# Solar Power Generation methods and Improvements: A Review

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***Abstract-*** *Solar energy generation is one of fastest growing and most promising renewable energy sources of power generation worldwide. Nowadays, the electrical energy becomes one of the basic needs in our daily life, which makes increasing demand for it. Solar power is the conversion of sun radiation into electricity through the use of solar photovoltaic cells. This paper contains literature survey which provides Solar Power Generation methods and enhancement techniques.*

***Keywords:*** Solar Collector, Heat transfer coefficient, Solar Selective coating

## I. INTRODUCTION

Solar power is the conversion of energy from sunlight into electricity, either directly using photovoltaics (PV), indirectly using concentrated solar power, or a combination. Concentrated solar power systems use lenses or mirrors and tracking systems to focus a large area of sunlight into a small beam. Photovoltaic cells convert light into an electric current using the photovoltaic effect. There are several applications that use solar power, here is the information on the generation of electricity through PV cells. The solar power generation is the most efficient route for power generation because it takes a minimum number of steps (for producing electricity) than that of other generation methods.

## II. METHODS OF SOLAR POWER GENERATION

Solar panels - A photovoltaic (PV) module is a packaged, connect assembly of typically 6x10 photovoltaic solar cells. Photovoltaic modules constitute the photovoltaic array of a photovoltaic system that generates and supplies solar electricity in commercial and residential applications.

Photovoltaic roof tiles - These are special tiles that are used on the roof of a house to take full advantage of sunlight. The tiles are the material used for the roof covering and the cells in these tiles trap the sunlight and transform it into electricity.

Specially designed buildings - Buildings can have a special design in order to collect the heat radiated by the sun. They usually face toward the sun in order to take full advantage of every second of daylight. There are large glass windows in every room and in summer, balconies and large trees are used as shade to prevent the entry of too much of the sun's heat during the day.

Heated Water Pipes - Using the heat from the sun to heat water pipes that run throughout the house is becoming the common method of using solar power. The pipes are painted black and placed in a type of greenhouse that will absorb the heat from the sun. This helps to keep water hot without having to use electricity. Having the pipes running through each room allows the solar power to heat the house in a manner similar to radiation heating systems.

## III. REVIEW OF WORK CARRIED OUT

Baker, Jr et.al. [1] studied the performance of a silicon cell non-tracking photovoltaic array has been made over a three year period. The array provided power in parallel with commercial utility power in a shared mode which makes use of all the solar energy generated. Tests of degradation, dirt accumulation, compatibility with telephone plant, and day by day performance were performed. A method is developed for predicting the energy output of a non-tracking array based on standard global insolation measurements. This paper presents a study of electric power generation by a 600 W photovoltaic array in New York City. he power source consists of approx 2600 silicon cells arranged in modules which are connected in series and parallel to provide suitable current to telephone repeater equipment which req. Each panel delivered a daily average energy of 0.80kWhuires direct current (d.c.) at approx. 26 V. An additional minor improvement in yearly output of 5 per cent can be achieved through quarterly adjustments of the panel tilt angle. An additional minor improvement in yearly output of 5 per cent can be achieved through quarterly adjustments of the panel tilt angle. note that on an annual basis each 4.8 m 2 panel produced about $20 worth of electricity. Some individual modules exhibited an efficiency of 10 per cent indicating that better selection and matching of cells can improve the panel efficiency without any improvement in the solar cell efficiency.

Ning Zhu et. al.[2] establish a small type solar power generation system based on the thermoelectric generator. Firstly, the amount of solar radiation at Fukuroi area is calculated. Secondly, a small parabolic solar collector is used to collect the light and the heat. Thirdly, a thermoelectric generator is designed and manufactured inside which 4 peltier modules are employed. Then, by mounting the thermoelectric generator to the focus part of the parabolic solar collector, an experiment testing the electricity generation performance of the solar power generation is carried out. A small solar heat electricity generation system based on thermoelectricity theory was developed. By carrying out a serial of calculations and experiments, it was confirmed that the maximum temperature reached 202 degree and the maximum open voltage was about 3.8V.

Mohd Tariq et.al.[3] works to make an effective solar panel charging system for the regulation of the flow of current to the desired output and saving the battery from receiving extra voltage and increasing the life. A small effective system comprising of four modules, first the stepping down the dc voltage for the microcontroller process to take place, secondly inverting the dc to ac, followed by the relay action of switching and finally passing it to the microcontroller module where it is governed as per the situation of the battery of the module as well as of the system. In the paper the proposed system will be very effective for solving several situations where the solar panel is incapable and not worthy for the work. The proposed effective charging system can be extended to any level, any set-up, which only involves the small embedded kit with the three essential modules empowering the renewable energy.

Karl Bammert et. al.[4] gives layout of Gas Cycles for Solar Power Generation .Using a 20 MW solar tower plant with closed-cycle air turbine as a reference, details were given about the layout sequence of a gas turbine installation. The most important layout parameters of the air turbine plant dealt with in great detail are compared with those of a helium plant of the same power output a smaller plant with 250 kW power output which has an open-cycle gas turbine. With all three plants the turbine inlet temperature is 800 °C. Through optimization of heat transfer in the receiver, the closed cycle plants, which are equipped with a single intercooler, feature a turbine inlet pressure of 3.1 MPa for helium, and 4.4 MPa for air. The inlet pressure of the open-cycle plant, which also has an intercooler, is obtained by a special cycle optimization, and amounts to 0.459 MPa. With the indicated efficiencies of the turbo machines, the temperature difference of the recuperator and the sum of relative total pressure losses, the efficiency at terminals was found to be 37.1%, 38.3% and 34.1%. In the closed-cycle plant, the receiver reaches a mean heat flux of 151 kW/m2 for helium, and 82 kW/m2 for air .On account of the lower pressure level the corresponding value for the open-cycle plant is only 40.7 kW/m2.

Zhi H. Wu et.al. [5] gives the concept of Dish Stirling Solar Power Generation Designed with a HTS Linear Generator. A novel dish Stirling solar power generation (DSSPG) system has been designed incorporated with a high temperature superconducting (HTS) linear synchronous generator (LSG). The high efficient HTSLSG is a compact energy converter for a Stirling engine in the DSSPG system, where a duplex of Stirling cycles is applied, in which a Stirling engine replaces the conventional linear compressor forming a Stirling pulse tube refrigerator (SPTR). This paper presents the DSSPG system designed with the HTSLSG cooled by the duplex Stirling system, and analyzes the thermal load and power distribution in the system to provide bases for consideration of practical application. Analysis results show that the DSSPG system with the HTSLSG refrigerated by the SPTR powered by the DSSPG system itself can be realized, and has higher efficiency than that with the conventional LSG and has larger system capacity.

Vijay Talekar et. al. [6] throws light upon utilizing Reflectors and Bi-Axial Tilting Mechanism and solar tracker for proper capturing of solar radiation and thereby enhancing the efficiency and maximizing the output. The output is maximized when the angle of incident of sunrays is normal to panel surface and to achieve this Bi-axial tilting mechanism is employed. The mechanism consists of various fixtures employed together to get the required orientation of the panel. Firstly, collector are used so as to gather maximum rays from sun, the collector are inclined at an angle of 120˚. As we are using a Bi-axial mechanism, the system is capable of moving in two directions, one of the sun during a day and second to the position of sun that changes every six month. In which dead weight is connected at one side end and a wire on other side for adjusting the tilt. To trace the exact path of the sun they had given rotational motion in which they have used mechanical pair. The male part rotates in the female part and rotational motion is achieved. They rotate the whole assembly manually by a string attached at one end. In this Study we have tabulated readings of current, voltage and power produced. The readings were taken for performance of panel at three positions. It is observed that performance of the panel with collector and with bi axial tracking is nearly 2.5times the performance of the stationary panel (45 degree in south direction) & tilted panel.

Dominik Heide [7] shows different ways to reduced storage and balancing needs in a fully renewable European power system with excess wind and solar power generation. A

straightforward part of this solution is to allow, on average, excess wind and solar power generation. Negative, hourly power mismatches in the fluctuating balancing between the combined wind and solar power generation and load will occur less frequently, thus lowering the need for storage. By using the same modelling approach as in this paper provides quantitative estimates on how the storage and balancing capacities decrease as a function of excess power generation. In addition to energy capacity for roundtrip storage, it also considers the annual balancing energy required for hydro storage lakes or gas power plants, as well as the balancing power, which is another important storage characteristics.The paper focuses on the required energy capacity for roundtrip storage. Estimates on the required annual balancing energy are given . The balancing power, or discharge power, is discussed in it. It also introduces a separation of time scales, which allows to distinguish between long- and short-term storage needs. The conclusion and an outlook are presented in this paper. In case of storage energy capacity, the optimal mix is 60% wind and 40% solar power generation for ideal roundtrip storage, and 70% wind and 30% solar power generation for hydrogen storage. In case of annual balancing energy, the optimal mix is 80% wind and 20% solar power generation. In case of balancing power, the optimal mix is 90% wind and 10% solar power generation.

Shao Shiquan et.al.[8] addresses a kind of maximum power point tracking (MPPT) control for a single solar power generation systems use the Takagi–Sugeno (T-S) fuzzy-model-based approach. In detail, we consider a dc/dc buck converter to regulate the output power of the photovoltaic panel array. First, the system is represented by the T-S fuzzy model. Next, give an approximate desire state of the photovoltaic panel array according to estimating calculate. Next, a fuzzy MPPT controller is proposed to achieve the given state. Then a popular traditional Perturbation & Observation Method (P&O) is used to change the given state. Finally, numerical simulation results are given to demonstrate the performance of the proposed methods.

Abraham Kribus [9] studied the potential use of optical fibers for solar thermal power generation is presented. The main performance characteristics (numerical aperture and attenuation) and typical costs of currently available fibers are discussed. Several approaches to the application of fibers are presented, for centralized (tower, central receiver) and distributed (dish–engine) systems. The overall system design-point efficiency and overall system cost are estimated. A scaling relation between system size and the cost of the fiber component is identified, which severely limits the applicability of fibers to small systems only. The overall system cost for centralized systems is found to be higher than the currently competitive range, even under optimistic assumptions of mass production of major components. A significant reduction in fiber cost is required before the use of fibers for centralized solar power generation can become competitive. In distributed generation using dish /engine systems, however, the use of fibers does achieve competitive performance and costs, comparable to the costs for conventional dish systems.

Jacques E. Ludman et.al. [10] developed A holographic device that greatly improves the efficiency of solar energy conversion. The single-element hologram focuses light, spectrally splits it and diverts unwanted infrared heat away from the solar cells. The output appears as a thin concentrated line, focused perpendicular to the hologram and displaced to the side. Solar cells are placed along this line such that each cell absorbs only the wavelengths which it can efficiently convert to electric power. The theoretical and experimental development of this system is discussed, as well as its application in space and on Earth. The system is excellent for space applications since the holograms are single element, very lightweight, and require minimal cooling. For terrestrial purposes, the projected costs of the system are nearly a factor of two lower per kWh than other solar concentrator systems; thus it is competitive with conventional power generation systems. Other state of the art holographic solar power generation systems are also discussed. The holographic concentrator antireflection and spectral splitter described here represents a major breakthrough in solar power technology. The advantages for space power are substantial. As a terrestrial source, it is the first system described for solar power generation that is clearly competitive with conventional sources.

## IV. CONCLUSION

From this review, various ways of producing power with the help of solar energy and the ways of enhancing it can be observed with the help of different paper references given above. The various ways of producing solar power can be utilised according to the area where it is to be situated and the enhancements in this sector helps the people using it to improve the efficiency and storage of this solar power that has been captured. The Bi-axial tilting mechanism can be used for optimum capture of sunlight and the reflectors complement it.

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