

Review Paper Solar Energy Generatio Recent Trends

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Abstract- Solar energy is a renewable energy source which have tremendous potential in compensating the short fall due to more demand in electrical energy drawn from non-renewable energy sources such as fossil fuels, coal, petroleum, hydropower plant generations and nuclear power plant. It also reduces environment pollution and noise. Fabrication of fundamental unit (solar cell) has undergone number of improvements from first generation (silicon based vapour solar cell) to another generation in order to achieve low cost and high efficiency as possible. An photovoltaic installation in electrical system is cheapest way to produce electricity from solar energy. This review paper also tries to emphasize the various practices to promote the benefits of solar energy.

Index terms- Solar energy, renewable energy, PV cell, electricity

INTRODUCTION

Solar energy is a limitless source of energy which is available at no cost [1] [2]. most of the countries suffering from the same problem of high demand with less electricity generation along with a serious decline in the availability of natural resources, fuels, coal and gases etc. The generation of hydro power plant varies with inflow of water from catchment area thus as the capacity of hydro power plant decreases the power crises arise. The solar power plant may be installed in way to work in unison during sun to compensate the shortage of electricity. Moreover this installation is to be done in such a way that solar panel will cover the rivers or reservoir reducing the evaporation which enhancing the capacity of dam. On the other hand the solar panel covering this area will generate electrical power which will the enhance the power generation of the system. Moreover by using some newer technologies this power generated

may be integrated with the power grid to enhance the capacity of grid.

The R & D in solar energy will be used to deal with alternative energy [3] – [4].solar cell fabric , floating solar array, solar panel roof are some of the new concept developed to use solar energy at large scale and act as effective frame to improving energy resource crises economically and reasonable method of future energy resource utilization. The advantages of solar energy sources are enormous as they are free from gas emissions, air pollution, noise in environment point of view.

SOLAR ENERGY

SOLAR CELL (PHOTOVOLTAIC CELL) AND WORKING

Earlier these are thin silicon wafer based [5] that transform solar energy into electrical energy but now modern photovoltaic technology is based on the principle of electron hole creation in each cell composed of two different layers (p-type and n-type materials) of a semiconductor material, as shown in Figure 1. In this arrangement of the structure, when a photon of sufficient energy fall on the p-type and n-type junction, an electron is ejected by gaining energy from the striking photon and moves from one layer to another. This creates an electron and a hole (charge carriers) in the process and now these charge carrier get collected at the respective electrodes establishing the potential difference across the p-n junction. The generation of voltage difference noticed at the p-n junction of the cell by this process is result in electrical power generation.

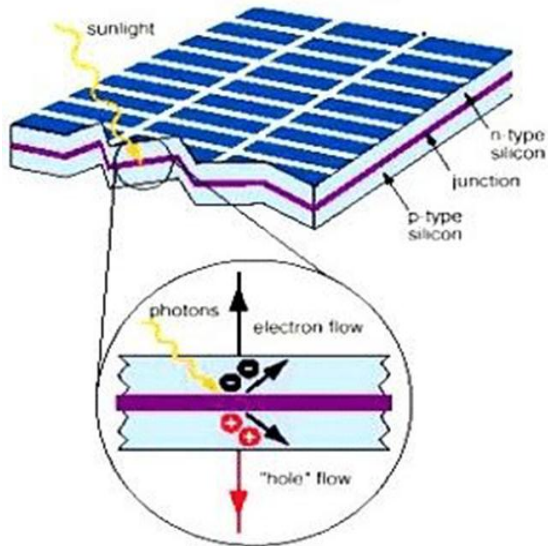


Figure 1: Internal reaction in solar cell and working [5]

SOLAR ENERGY SYSTEM

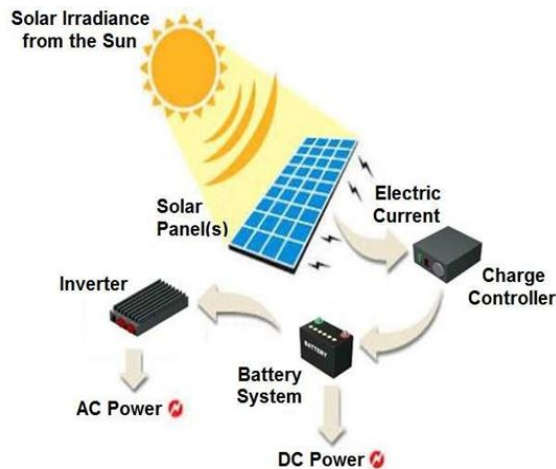


Figure 2: working of solar energy system [9]

CHARGE CONTROLLER - A charge controller or charge regulator is basically a voltage and/or current regulator to keep batteries from overcharging. It regulates the voltage and current coming from the solar panels going to the battery. Most batteries need around 14 to 14.5 volts to get fully charged.[7]

BATTERY SYSTEM- it is a device which store direct current (power) coming from solar panel and which is used when no sunlight available like in night time or rainy or foggy periods

INVERTER -it is used to convert direct current into alternate current which is used in various electrical appliances.

MODELING OF PANEL

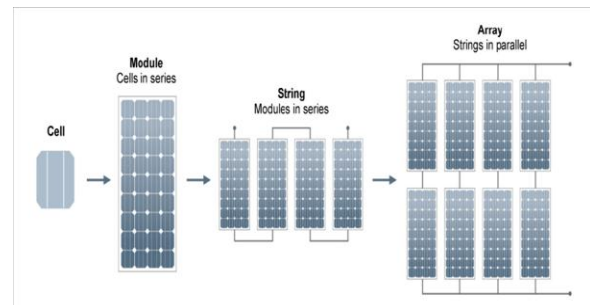


Figure 3: PV array module [8]

PV CELL - fundamental unit of solar energy system.

PV MODULE- it is made by solar cell circuits sealed in an environmentally protective laminate. Generally sizes from 60W to 170W. Usually a number of PV modules are arranged in series and parallel to meet the energy requirement. [9]

PV Panel -It includes one or more PV modules in which pv cell assembled in series connections.

PV ARRAY-It is containing of several amount of PV cells in series and parallel connections. Series connections are responsible for increasing the voltage of the module whereas the parallel connection is responsible for increasing the current in the array. It generates maximum 180W in full sunshine. Large the total surface area of the area of the array, more solar electricity it will produce.

NEWER METHODS WHICH WILL ENHANCE THE USE OF SOLAR ENERGIES ALONG WITH INDIA ' ACHIEVMENT IN SOLAR ENERGY

Day by day new trends and innovations are being developed throughout the world in R&D centers, automobile sectors and domestic use in institutions, hostels to reduce the energy wastage and to generate the power by solar devices. Many of them are explained given below:

1. In the race of achieving solar cell of higher efficiency it have been developed the solar cell having conversion efficiency more than 37% as compared to the previous solar cells having efficiency of 27 % made of two materials.

Now India's company Tata power is going to install the solar panels having 35% efficiency [10]. In These cells three photo absorption layers are stacked together. This has been developed by stacking Indium, Gallium and arsenide as the bottom layers. These cells have capability of absorbing the light from various wavelengths available in sunlight and convert into electrical energy. Through optimal process the active area has been increased. This breakthrough in technology has been done by new energy and industrial technology development organization.

The conversion efficiency of solar panels/plates is increased by newer devices of cleaning these panels. The device makes use of automated “dry-sweep” to push dust and dirt away from the surface of these devices which is very rugged and have low maintenance cost. The device is powered by the lithium ion batteries. These batteries are charged by the array itself and have high efficiency. The device has moving parts. It is very interesting that this act like a robotic arm and automated work with scheduling. The device can jump the obstacle between the panels[11].

2. In shortage of supply of various energies from conventional and renewable sources, now whole world is doing R & D to extract more and more energy using various new technologies. In this direction an effort made by Japan which developed a fabric known as a solar cell fabric capable of extracting the solar energy from sunlight while you are moving by wearing this fabric made cloth. This fabric is made from wafer thin solar cells woven in a stylish way. The electricity generated will be capable to charge the mobile and other portable electronic gadgets. The thread used will be stronger and which increases the life or durability of the fabric cloth.

By using above idea, we can make window blind makers and certain type of curtain to generate electric power when sun rays fall on these. Various companies developing this type of fabric in association with solar cell maker to recharge their small gadgets [12].

3. Solar panel / solar energy system can be installed on the roof area of buildings in cities if there is lack of space on ground in cities so it can fulfill the needs of at least that household like this energy is used in

water pumping motor, in water heating and in other electric appliance to reduce the electricity load from grid supply.

this new trend of solar panel roof will work greatly in remote area where grid supply is not viable these panels generate power for themselves and supply electricity to the neighbours also who cannot afford the cost of installation. This will help nearby masses and community in that region where distribution of power is not feasible by other ways & transmission may not be possible due to heavy expenditure.

In some advanced countries like china the roof of the max. Of the homes is made of solar panel by using aluminum or strong alloy to support the weight of panels.

4. The solar panel can be installed on the vehicles where it is possible so that charging of batteries and other devices in the vehicle may be done with the help of solar energy. Whenever the solar rays fall on the panel this will improve the electrical efficiency of the vehicles.

Japan and in other advanced countries where conversion technologies from solar to electrical are being used frequently and sufficiently, have already done this experiment to use solar energy more and more. In India also solar panels have been installed in metro railway service.

Indian Railways on July 14 launched first solar-powered DEMU (diesel electrical multiple unit) train from the Safdarjung railway station in Delhi. The train will run from Sarai Rohilla in Delhi to Farukh Nagar in Haryana. A total of 16 solar panels, each producing 300 Wp, are fitted in six coaches.

5. Solar panels can be installed on surfaces of water bodies. This floating solar array concept was first come in light by US. The development of floating photovoltaic power stations is mainly photovoltaic plus floating type and installed on water has no support foundation and cable trench excavation . large open surface effectively avoid the restriction of shadows on the efficiency of photovoltaic modules, uniform area and long illumination time effectively increasing power generation efficiency[13]

India is planning to construct world's largest floating solar power plant of 1GW on the Indira Sagar Dam in MP which would dwarf the world's current largest floating PV array, a 150MW project in Anhui, China.

Floating solar arrays are an increasingly attractive option for large-scale PV deployment at reservoirs and alongside hydropower facilities, especially where land use is constrained elsewhere, according to a World Bank report on the sector published last year. [14]

6. To satisfy increasing demand of electrical power demand is increasing and keeping in mind climatic concerns it is desired to integrate renewable energy sources especially solar energy with utility grid. By using better flexibility in integration through power electronics, Harmonics can be reduced and the reactive power can be balanced.

1. In these days most of the power industries switchover side by side starting manufacturing of the solar inverters of high capacity. These may be utilized to get emergent power if not continues at remote locations where there is no grid supply.
2. CSP systems technology [15] is used for power generation in the system large, flat, sunlight mirrors known as heliostats receive sun light at the top of the tower. A fluid for heat transfer is used to generation the steam which is used for production of electrical power .In some countries the capacity of these plant as high as up to 200 MW. These power tower are very popular in these days because of solar to electrical conversion efficiency is high [16].

CONCLUSION

Use of conventional methods for electricity generation causes continuous depletion of energy resources along with harm to environment so there is a need to find alternative generation process which is solar energy generation because of its efficiency, advancements in it's technology, ecofriendly characteristics, simplicity and durability. Moreover the power generation due to hydro power plant is not also regular due to irregular flow of water from the catchment area. So it is concluded that solar power plant may be installed in such a way so these may work in unison with hydro and other methods of generation to enhance the clean and green energy.

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