

REVIEW PAPER ON SOLAR ENERGY

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Abstract- Solar energy refers to capturing the heat energy from the sun which is transferred in three ways: by radiation, conduction, and convection. It is a non-vanishing renewable source which is free of cost. 173,000 terawatts of solar energy strike the earth each day, which is more than 10,000 times the world's total energy use. It is generated as per applications like industrial, commercial, and residential. This paper tells us about solar energy in brief, what is it? how it is converted into different energy.

I. INTRODUCTION

Solar energy is an energy which is obtained by capturing heat and radiation light from the sun, this is an unlimited source of energy which is available at no cost. Every day earth receives sunlight about (1366W Approx.) The major benefit of solar energy over the conventional power generators is that the sunlight can be directly converted to solar energy with the use of photovoltaic (PV) solar cells. [2]

Solar energy required considerably lower manpower expenses over conventional energy production technology.

II. SOLAR PANEL (SOLAR CELL)

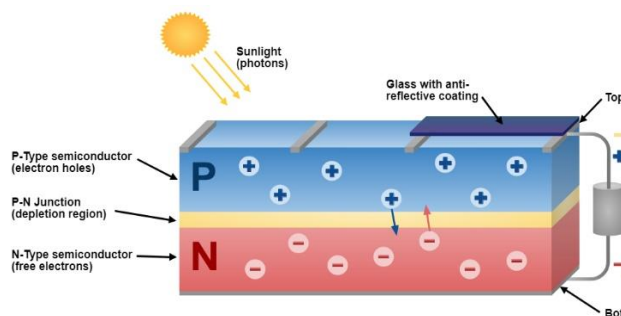


Figure 1: - Internal Reaction inside PV solar cell

The solar panel (also known as PV panels) or solar cells which converts light from sun receiving on earth which compose of “photons” particle into electricity. Solar panels consist of various kinds of semiconductor

materials. It has two types: positive charge and negative charge shown on fig.1. Solar panel comprised of several individual solar cells which itself composed of layer of silicon, phosphorous (which provide negative charge), and boron (which provide positive charge) When the cell absorbed photons from sunlight, electrons are knocked free from silicon atoms and are drawn off by a grid of metal conductors, pressure a flow of electric direct current. The entire process is known as Photovoltaic Effect.

III. TYPES OF SOLAR PANEL

There are three types of Solar panel: -

1. Monocrystalline Solar Panel
2. Polycrystalline Solar Panel
3. Thin Film Solar panel

1. MONOCRYSTALLINE SOLAR PANEL

These panels conduct electricity more efficiently and perform better in high temperatures and shaded conditions, enabling them to generate more solar power than other panels of the same size. [2] That makes them ideal for smaller rooftops. Because this panel has efficiency rate of 15%-24%, which is higher than all other types of solar panel. However, these are the most expensive panels and generate more waste in the manufacturing process.



Figure 2: - Monocrystalline solar panels

2.POLYCRYSTALLINE SOLAR PANEL

Polycrystalline or multicrystalline solar panels are composed of polycrystalline solar cells, because of this the panel look blue. They are less efficient but are less expensive. Because this panel has efficiency rate of 12%-16%, which is lower than Monocrystalline solar panels and higher than Thin film solar panel. There is less silicon waste in the manufacturing process. These are the most prevalent solar panels globally, primarily due to a production boom in China over the last few years.



Figure 3: - Polycrystalline solar panel

3.THIN FILM SOLAR PANEL

Thin Film solar cell, design to convert light energy into electrical energy (through photovoltaic effect) it composes of micron- thick photon absorbing material layers laid over a flexible substrate. It is a commercially available but newer technology that makes sense where space is not an issue. Thin film solar panels are low cost, easy to produce, flexible, portable, and lightweight. Because this panel has efficiency rate of 7%-13%, which is lower than all other types of solar panel [5] Thin film solar cells were used for calculator watches, etc. They are expected to be less durable and to have a shorter lifespan.



Figure 4: - Thin Film Solar panel

TYPES OF SOLAR PANEL

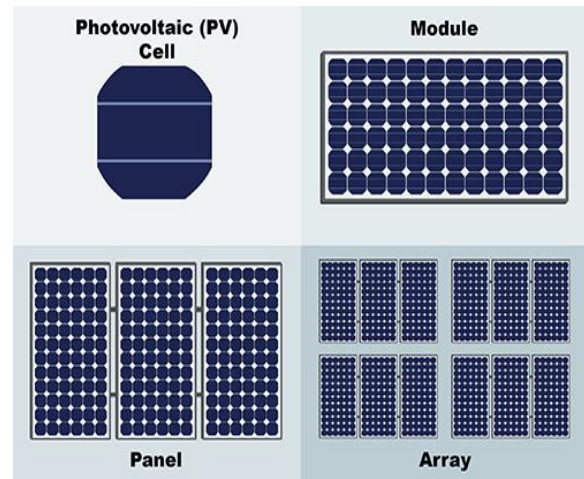


Figure 5: - Types of solar panel

1.PHOTOVOLTAIC MODULE

A single solar cell cannot provide required useful output. So to increase output power level of a PV system, number of such PV solar cell is connected. The Module is encapsulated with tempered glass (or other transparent material) on the front surface, and a with protective and waterproof material on the back

surface. The edges are sealed for weatherproofing, and often there is an aluminum frame holding everything together in a mountable unit. Backside of the module there is a junction box, or wire lead present for providing electrical connections. [3] Generally, sizes from 60W to 170W. Usually a number of PV modules are arranged in series and parallel to meet the energy requirement.



Figure 6: - Photovoltaic Module (Multiple Cell)

2. PHOTOVOLTIC PANEL

PV panels include one or more PV modules assembled as a pre-wired, field-installable unit. The modular design of PV panels allows systems to grow as needs change. Modules of different manufacture can be intermixed without any problem, as long as all the modules have rated voltage output within 1.0-volt difference.

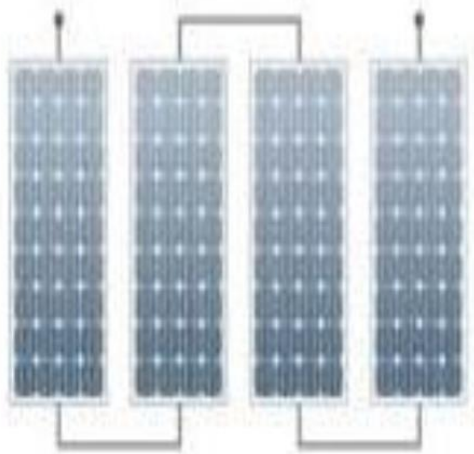


Figure 7: - Photovoltaic Panel

3. PHOTOVOLTAIC ARRAY

A PV Array consists of a number of individual PV modules or panels that have been wired together in a series or parallel. 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 can be as small as a single pair of modules, or large enough to cover acres. It generates maximum 180W in full sunshine. Large the total surface area of the area of the array, more solar electricity it will produce.



Figure 8: - Photovoltaic Array

IV. HOW SOLAR ENERGY IS GENERATED

Solar Panel or PV cells Convert Sunlight to Direct Current (DC) electricity. Charge Controller work as control the power from solar panel which reverse back to solar panel get cause of panel damage. [4] Battery System act as storage of electric power is used when sunlight not available (i.e. night). From this system connected to inverter for convert Direct Current (DC) into Alternating Current (AC).

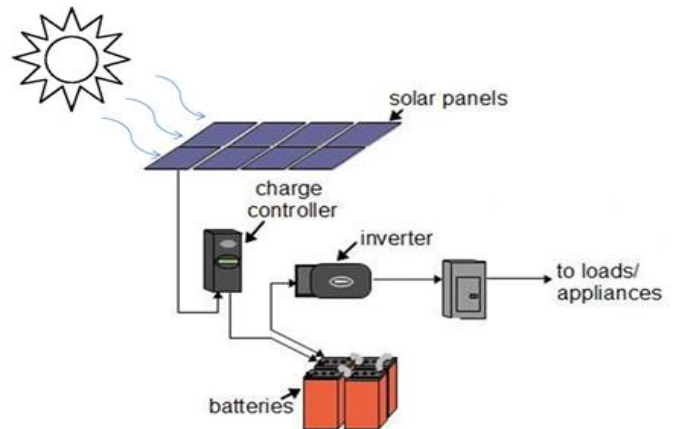


Figure 9: - Generation of solar energy

V. CONCENTRATING SOLAR COLLECTOR

A Solar collector that uses Reflective surface to concentrate sunlight onto a small area, where it is absorb and converted into heat or, in the case of solar photovoltaic device, into electricity. Concentrators can increase the power flux by hundred time. Concentrating PV modules/Array track the sun throughout the day and use concentrating device to reflect direct sunlight onto solar cell to produce electricity directly. Types of solar collector are as follows.

- 1.Parabolic Trough Reflector
- 2.Fresnel
- 3.Prabolic Dish
- 4.Central Receiver

1. PARABOLIC TROUGH REFLECTOR (PTC)

A parabolic trough comprises a linear parabolic reflector that concentrates sunlight on a receiver that is positioned along the focal line of the reflector. The receiver is a tube placed directly over the middle of the parabolic mirror and filled with a working fluid. The heat absorbed by the working fluid transfers to water for producing steam. The focus of solar radiation changes with the change in the Sun's elevation. The reflector keeps following the sun during the day by tracking along a single axis. [7] A working fluid is heated 150-350 0Cas it flows though the receiver is then used as heat source for a power generation system. Among all the concentrated Solar collectors, trough collector is the most develop technology.

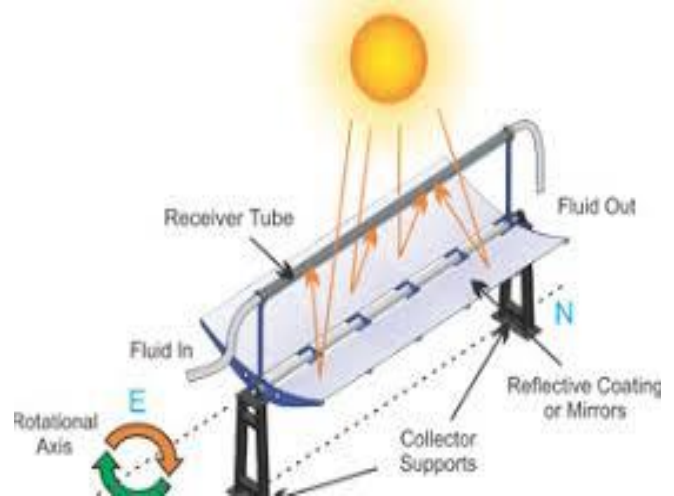


Figure 10: - Parabolic Trough Reflector

2.FRESNEL

Fresnel reflectors contain many thin mirror type strips to concentrate sunlight on tubes through which the working fluid is pump. In this type of lens, the refraction happens to produce in the surface, while the large material between the two surfaces doesn't have any problems in the refraction. It will use raise more temperature than conventional one and also used in furnace heating. [6] It installation has been used for surface modifications of metallic materials. This equipment is applying solar energy in the field of high and very high temperatures. These temperatures are achieved in a few seconds. Fresnel concentrator performed 34.3% reduction in reflective area compared to a parabolic of the same diameter, the 20 minutes series of action performance needed for manual adjustment in order to track the sun proved to be a major disadvantage with this device.

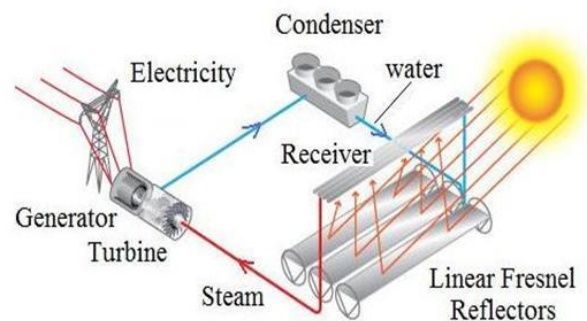


Figure 11: - Fresnel Reflector

3. PARABOLIC DISH

A Parabolic Dish Collector also known as Dish Stirling. It is similar in appearance to a large satellite dish, but has mirror-like reflectors and absorbs at the focal point. The reflector tracks the sun along dual axes. This system provides efficiency (between 31% to 32%). By this dish it produces in MW level in solar plant. This is the highest conversion performance of the concentrating solar power technology.

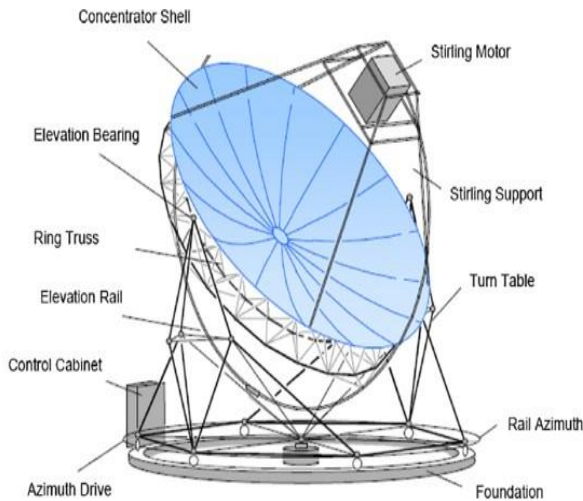


Figure 12: - Parabolic Dish

4. CENTRAL RECEIVER

Central receivers are one of the most promising applications in the utilization of solar energy to produce electric power on a large scale. It is also called as "Power Tower". It operates by reflecting surface called heliostats (Heliostats are large flat or slightly curved mirrors which are mounted on metallic structures) are laid around a central tower where they reflect solar irradiance to a receiver on the top of the tower. The receiver collects the sun's heat transfer fluid, which is used to generate a steam turbine located at the foot of the tower for production of electricity.

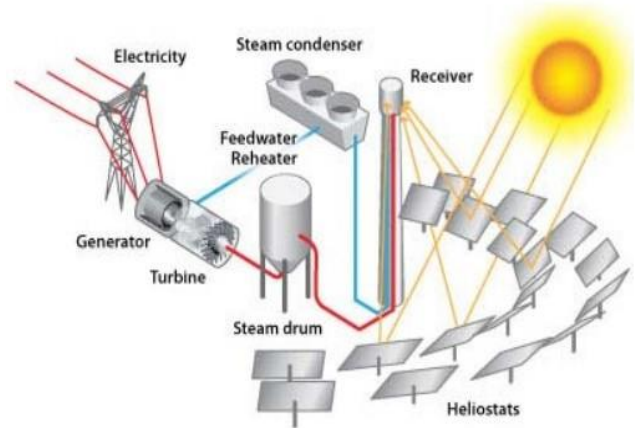


Figure 13: - Central Receiver

Advantages of Solar Energy

- It is a truly renewable energy source
- Reduces the electricity Bills
- Low Maintenance Cost
- Eco-Friendly
- Easy installation
- Long Lasting Solar cells.
- It has no moving part and not required additional fuel.

DISADVANTAGE OF SOLAR ENERGY

- The initial cost of purchasing a solar system is high.
- Solar energy storage is expensive
- Uses a lot of space
- No generation of energy, when the sun is not shining

APPLICATION OF SOLAR ENERGY

It is used in many applications some of them are mentioned below.

- Solar Water Heater
- Solar Pump
- Solar Cooker
- Solar Furnaces
- Solar Electric Power Generation
- Solar Green House
- Solar Cars



Figure 14: - Solar Water heater



Figure 15: -Solar Green House



Figure 16: - Solar Pump



Figure 17: - Solar cooker

VI. CONCLUSION

This paper presents a review on solar energy. It is a renewable energy source. Most of the people are aware about non-renewable energy resources. The use solar energy has increased more popular due to their economic benefits, energy free, does not create pollution, on Battery Backup Solar Energy can even provide Electricity 24x7 even at night. It has more benefits compared to other forms of energy like fossils fuels and petroleum deposits. It is an alternative which is promise and consistent to meet the high energy demand. Research on solar cell and solar energy is promise has a future worldwide.

ACKNOWLEDGEMENT: -

We want thanks our principal Prof. Anand Bhalerao sir, and our head of department Prof. D S. Bankar sir and all the staff members of electrical engineering department who helped and guide us for making the review paper.

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