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A Review Paper on Solar Energy-Generated Electricity

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Abstract: ***Solar energy, which is generated by sunlight, is a non-depleting renewable energy source that is also environmentally benign. Enough sunshine energy hits the globe every hour to meet the world's annual energy requirement. We needed electricity every hour in today's generation. This Solar Energy is used for a variety of purposes, including industrial, commercial, and domestic. It is simple to obtain energy from direct sunshine. As a result, it is incredibly effective and does not pollute the environment. We reviewed Solar Energy from Sunlight in this post and evaluated its future trends and characteristics. The page also aims to discuss how solar panels function and the different types of solar panels, as well as the various applications and strategies for promoting the benefits of solar energy.***

Keywords: Renewable energy, Solar panel, Photovoltaic cell, Modelling of PV Panel, Solar Concrete Collector

I. INTRODUCTION

Nowadays, renewable energy supplies are becoming scarcer, the last 10 years have become increasingly crucial for the per-watt cost of solar energy equipment. It is expected to become more cost-effective in the coming years, as well as a better technology in terms of cost and applicability. Every day, the earth receives sunlight from the sky (1366W approx.) This is a limitless and free source of energy. Solar energy has a significant advantage over other traditional power generators in that sunlight may be directly converted to solar energy using the tiniest photovoltaic (PV) solar cells. Many studies have been conducted to integrate the Sun's energy process by generating high-converting solar cells/panels/modules. the most significant benefit of solar energy

II. SOLAR ENERGY

Solar energy is the amount of energy in the form of heat and radiation. As can be seen in Fig.1.0, Solar thermal energy, solar architecture, solar heating, molten salt power plants, and artificial photosynthesis are all examples of natural sources of energy that use a variety of ever-changing and improving technology. The enormous amount of solar energy accessible makes it a very desirable source of energy. Solar radiation returns about 30% (about) to space, while the rest is absorbed by the ocean, clouds, and land masses.

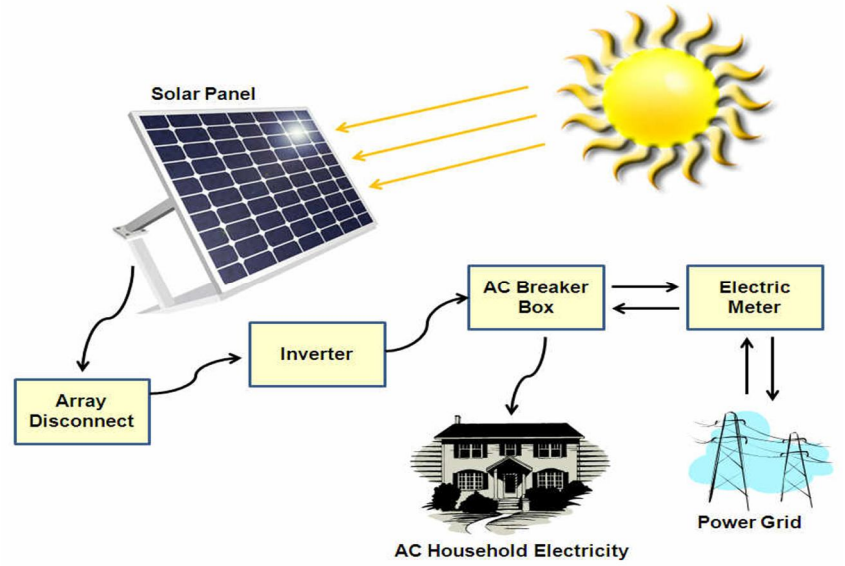

Fig.1.0 Solar Power System

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III. MATERIALS AND METHOD

The PV array (which includes the PV panels and support structures) and the balance-of-system (BOS) components are the two sections of a photovoltaic system (which include storage batteries, Charge controllers, inverters a, and wirings). A. Solar Energy's Basic Components Solar panels, charge controllers, batteries, and power inverters are the four main components of a solar power system.

a) Solar panels: Individual solar cells are combined to make a solar module, and several solar modules are joined to form a solar array. For maximum power output, they can be connected in series, parallel, or series-parallel combinations.

b) Charge Controllers: Charge controllers are used to keeping batteries from being overcharged by limiting high voltage, which might harm them. Pulse Width Modulation (PWM) is used in the cheapest charge controllers for the house, whereas Maximum Power Point Tracking (MPPT) is used in the best charge controllers.

c) Batteries: Deep Cycle Batteries are required for electricity storage, although more specialized batteries, such as Tubular Batteries, are gaining appeal for bigger uses such as household power.

d) Power Inverters: The PV panel generates Direct Current (often 12V, 24V, or 48V), which is subsequently converted to Alternating Current (AC) (AC).

Although Fig. 2.0 demonstrates that a DC load can be connected to the charge controller and battery storage system, a circuit breaker must be installed between the charge controller and the battery storage system to prevent excess current from flowing to the battery in the event of a short circuit. Which can be duplicated at all required locations.

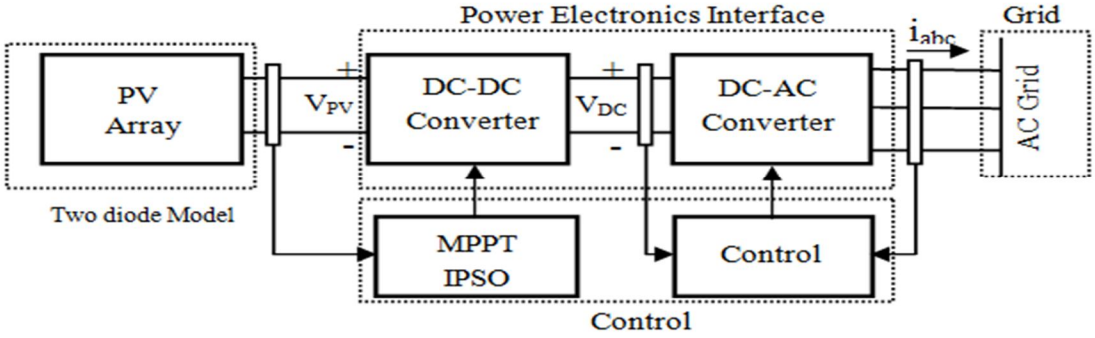

Fig.2.0 Block diagram of a typical Photovoltaic System.

IV. WORKING ON SOLAR ENERGY

Photovoltaic (PV) cells Direct Current (DC) electricity can be generated by converting sunlight. Charge Controller works to control the power from the solar panel which reverses back to the solar panel to get the cause of panel damage. When sunlight is not available, battery systems are utilized to store electric power (i.e. night). This system is connected to the inverter to convert Direct Current (DC) into Alternating Current (AC).

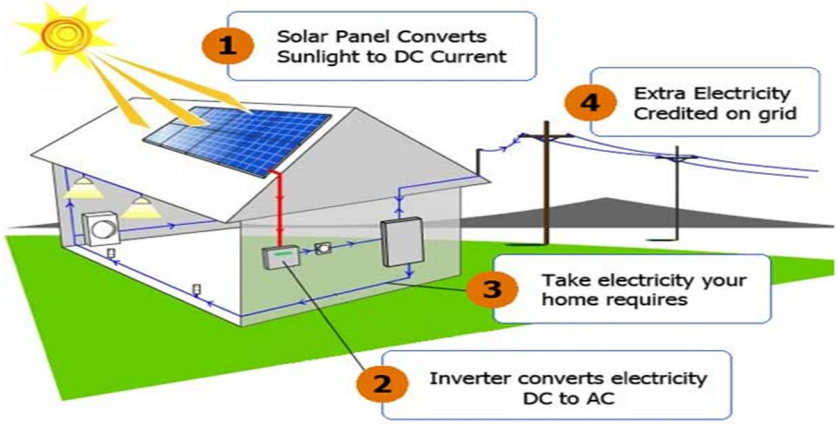

Fig.3.0 Working of solar energy

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V. MODELING OF PV PANEL

A. Solar Cell

Solar radiation was immediately turned into electricity by the cells. It is made up of a variety of semiconductor materials. It comes in two varieties: positive and negative charge. This cell technology is used to create solar cells that are both inexpensive and efficient. When photons from the sunlight are absorbed by the cell, electrons are knocked loose from silicon atoms and pulled 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.

Fig.4.0 Solar Cell

B. Photovoltaic Module

PV modules are the fundamental building elements of a PV system, consisting of solar cell circuits sealed in an environmentally protecting laminate. Sizes range from 60W to 170W on average. To meet the energy demand, numerous PV modules are usually connected in series and parallel.

Fig 5.0 Photovoltaic Module

C. Photovoltaic Panel

It consists of one or more PV modules integrated as a field-instable, pre-wind unit. The PV cell on this panel is made up of several connections. Individual PV cells are linked to solar panels.

Fig 6.0 Photovoltaic Panel

D. Photovoltaic Array

It contains a large 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 produces a maximum of 180W. The larger the array's total surface area, the more solar electricity it will generate.

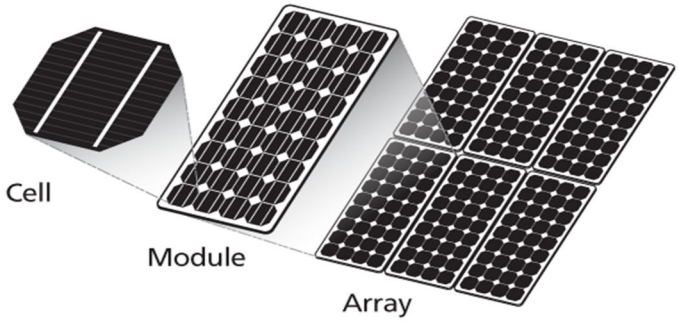

Fig 7.0 Photovoltaic Array

VI. SOLAR CONCRETE COLLECTOR

A. Parabolic Trough Reflectors

It contains a linear parabolic reflector that concentrates light onto a receiver positioned along the reflector's focal line. It consists of the receiver a tube positioned directly above the middle of the parabolic mirror and fluid with a working fluid. A working fluid is heated 150-350 0Cas it flows through the receiver and is then used as a heat source for a power generation system.

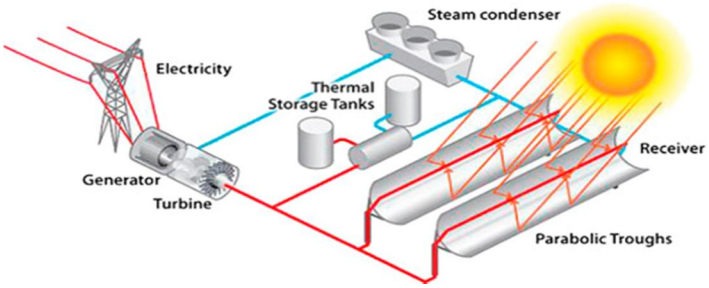

Fig 8.0 Parabolic Trough Reflectors

B. Fresnel

The refraction occurs on the surface of a Fresnel lens, although the vast material between the two surfaces has no problems with refraction. It will boost the temperature more than a traditional one and may also be used to heat a furnace. Its setup has been utilized to modify the surface of metallic materials. In the realm of high and very high temperatures, this technology 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 the reflecting area by 34.3 percent. However, the 20-minute sequence of action performance required for manual adjustment to follow the sun proved to be a severe disadvantage with this device.

Fig 9.0 Fresnel Reflectors

C. Central Receiver

It's typically employed in large-scale plants that generate a lot of electricity. It's also known as the "Power Tower." It works by focussing a field of thousands of mirrors on a receiver at the top of a tower in the middle of the city. The receiver gathers the sun's heat transfer fluid, which is utilized to power a steam turbine at the tower's base for electricity generation.

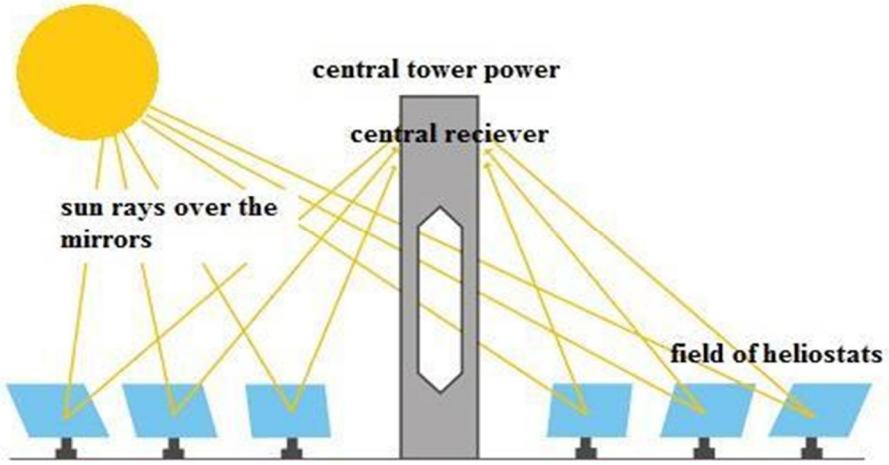

Fig 10.0 Central Receiver

VII. MERITS OF SOLAR ENERGY

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 require any wires, cords, etc.). Rooftop means no more room is required, and each residential or commercial user can generate their electricity. It is a free, environmentally beneficial, renewable resource that is readily available. It has no moving parts and does not require any additional fuel for power generation other than sunlight. There is no need for water or fuel.

VIII. DEMITS OF SOLAR ENERGY

When the sun isn't shining, no energy is generated. The initial investment is substantial. For a significant amount of power, more space is required. Inverter and storage are necessary for alternating Current (AC) applications at night. Production of single silicon crystal PV systems is technically difficult, energy-intensive, and time-consuming.

IX. APPLICATIONS OF SOLAR ENERGY

It is utilized for a variety of purposes, including power, evaporation, water heating, building heating and cooling, food cooking, and water pumping.

Fig 11.0 Solar Cooker

Fig 12.0 Solar Dryer

X. CONCLUSION

Most individuals are aware of non-renewable energy sources. Solar energy has grown in popularity because 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, thanks to battery backup. This can also be used with an inter-grid system that has a constant power source. It has more advantages than other sources of energy, such as fossil fuels and petroleum resources. It is a viable and consistent option for meeting the increased energy demand. Solar cell and solar energy research have a bright future worldwide.

XI. RECOMMENDATIONS

The following are suggested for improvement of solar energy power technology:

1) Renewable energy power station such as solar (PV) should be actively encouraged.
2) There should be massive increase in manufacturing capacity and more effort has to be put into improving efficiencies while reducing the manufacturing costs.
3) Installation of LEDs bulb instead of incandescent or high power consume bulb.
4) Turn off all standby mode for used equipment.
5) Embraced the culture of energy efficient home.
6) High consumption devices should be run during the day when there is sun

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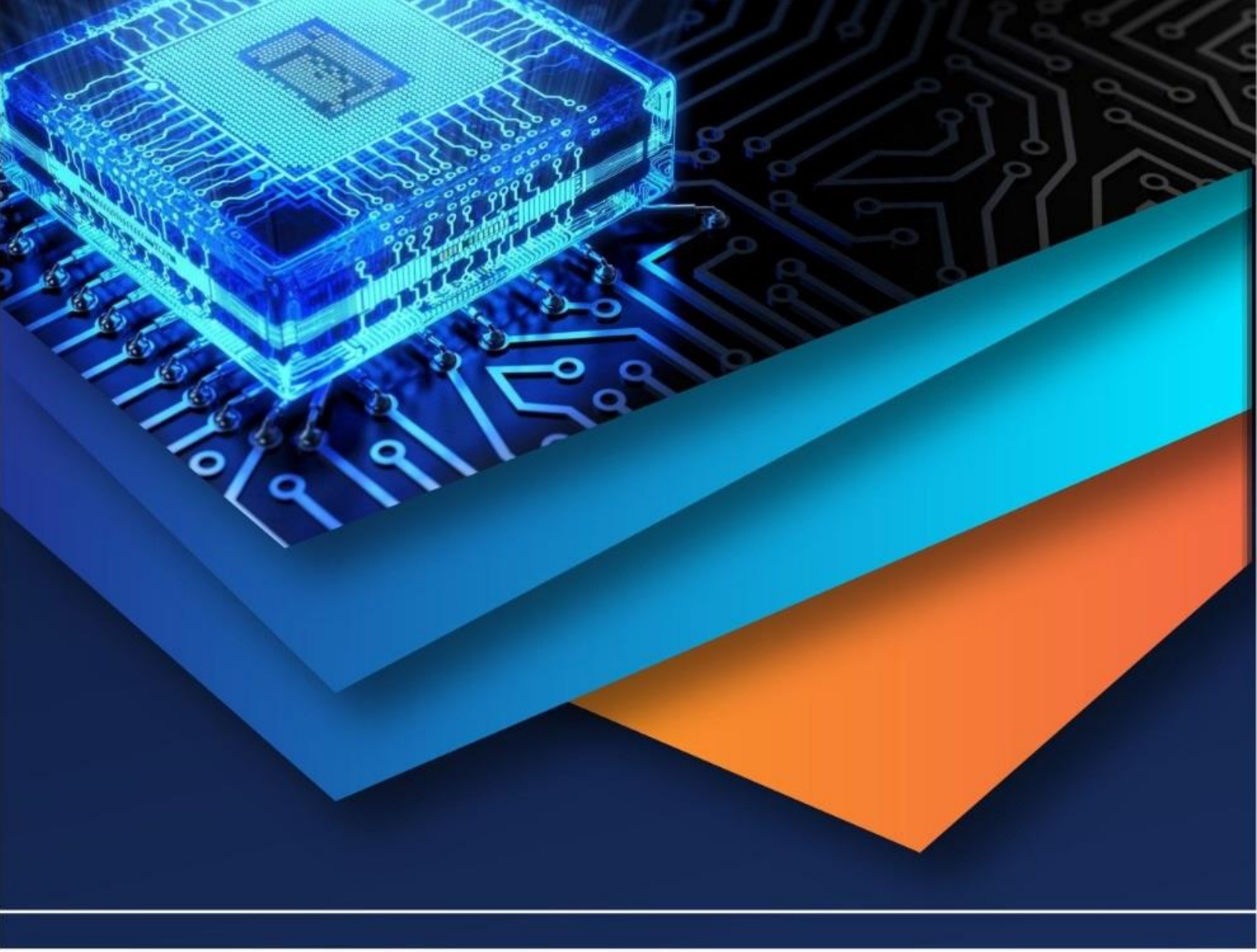

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