from solar cell easy, convenient and in user friendly way for non-technical person, by using latest development in the field of electrical and electronics.

Today‘s scenario is that many region of our country facing a problem of load shading i.e. scarcity of electricity. Energy generation with non-renewable sources such as natural gas, coal and other power generator fuel is not easy and it is costly also. So there is a very urgent and great need of finding alternate source of energy to generate electricity.

As we have seen that because of scarcity of electricity there is very emergency to find out alternate source of energy therefore main objective of this project is to generate electricity from renewable sources such as sunlight, wind and tides. In this project we have considered two main sources i.e. sunlight and wind to generate electricity.

The installed capacity of renewable energy connected to grid in India is around 33.8 GW on December 2014 the total 66% is from wind energy system and 4.6% from solar photovoltaic system and remaining fro other renewable energy sources so we combine both the systems together to increase efficiency.

sources	Installed capacity
wind	22,465.03
solar	3,062.68
Small hydro	3,990.80
biomass	1,365.20
Bagasse cogeneration	2,800.35
Waste to power	107.58
Total installed	33,791.74

Table 1:

A. Solar Tracking System:

Fig. 1:

This is a power generating method from sunlight. This method of power generation is simple and is taken from natural resource. This needs only, maximum sunlight to generate power. This project helps for power generation by setting the equipment to get maximum sunlight automatically. This system is tracking for maximum intensity of light. When there is decrease in intensity of light, this system automatically changes its direction to get maximum intensity of light.

A Solar Tracker is basically a device onto which solar panels are fitted which tracks the motion of the sun across the sky ensuring that the maximum amount of sunlight strikes the panels throughout the day. After finding the sunlight, the tracker will try to navigate through the path ensuring the best sunlight is detected. The Solar Tracking System is made as a prototype to solve the problem. It is completely automatic and keeps the panel in front of sun until that is visible. The unique feature of this system is that instead of taking the earth as its reference, it takes the sun as a guiding source. Its active sensors constantly monitor the sunlight and rotate the panel towards the direction where the intensity of sunlight is maximum. The power generated from this process

is then stored in a lead acid battery and is made to charge an emergency light and is made to glow during night.

B. Wind Power:

Wind power is the conversion of wind energy into a useful form of energy. All renewable energy (except tidal and geothermal power), ultimately comes from the sun. About one or 2 per cent of this energy is converted to wind energy (which is about 50-100 times more than the energy converted to biomass by all plants on earth . Differential heating of the earth‘s surface and atmosphere induces vertical and horizontal air currents that are affected by the earth‘s rotation and contours of the land Winds are influenced by the ground surface at altitudes up to 100 meters.

Fig. 2:

Wind is slowed by the surface roughness and obstacles. When dealing with wind energy, we are concerned with surface winds. A wind turbine obtains its power input by converting the force of the wind into torque (turning force) acting on the rotor blades. The amount of energy which the wind transfers to the rotor depends on the density of the air, the rotor area, and the wind speed. The kinetic energy of a moving body is proportional to its mass (or weight). The kinetic energy in the wind thus depends on the density of the air, i.e. its mass per unit of volume. In other words, the "heavier" the air, the more energy is received by the turbine.

Number of blades -

Most common design is the three-bladed turbine. The most important reason is the stability of the turbine. A rotor with an odd number of rotor blades (and at least three blades) can be considered to be similar to a disc when calculating the dynamic properties of the machine.

A rotor with an even number of blades will give stability problems for a machine with a stiff structure. The reason is that at the very moment when the uppermost blade bends backwards, because it gets the maximum power from the wind, the lowermost blade passes into the wind shade in front of the tower.

There are basically two type of windmill as follows:

1) Horizontal axis windmill
2) Vertical axis windmill

Horizontal axis windmill -

Wind is created by the unequal heating of the Earth‘s surface by the sun. Wind turbines convert the kinetic energy in the wind into mechanical power that runs a generator to produce clean, nonpolluting electricity. Today‘s small-scale turbines are versatile and modular. Their rotors consist of two or three blades that are aerodynamically designed to capture the maximum energy from the wind. The wind turns the blades, which spin a shaft connected to a generator that makes electricity. A mainframe supports the rotor, generator, and tail that align the rotor into the wind.

Vertical axis windmill -

The first practical windmills were the vertical axle windmills invented in eastern Persia (what is now Afghanistan), as recorded by the Persian geographer Estakhri in the 9th century. The authenticity of an earlier anecdote of a windmill involving the second caliph Umar (AD 634–644) is questioned on the grounds that it appears in a 10th-century document. Made of six to twelve sails covered in reed matting or cloth material, these windmills were used to grind grain or draw up water, and were quite different from the later European horizontal-axis versions. Windmills were in widespread use across the Middle East and Central Asia, and later spread to China and India from there.

Some popular treatments of the subject have speculated that, by the 9th century, the Persian-style vertical-axle mills spread to Europe through Al-Andalus (Islamic Spain). This has been denied by the specialist of medieval European technology, Lynn White Jr., who points out that there is no evidence (archaeological or documentary) that the Afghanistan-style vertical-axle windmill spread as far west as Al-Andalus, and notes that "all Iberian windmills rotated on horizontal axles until towards the middle of the fifteenth century." Another historian of technology, Michael Jonathan Taunton Lewis, suggested an alternative route of transmission for the Islamic horizontal-shaft windmill, with its diffusion to the Byzantine Empire and its subsequent transformation into the vertical-shaft windmill in Europe.

C. Battery:

An electrical battery is one or more electrochemical cells that convert stored chemical energy into electrical energy. Here are two types of batteries: primary batteries which are designed to be used once and discarded when they are exhausted, and secondary batteries which are designed to be recharged and used multiple times.

1) Principle Of Operation:

A battery is a device that converts chemical energy directly into electrical energy It consists of a number of voltaic cells; each voltaic cell consists of two half cells connected in series by a conductive electrolyte containing anions and cations. One half-cell includes electrolyte and the electrode to which anions (negatively charged ions) migrate, i.e., the anode or negative electrode; the other half-cell includes electrolyte and the electrode to which cations (positively charged ions) migrate, i.e., the cathode or positive electrode

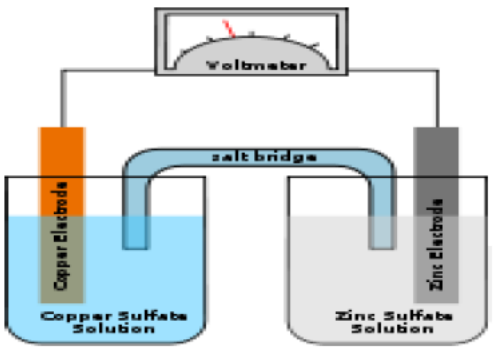

Fig. 3:

In the redox reaction that powers the battery, reduction (addition of electrons) occurs to cautions at the

cathode, while oxidation (removal of electrons) occurs to anions at the anode. The electrodes do not touch each other but are electrically connected by the electrolyte. Many cells use two half-cells with different electrolytes. In that case each half-cell is enclosed in a container, and a separator that is porous to ions, but not the bulk of the electrolytes, prevents mixing.

Each half cell has an electromotive force (or emf), determined by its ability to drive electric current from the interior to the exterior of the cell. The net emf of the cell is the difference between the emfs of its half-cells, as first recognized by Volta. Therefore, if the electrodes have emfs ε1 and ε2, then the net emf is ε2-ε1; in other words, the net emf is the difference between the reduction potentials of the half-reactions

D. Inverter:

The circuit wired around IC CD4047 is an astable multivibrator operating at a frequency of 50 Hz. The Q and Q outputs of this multivibrator directly drive power MOSFETs IRF540. The configuration used is push-pull type. The inverter output is filtered and the spikes are reduced using MOV (metal oxide varistor). The inverter transformer used is an ordinary 9-0-9, 1.5A mains transformer readily available in the market. Two LEDs (D6 and D7) indicate the presence of mains/battery. The mains supply (when present) is stepped down rectified and filtered using diodes D1 through D4 and capacitor C1. A part of this supply is also used to charge the battery. In place of a single 12V, 4Ah battery, one may use two 6V, 4Ah batteries (SUNCA or any other suitable brand). The circuit can be easily assembled on a general-purpose PCB and placed inside a metal box. The two transformers may be mounted on the chassis of the box. Also, the two batteries can be mounted in the box using supporting clamps. The front and back panel designs are shown in the Fig. 4.4. The same circuit can deliver up to 100W, provided the inverter transformer and charging transformer are replaced with higher current rating transformers, so that the system can be used for some other applications as well.

E. Working:

1) The solar and wind power will be taken from the solar panel and wind mill respectively.
2) This energy will be stored in the battery; the stored voltage is DC voltage which is required to convert into AC by using inverter.
3) Then this voltage is applied to the load.

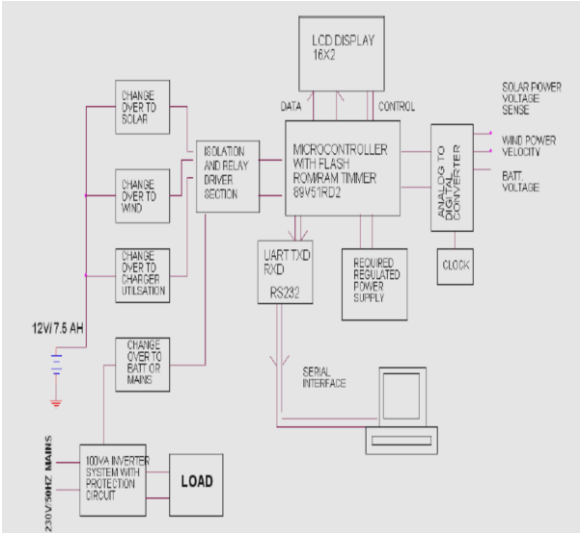

Fig. 4:

4) Solar panel is used convert the solar energy into electrical energy and windmill is used convert the wind energy into the electrical energy.
5) 4. The output from solar panel is 20watts per panel and windmill is 3-4 watts this given to the battery.
6) 5. The battery used for storage purpose which is DC voltage.
7) 6. Now the DC voltage is converted into the AC through the inverter circuit the MOSFET is used for inverter circuit because it gives regulation at load.
8) 7. The microcontroller is used for control operation of battery to avoid the overcharging and undercharging through the relay circuit.
9) 8. The LCD display is used to display status of battery. If the battery will overcharge or undercharge it also display on the LCD display.

II. Conclusion

We will try to bring all component & aspects of generating energy from solar cell easy, convenient & in user friendly way for non-technical person, by using latest development of electrical and electronics. It is useful for providing grid quality, reliable power in rural areas where the line voltage is low and insufficient to connected load. The sun light is continuously available at day time and wind is available during day as well as night so that this system runs continuously. In future there is shortest of the non-conventional energy sources such as coal, gases, atomic, fuel etc. At that time we can use the conventional energy sources for production of electricity.

Acknowledgment

Self-sustaining solar powered homes becoming the next big thing in home development. In near future we can build a more sophisticated and less space consuming hybrid system that can handle more loads.

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