Journal of Nuclear Energy Science & Power Generation Technology

Review Article A SCITECHNOL JOURNAL

# Solar Energy in Stationary Collector: A Review

**Ashwini Kumar[1*], Rishi Sikka[2] and Monika Mehra[3]**

*[1]Department of Physics, SGT University, Gurugram, Haryana, Tunsia, India*

*[2]Department of Electrical and Electronic Engineering, RIMT University, Mandi Gobindgarh, Punjab*

*[3]Department of Electrical and Electronic Engineering, Sanskriti University, Mathura, Uttar Pradesh, India*

***Corresponding author:** Ashwini Kumar, Department of Physics, SGT University, Gurugram, Haryana, Tunsia, India E-mail: monikamehra@rimt.ac.in

**Received date:** 09 February, 2022, Manuscript No. JNPGT-22-46543;

**Editor assigned date:** 11 February, 2022, PreQC No. JNPGT-22-46543 (PQ);

**Reviewed date:** 25 February, 2022, QC No. JNPGT-22-46543;

**Revised date:** 13 April 2022, Manuscript No. JNPGT-22-46543 (R);

**Published date:** 03 May 2022, DOI: 10.4172/2325-9809.1000291

## Abstract

In the present era each home and industry needs power, yet the most concerning issue is that the greatest population of the world is confronting power issues in view of energy emergencies. The petroleum derivatives are restricted in sum. There are different kinds of energy present in the earth, for example, wind energy, biomass energy and sun oriented energy. Sun oriented energy or solar energy is the most widely recognized energy which is used in the different industries. This paper presents a review dependent on sun oriented energy in fixed authority. In this review, it examined the different kinds of fixed authority, sun oriented energy stockpiling, applications in different fields, favourable position and weakness of sun powered energy. In future, sun powered energy is exceptionally requesting wellspring of energy since it is environmentally friendly power and financially savvy. It supports national energy autonomy in light of the fact that sunlight based energy is used where it can be created. Further this solar energy makes the nearby positions for the new energy economy.

**Keywords:** Bio sorbents; Solar energy; Stationary collector

## Introduction

### Solar collector and its types

Sun based collectors or solar collectors are the various types of heat exchanger, which is used to retain the sunlight based radiation; solar energy change into the heat as well as passes on it to a liquid which is moving through the collector. Generally, sun based warm collector are separate into two types of concentrating and non-concentrating or stationary. There are different kinds of collector which depend on their movement, absorber, and their inductive temperature range [1].

### Non-concentrating or stationary collector

Non-concentrating or stationary collector acquired their name from being a collector which does not track sun directed at the fixed direction and inclination [2].

## Literature Review

### Evacuated tube solar collector

It is a gadget which can be used in essentially to transmit the heat for different applications like thermal power plant, water heating, and cooling and so on evacuated tube solar collector are more stunning technique as compare to the other technique because of their heat extraction and their high capability of heating [3]. Solar collectors using evacuated tubes use glass tubes to create a vacuum around the absorber, successfully resisting atmospheric pressure. Each tube is made up of a heat pipe enclosed within a vacuum-sealed tube. Convection and convention losses are reduced by using a vacuum envelope. To transmit heat from within the heat pipe, liquid vapour phase transition material can be used (conductor) [4]. Pipe made primarily of copper is linked to a black coppers fin that fills the tube and monitors solar energy while preventing radiation losses. A metal tip protrudes from the tube into the condenser at the top of the pipe (manifold). A tiny quantity of liquid vapour phase fluid, mostly methanol, is contained in the pipe and is subjected to a repeating evaporation-condensation cycle. When the solar energy is observed by the black fins, it will transfer heat energy to the fluid which will evaporate and transfer through the heat pipe to the top of the pipe as shown in Figure 1 [5]. These fluids will condensate when it will reach the top of the pipe by releasing its latent heat to the moving fluid in the manifold. When compared to flat plate collectors, evacuated tube collectors are more costly but more efficient. It's used in both cooling and heating systems (Figure 2).

**Figure 1:** The evacuated tube solar fins. It is made up of a series of parallel clear glass tubes connected to a header pipe that replace the darkened heat absorption panel.

**Figure 2:** The solar collector with a flat plate. It's a metallic box with a top cover made of plastic or glass and a dark-colored absorber plate on the bottom.

### Flat plate collector

When solar radiations is transmitted over the transparent cover, it collides with the dark colored absorber plate, which has a high absorptive capacity, resulting in a device that may be used in solar water heating systems in the house and solar space heating.

The plate collects the energy and transports it to the fluid passengers' transit medium, where it is directed for use or storage as shown in Figure 2 [6]. Flat plate collector is characterized by its ability to use direct and diffused beams of solar radiations [7].

This types of collectors are made up of an enclosure, a dark colored absorber plate with fluid circulation passages, as well as a transparent covers that permits sun based energy to passes through. To prevent heat loss to the environment, the sides and rear of the enclosures are usually insulated. To remove heat from the solar collector, a heat transfer fluid is pumped via the absorbers fluid passages. A heat exchanger is generally used to transmit heat from the solar collectors to a warm water storage tank if a heat transfer fluids is used.

### Compound parabolic collector

A compound parabolic collector is a kind of solar collector that is made in the shape of two parabolas coming together, as illustrated in Figure 3.

It is a member of the non-imagining family, although it is regarded as one of the collectors with the greatest concentration ratio. Only intermittent tracking is needed because to the wide aperture area. The rising expense of fossil fuels and power, along with the environmental issues caused by $CO_2$ emissions, has prompted our civilization to focus on renewable-energy sources [8].

Solar energy's is a potential method to meet a large portion of the world's energy requirements in a variety of ways. Flat Plate Collectors (FPC) are often used for residential hot water generation and low temperature applications (30° C-90°C). Concentrating collectors with high concentration ratios provide sufficient heat for electricity generation in power plants at high temperatures (300°C-400°C).

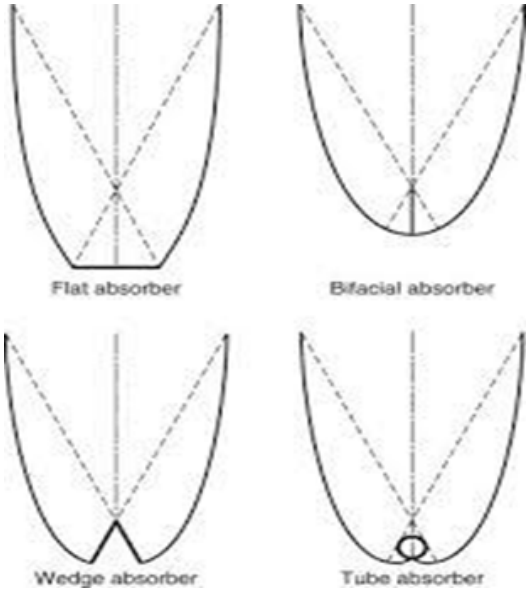


**Figure 3:** Represents the compound parabolic collector [9]. It is a non-imaging type collector.

The Compound Parabolic Collector (CPC) with evacuated tube, which is capable of producing effectively the processing heat, is the most appropriate solar collector for these circumstances. The collector was simulated using the commercial program Solid works flow simulation. The reflector design is the study's unique feature. The technique used results in an intercept factor near to one, which is excellent for modeling. Furthermore, a comparison of pressurized water and thermal oil is given in order to establish which fluid is the most energy-efficient.

## Discussion

### Solar energy storage

Energy storage is defined as "the storing of energy in a viable form for later use in the production of electricity or other applications deemed necessary." Energy storage is accomplished via the use of technology or physical mediums which store energy for later use in useful activities. Accumulators are electronic devices that store energy. Most renewable energy sources (most notably solar and wind) provide power that is intermittent or unpredictable. When intermittent power sources reach significant levels of system penetration, energy storage becomes an option for providing stable and reliable energy supply. Individual energy storage projects supplement electrical networks by gathering surplus electricity during times of low demand and storing it in different ways until it is required on the grid. After that, the energy is converted into electric form and delivered back into the system as required. Pumped-storage Hydroelectricity, which has long had the nation's biggest highest capacity of stored energy, as well as battery pack systems, thermal energy storage, such as molten salts, which can efficiently store and release large amounts of heat energy, and compressed air energy storage, are all examples of renewable energy storage. Flywheel energy storage devices, cryogenic stored energy, or even superconductivity magnetic coils are less frequent, specialized types of storage. Molten salts may be used to store solar energy at high temperatures. Because salts are inexpensive, have a

high specific heat capacity, and can deliver heat at temperatures that are compatible with standard power systems, they are an excellent storage medium. Solar PV utilized this energy storage technique and was able to store 1.44 TJ with 99% yearly storage efficiency in its 68 $m^3$ storage tank. Rechargeable batteries have historically been used to store surplus energy in off-grid PV installations. Excess energy may be supplied to the transmission grid, while normal grid electricity could be utilized to compensate for grid-tied system shortages. Household systems get credit for any energy they transmit to the grid using net metering techniques.

### Applications of solar energy

Solar energy may be used in a variety of ways because it is free and does no environmental impact. Solar energy is currently used for building heating, water heating, food refrigeration, industrial heating, cooking, drying, and distilling, among other things. Solar energy may be used for a variety of purposes.

### Roof mounted photovoltaic

These systems are used to integrate buildings. Building Integrated Photovoltaics (BIPVs) are becoming more popular among homes in regions where there is no power infrastructure. Photovoltaic panels are placed on the top roofs of buildings to power the walls. Solar energy generated at the same site can also be fed into the system as a source of surplus energy. It is the most expense as well as promising method of lowering household energy use. A study of solar photovoltaic and roof-top applications is provided by team of expert [10]. Authors also discussed the classification of the photovoltaic technology.

### Irrigation for agricultural crops

Solar energy is utilized in different regions of the globe to irrigate field crops at a low cost and in places where there is no access to an electrical grid. For improved water usage efficiency, an motors may be powered by a micro-processor controlled the solar energy system with deposited energy to run either a drop or sprinkle irrigation system. Crop water requirements may be used to determine irrigation intervals and discharge rates. Microprocessors may be programmed to meet such needs. Because there is no reliance on the electrical grid for power, the irrigation system is constantly on. Solar water may be classified into two categories: solar thermal and solar photovoltaic. Their performance is influenced by a variety of variables. It has a significant impact on solar radiation, the quantity of water, the source of water, and the length of use of the system, as well as well characteristics and water storage conditions. experts presented a study based on a solar power irrigation systems for farming that is founded on the moisture contents of the field as well as saves energy and water via optimal design [11].

### Solar energy for drying moisture

Agricultural producers' content causes microbial deterioration by preventing spoilage organisms' activities. Crop drying systems come in a variety of configurations. Artificial dryers are not cost-effective. Because of the sanitary nature of such systems, many people in rural regions have used open sun drying for many years. In this respect, the introduction of photovoltaic technology is currently promising in terms of designing solar-powered artificial dryers for the betterment of people. A review focused on sun drying methods is presented by expert [12]. The authors explored several drying procedures as well as sun drying modes.

### Heating and cooling solar

- The most common method for improved productivity is air and water heating. Various studies have failed to enhance the cooling and heating system. Solar plate heating and cooling systems are increasingly widely used, with the goal of enthralling both the home and business markets. Solar voltaic technology may be included to increase the system's capacity. In the agricultural sector, solar thermal refrigerators are becoming more popular. Elisa et al. presented a study paper focused on the creation of novel heating as well as cooling systems for non-residential building utilizing renewable energy sources [13].

### Advantages of Solar Energy

- Sun gives the solar resources. Solar resources may be found all around the planet. There is no emission in this solar resource. This energy is environmentally safe. This solar resource can be allowed faster than other renewable power plants.
- Solar energy is a type of renewable resource that is both environmentally friendly and aesthetically inconspicuous. Solar energy-based power facilities do not emit any harmful pollutants.
- The sun provides this renewable resource to the planet on a continual basis. Because the sun is accessible everywhere, it may be installed in almost any geographical area. The sun generates on-site or local energy, reducing the need for large complicated infrastructure or high-voltage transmission lines. Solar energy plants produce no harmful pollutants, generate no noise, and are not seen as an "eyesore."
- This energy may benefit future generations' health since it cleans the environment without emitting any pollutants (zero-emission power).
- It is a distributed generation energy source that may help to alleviate national security worries regarding power outages.
- Using solar energy to generate zero-emission power. There is a reduction in the amount of water consumed. This is a major accomplishment for the geographical area.

### Disadvantages

- The main drawback of solar energy, or any renewable energy for that matter, is its scarcity. One of the most important factors is the condition that determines availability. As a result, we cannot guarantee that future resources will not be accessible.
- The downside of solar energy is the storage issue, which necessitates a high land area need, which is not always practical and raises project costs.
- A solar thermal power plant requires a large quantity of water. So, in a nutshell, it's near a big supply of water.

## Conclusion

Solar energy became a well-recognized and widely used technology all over the globe. Several billions of dollars have already been spent, with much more to follow in the coming years to solve the solar industry's present constraints. In both industrialized and developing nations, an amount of new large-scale solar power (for example, CSP) projects are going live or are in the planning stages. Although CSP is more costly than PV, it has been shown to be appropriate for areas where clouds and haze are not common. PV technology may be the main source of solar energy production for the time being.

Furthermore, due to the slow development of enabling legislation and institutions, the potential market for off-grid solar systems remains largely unexplored. Despite recent price reductions in solar technology, the total cost of solar energy generation remains high.

The necessity for creative ways to minimize the financial effect of different government incentives is highlighted by important incentives and rebates for the solar energy industry's growth. The solar sector, on the other hand, should place a greater emphasis on technological quality and development. Researchers also should work to improve solar power's efficiency against both traditional and renewable energy sources. PV systems should receive further research attention in the near future in order to improve their efficiency, stability, manufacturability, as well as availability, as well as lower BOS and module prices. This study examined the worldwide capacity of solar energy technologies, as well as their limits and advantages, as well as their future possibilities. As a result, despite a few limitations, we reached the conclusion that solar energy technology is among the most promising renewable energy sources for meeting future global energy demand.

## References

1. Abolhosseini S, Heshmati A, Altmann J (2014) A review of renewable energy supply and energy efficiency technologies. IZA Discuss 36.
2. He H, Li A, Li S, Tang J, Li L, et al. (2020) Natural components in sunscreens: Topical formulations with sun protection factor (SPF). Biomed Pharmacother 134: 111161.
3. Martínez Rodriguez G, Fuentes Silva AL, Picon Nunez M (2018) Solar thermal networks operating with evacuated-tube collectors. Energy 146: 26-33.
4. Papadimitratos A, Sobhansarbandi S, Pozdin V, Zakhidov A, Hassanipour F, e al. (2016) Evacuated tube solar collectors integrated with phase change materials Sol Energy. 129:10-19.
5. Badar AW, Buchholz R, Lou Y, Ziegler F (2012) CFD based analysis of flow distribution in a coaxial vacuum tube solar collector with laminar flow conditions. Int J Energy Environ Eng 3: 1-5.
6. BeJan A, Kearney DW, Kreith F (1981) Second law analysis and synthesis of solar collector systems. J Sol Energy Eng 103: 23-28.
7. Jebasingh VK, Herbert GJ (2016) A review of solar parabolic trough collector. Renew Sustain Energy Rev 54:1085-1091.
8. Bellos E, Korres D, Tzivanidis C, Antonopoulos KA (2016) Design, simulation and optimization of a compound parabolic collector. Sustain Energy Technol Assess 16: 53-63.
9. Gudekar AS, Jadhav AS, Panse SV, Joshi JB, Pandit AB (2013) Cost effective design of compound parabolic collector for steam generation. Sol Energy 90: 43-50.
10. Rodriguez P, Timbus A, Teodorescu R, Liserre M, Blaabjerg F (2009) Reactive power control for improving wind turbine system behavior under grid faults. IEEE Trans Power Electron 24: 1798-1801.
11. Biswas PK, Bhowmick MK (2015) Crop diversification through pulses in the northeastern plain zone of India. Diversification Agriculture Eastern India 131-139.
12. VijayaVenkata, Raman S, Iniyan S, Goic R (2012) A review of solar drying technologies. Renew Sustain Energy Rev 16: 2652-2670.
13. Moretti E, Bonamente E, Buratti C, Cotana F (2013) Development of innovative heating and cooling systems using renewable energy sources for non-residential buildings. Energies 6: 5114-5129.