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A Review Paper on Solar Energy Based Electricity Generation and its Utilization

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Abstract:

Solar energy, which is generated by sunlight, is a non-depleting, renewable, and environmentally beneficial form of energy. Enough solar energy hits the planet every hour to satisfy the world's annual energy needs. Electricity is required every hour in today's generation. Solar energy is used for a variety of purposes, including industrial, commercial, and domestic. It is readily able to extract energy from direct sunlight. As a result, it is highly efficient and does not pollute the environment. In this paper, we looked at solar energy derived from sunlight and explored future trends and features. The article also aims to describe how solar panels operate, as well as the many uses and techniques for promoting solar energy's benefits.

Keywords: Solar panel, Photovoltaic cell, PV panel modelling, Solar Concrete, Renewable energy.

I. INTRODUCTION

Due to the diminishing supply of renewable energy resources, the last 10 years have become more essential for solar energy to get explored as much as possible. It is certain to become more cost-effective in the coming years, and to improve as a technology in terms of both cost and applicability. On a daily basis, the earth gets sunshine from sun. This is a limitless supply of energy that is completely free. Solar energy has a significant advantage over other traditional power producers in that sunlight may be transformed directly into solar energy using the tiniest photovoltaic (PV) solar cells. There has been a significant amount of study towards combining the Sun's energy process by producing solar cells/panels/modules with high converting forms. When compared to the pricing of various fossil fuels and oils during the last ten years, one of the most significant advantages of solar energy is that it is free and available in huge amounts. Furthermore, compared to traditional energy production technologies, solar energy requires far less personnel.

II. SOLAR ENERGY

Solar energy is a quantity of energy in the form of heat and radiations. Figure 1 depicts the situation. The sun's radiant light and heat are a natural source of energy that may be harnessed through a variety of ever-evolving and growing technologies such as solar thermal energy, solar architecture, solar heating, molten salt power plants, and synthetic photosynthesis. The vast amount of solar energy accessible makes it a very enticing source of energy. Solar radiation returns 30 percent (about) to space, while the remainder is absorbed by the ocean, clouds, and land masses.

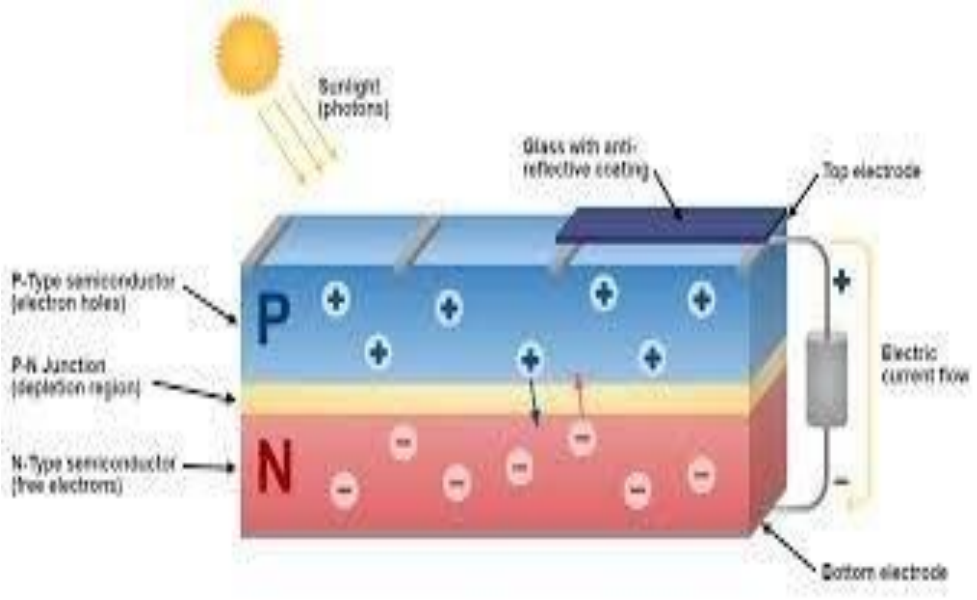

Figure 1 Internal of Reaction of Solar energy [1]

III. SOLAR ENERGY IN ACTION

Photovoltaic (PV) cells Direct Current (DC) power may be generated by converting sunlight. Charge controllers control the electricity from solar panels, which can cause panel damage if the current is reversed back to the panels. When sunshine is not available during night time, a battery system is utilised to store electric power. This system is linked to an inverter, which converts Direct Current (DC) to Alternating Current (AC).

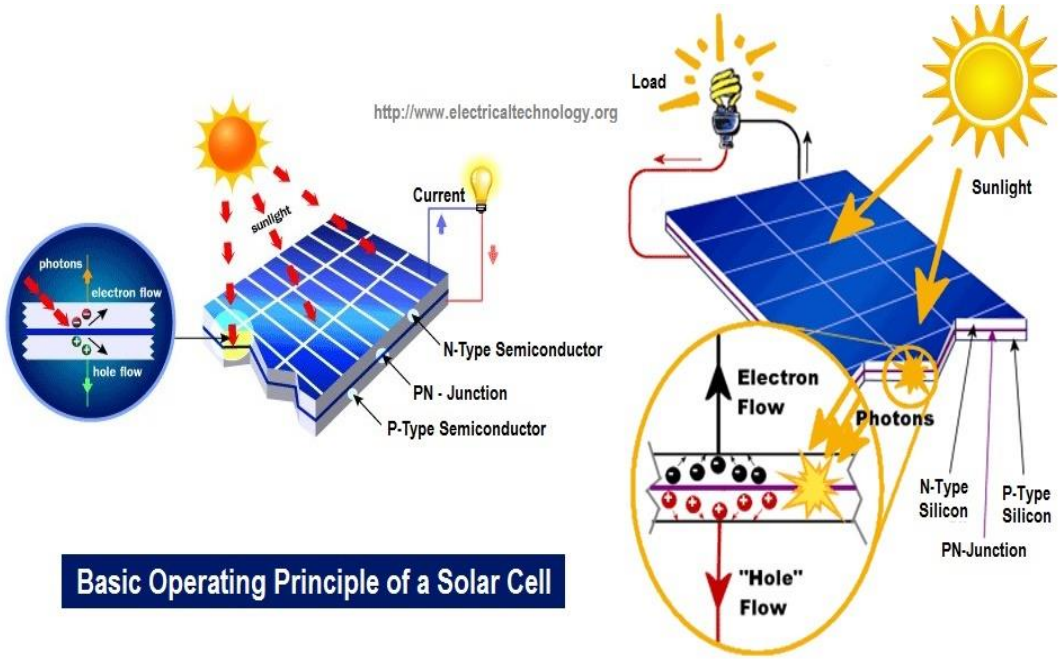

Figure 2 Working of solar energy [2]

IV. PV PANEL MODELING

A. *Solar Cell (Photovoltaic Cell)*

Solar radiation was immediately transformed into electricity by the cells. It is made up of a variety of semiconductor materials. There are two types of charge: positive charge and negative charge, as indicated in Figure 1. This cell technique is utilised to create solar cells that are both inexpensive and efficient. When photons from sunlight are absorbed by the cell, electrons are knocked loose from silicon atoms and dragged off by a grid of metal conductors, causing an electric direct current to flow. PV solar cells are made up of a variety of substances.

Figure 3 Photovoltaic Cell [3]

B. *Photovoltaic Module*

PV modules are the fundamental building blocks of a PV system, consisting of solar cell circuits sealed in an environmentally protective laminate. Sizes may range from few Watts to hundred of Watts on average. To meet the energy demand, a number of PV modules are usually connected in series and parallel.

Figure 4 Photovoltaic Module

C. *Photovoltaic Panel*

It consists of one or more PV modules built as a field-instable, pre-wind unit. PV cells are connected in series on this panel. Individual PV cells are joined together to form solar panels.

Figure 5 Photovoltaic Panel

D. ***Photovoltaic Array (PVA) is a type of photovoltaic***

It is made up of a number of PV cells connected in series and parallel. The parallel connection is responsible for raising the current in the array, whereas the series connection is responsible for increasing the voltage of the module. In direct sunlight, it may produce several watts of electricity as per size. The larger the array's overall surface area, the more solar power it will generate.

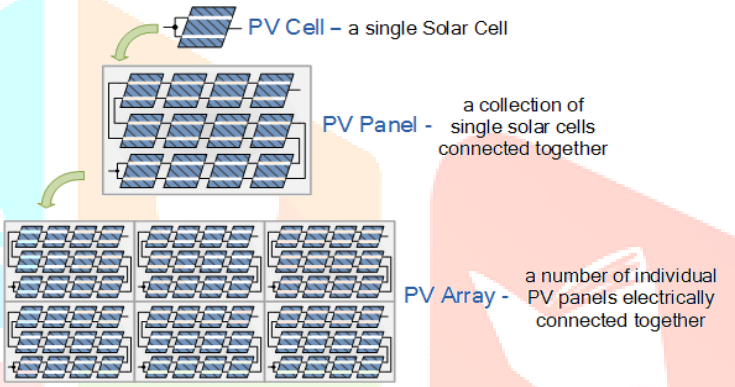

Figure 6 Photovoltaic Arrays

V.COLLECTOR OF SOLAR CONCRETE

A. REFLECTORS OF PARABOLIC TROUGH

It has a linear parabolic reflector that concentrates light onto a receiver that is positioned along the focal line of the reflector. It comprises of a receiver, which is a tube positioned exactly above the parabolic mirror's centre, and a fluid with a working fluid. As it passes through the receiver, a working fluid is heated to 150-350°C, which is subsequently employed as a heat source for a power production system.

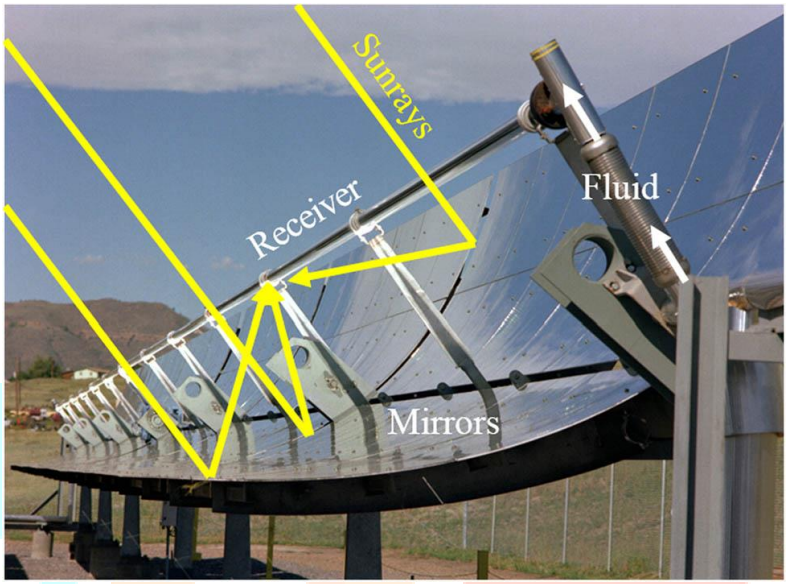

Figure 7 Parabolic Trough Reflectors [4]

B.Fresnel

The refraction occurs in the surface of a Fresnel lens, but the vast material between the two surfaces has no difficulties with refraction. It will boost the temperature more than a normal one and may also be used to heat a furnace. Its setup has been utilised to modify the surface of metallic materials. In the realm of high and extremely high temperatures, this device uses solar energy. In a matter of seconds, these temperatures are reached.When compared to a parabolic of the same diameter, the Fresnel concentrator reduced reflective area by 34.3 percent. However, the 20 minute sequence of action performance required for manual adjustment in order to monitor the sun proved to be a severe drawback with this device.

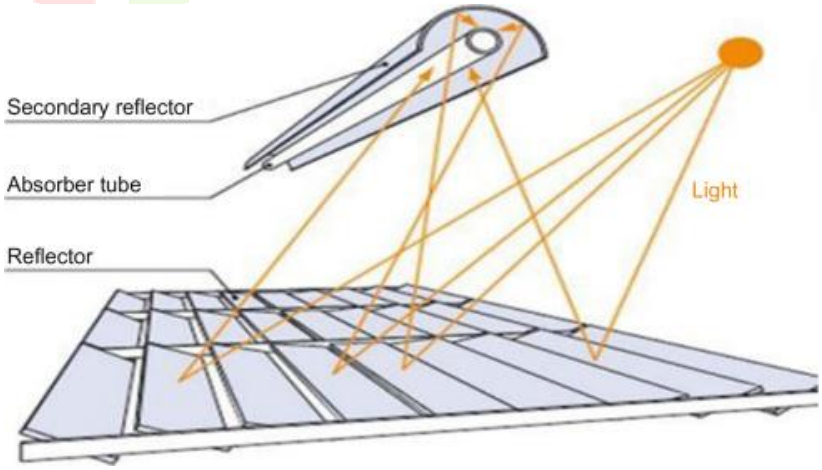

Figure 8 Fresnel Reflector [5]

C. Parabolic Dish

It resembles a huge satellite dish in appearance, but it features mirror-like reflectors and an absorber as the focal point. It made use of a twin axial sun tracking system. It is a 30 percent efficiency that has been attained. In a solar facility, this dish generates at a MW level. This is the concentrating solar power technology's greatest conversion performance.

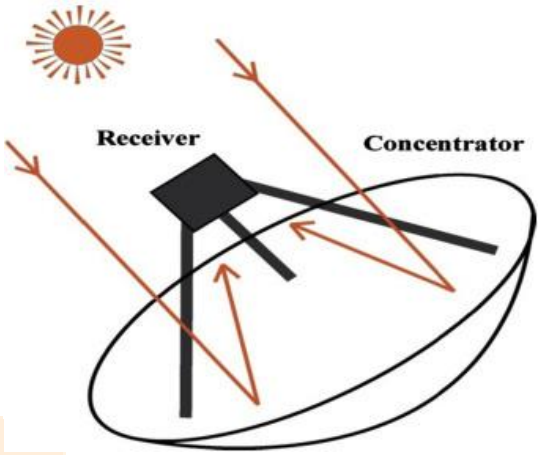

Figure 9 Parabolic Dish [6]

D.Central Receiver

It's mainly utilised in large-scale facilities that generate a lot of electricity. It is also known as the "Power Tower." It works by concentrating a field of thousands of mirrors on a receiver at the top of a tower in the middle of the city. The receiver receives the sun's heat transfer fluid, which is utilised to power a stream turbine at the tower's base to create electricity.

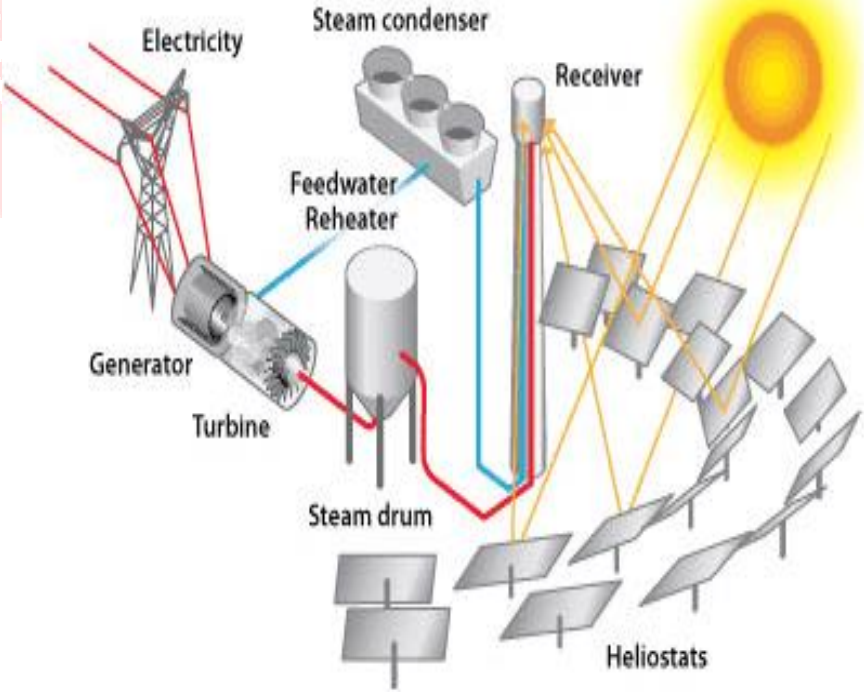

Figure 10 Central Receiver [7]

VI. SOLAR ENERGY BENEFITS

It can help you save up to 20% on your energy bills. It can be used in remote areas. Installation is simple (i.e. does not required any wires, cords etc.). Rooftop means no more room is required, and each residential or business user may generate their own power. It is a free, environmentally beneficial, renewable resource that is readily available. It has no moving components and does not require any extra fuel for power generation other than sunlight. There is no need for water or fuel.

VII. SOLAR ENERGY RESPONSIBILITIES

When the sun shine is not present, no energy is generated. The initial investment is substantial. For a big amount of electricity, more space is required. Inverter and storage are necessary for alternating current (AC) applications. Production of single silicon crystal PV systems is technically difficult, energy-intensive, and time-consuming.

VIII. SOLAR ENERGY APPLICATIONS

It is utilised in a variety of applications including as power, evaporation, water heating, building heating and cooling, food preparation, and water pumping.

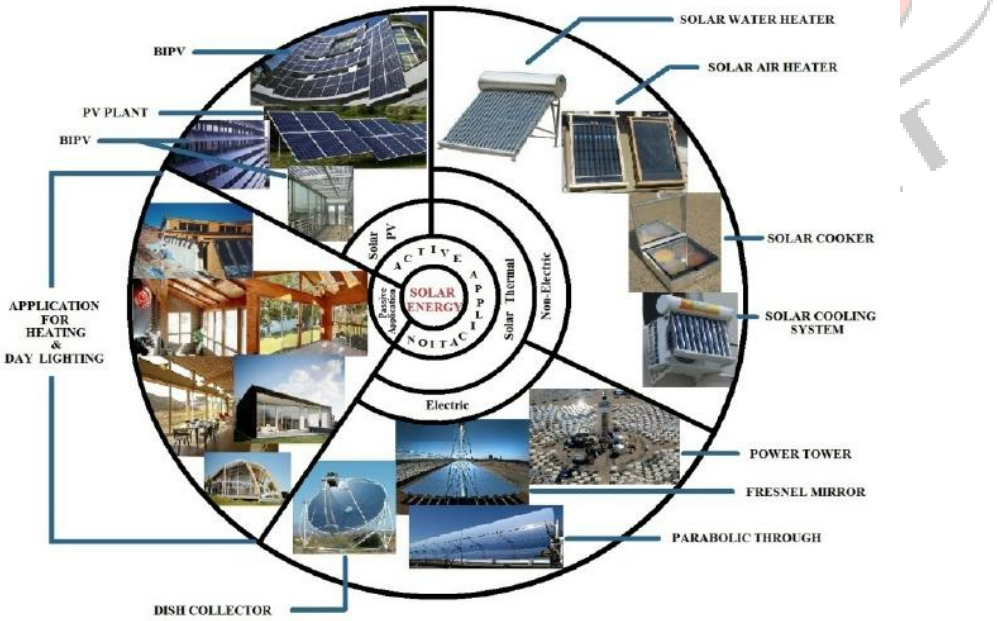

Figure 11 APPLICATIONS OF SOLAR ENERGY [8]

IX.CONCLUSION

The majority of individuals are aware of nonrenewable energy sources. Solar energy has grown in popularity as a result of its cost-effectiveness. Solar Energy can even offer electricity 24 hours a day, seven days a week, even on overcast days and at night due to battery backup. This may also be utilised with an inter-grid system that has a constant power source. It offers more advantages than other sources of energy, such as fossil fuels

and petroleum reserves. It is a viable and consistent option for meeting the increasing energy demand. Solar cell and solar energy research has a bright future worldwide.

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