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# ELECTRICITY GENERATION THROUGH SOLAR RADIATION

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**Abstract:** The paper presents estimation of steam generation potential at institution .Solar technology offers great potential in supply the world energy need. However it's current contribution to the world is still limited. There are different types of devices i.e. Collector, concentrator and receiver. These delivers different output quantitatively. Qualitatively the output of these devices is hot water. With some metrological input we would like to see which delivers proper desired output. In this paper different types of devices will be simulated and their performance will be compared.

**Keywords:** Solar collectors; Optical and thermal analysis; Water heating; Cooling; Solar power Generation

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## INTRODUCTION

Solar energy is a vital energy source that can make environment friendly energy more flexible, cost effective and commercially widespread. Photovoltaic cell is not use for steam generation. For maximum efficiency and more steam generation. Concentrator, collector and receiver are developed to solve this problem. Solar concentrator is a device that allows the collection of sunlight from a large area and focusing it on a smaller receiver or exit. A conceptual representation of a solar concentrator used in harnessing the power from the sun to generate electricity. A solar collector is used to concentrate solar radiation onto a receiver where heat transfer to a fluid takes place. There are different types of solar collector used.

The sun is a sphere of intensely hot gaseous matter with a diameter of 1.39 $\times 10^9$ m. The solar energy strikes our planet a mere 8 min and 20 s after leaving the giant furnace, the sun which is 1.5 $\times 1.0^{11}$ m away. The sun has an effective blackbody temperature of 5762 K. The temperature in the central region is much higher and it is estimated at 8 $\times 10^6$ to 40 $\times 10^6$ K. The solar energy strikes our planet a mere 8 min and 20 s after leaving the giant furnace, the sun which is 1.5 $\times 1.0^{11}$ m away. The sun's total energy output is 3.8 $\times 10^{20}$MW. Which is equal to 63 MW/m2 of the sun's surface? This energy radiates outwards in all directions. This energy radiates outwards in all directions. Only a tiny fraction, 1.7 $\times 10^{14}$kw, of the total radiation emitted is intercepted by the earth. The greatest advantage of solar energy as compared with other forms of energy is that it is clean and easily available. The benefits arising from the installation and operation of renewable energy systems can be distinguished into three categories; energy saving, generation of new working posts and the decrease of environmental pollution. A worldwide research and development in the field of renewable energy resources and systems is carried out.

## II Solar Collectors

Solar energy collectors are special kind of heat exchangers that transform solar radiation energy to internal energy of the transport medium.The major component of any solar system is the solar collector.This is a device which absorbs the incoming solar radiation, converts it into heat, and transfers this heat to a fluid (usually air, water, or oil) flowing through the collector.

Types of Solar Collectors

1. Non-concentrating or stationary.
2. Concentrating.

**1) Non-concentrating or stationary**

A non-concentrating collector has the same area for intercepting and for absorbing solar radiation, whereas a sun-tracking.

**2) Concentrating.**

Concentrating solar collector usually has concave reflecting surfaces to intercept and focus the sun's beam radiation to a smaller receiving area, thereby increasing the radiation flux.

**III Stationary collectors**

Solar energy collectors are basically distinguished by their motion, i.e. stationary, single axis tracking and two axis tracking, and the operating temperature. These collectors are permanently fixed in position and do not track the sun .

**Types of Stationary collectors**

1. Flat plate collectors (FPC).

2. Stationary compound parabolic collectors (CPC).

3. Evacuated tube collectors (ETC).

**IV .Concentrating Type**

1. Parabolic trough collector.

2. Linear Fresnel reflector (LFR).

3. Parabolic dish.

4. Central receiver

**A) Parabolic trough collector.**

Concentrating, or focusing, collectors intercept direct radiation over a large area and focus it onto a small absorber area. These collectors can provide high temperatures more efficiently than flat-plate collectors, since the absorption surface area is much smaller. However, diffused sky radiation cannot be focused onto the absorber. Most concentrating collectors require mechanical equipment that constantly orients the collectors toward the sun and keeps the absorber at the point of focus. Therefore; there are many types of concentrating collectors.

- Parabolic troughs are devices that are shaped like the letter "u".
- The troughs concentrate sunlight onto a receiver tube that is positioned along the focal line of the trough.
- Sometimes a transparent glass tube envelops the receiver tube to reduce heat loss.

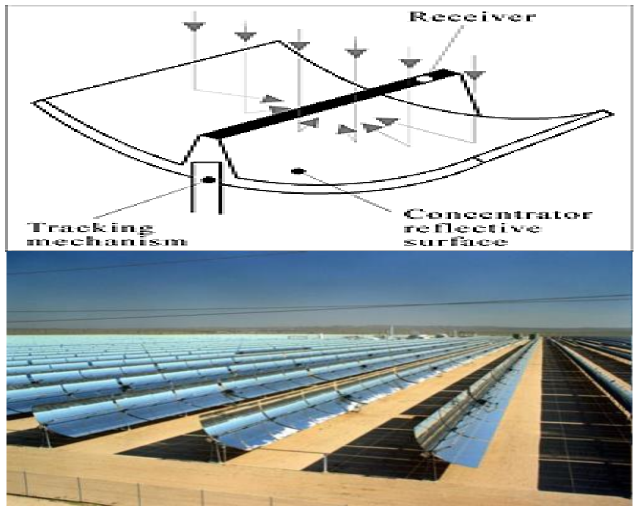
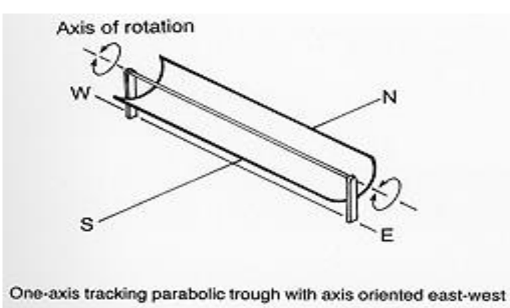
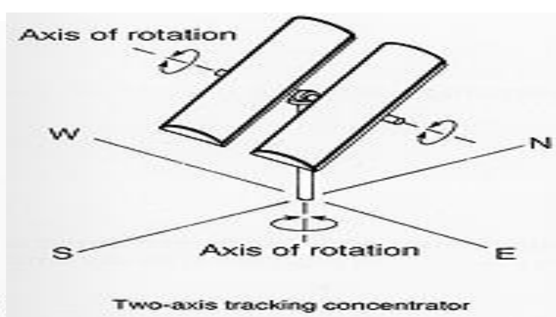



**Figure-: Parabolic trough system**

Temperatures at the receiver can reach 400 °C and produce steam for generating electricity. However with long operating experience, continued technology improvements, and operating and maintenance cost reductions, troughs are the least expensive, most reliable solar thermal power production technology for near-term

- **Parabolic troughs often use single-axis or dual-axis tracking**



**V. Thermal analysis of collectors**

The basic parameter to consider is the collector thermal efficiency. This is defined as the ratio of the useful energy delivered to the energy incident on the collector aperture. The incident solar flux consists of direct and diffuse radiation. While FPC can collect both, concentrating collectors can only utilize direct radiation if the concentration ratio is greater than 10.

**A) Flat-plate collectors performance**

$$n = F_R\left[\tau\alpha - \frac{U_L(T_i - T_a)}{G_t}\right]$$

FR - heat removal factor

τα - Transmittance–absorptance product

UL - solar collector heat transfer loss coefficient

(W/m2)

Ti -Temperatures of the fluid entering the collector (C)

Ta - Ambient temperature (C)

Gt - Total (direct plus diffuse) solar energy incident

on the collector aperture (W/m2) .

**B) Concentrating collectors performance**

$$n = F_R\left[n_o - U_L\left(\frac{T_i - T_a}{G_b C}\right)\right]$$

no -collector optical efficiency .

C - collector concentration ratio

**VI. Flat plat collector and parabolic trough collector connected in series, parallel and series-parallel**

Solar flat plat collector under normal circumstances does not have any loss of water either room temperature in hot condition there for when there are two or more flat plat collector connected in series the output of the first collector as an input of second naturally we say that when two collected are connected in series discharge remain constant .when two or more collected are connected parallel and if they adjacent to each other radiation received by both of them will be ideal speaking same other design parameter being head constant .Temperature accurse will be identical.

Flat plat collector and Parabolic trough collector

- Series

  Q -: Constant

  T -: Increase

- Parallel

  Q -: Increase

  T -: Constant

- Series-Parallel

  Q -: Increase

  T -: Increase

**Load Data of College of Engineering & Technology, Babhulgaon Akola.**

- Total connected load- 0.50490 MW
- Average Daily load/ consumption- 633.1607 KW

**VII. Modeling of solar systems**

The proper sizing of the components of a solar system is a complex problem which includes both predictable (collector and other components performance characteristics) and unpredictable (weather data) components. In this section an overview of the simulation techniques and programs suitable for solar heating and cooling systems is presented.

Computer modeling of thermal systems presents many advantages the most important of which are the following.

1. Eliminate the expense of building prototypes.

2. Complex systems are organized in an understandable format.

3. Provide thorough understanding of system operation and component interactions.

4. It is possible to optimize the system components.

5. Estimate the amount of energy delivery from the system.

6. Provide temperature variations of the system.

7. Estimate the design variable changes on system performance by using the same weather conditions.

The following sections describe briefly five Software programs.

A) TRNSYS simulation program.

B) WATSUN simulation program.

C) Polysun simulation program.

D) F-Chart method and program.

E) Matlab and Artificial neural networks in solar energy systems modeling and prediction

**VIII. Solar collector applications**

Solar collectors have been used in a variety of applications. These are described in this section. In the most important technologies in use are listed together with the type of collector that can be used in each Case.

A) Solar water heating systems

B) Space heating and cooling

C) Solar refrigeration

D) Industrial process heat.

E) Solar desalination.

F) Solar thermal power systems

**IX. Conclusion& Future scopae**

Several of the most common types of solar collectors are presented in this paper. The various types of collectors described include flat-plate, compound parabolic, evacuated tube, parabolic trough, Fresnel lens, parabolic dish and Heliostat field collector (HFC). The optical, thermal and thermodynamic analysis of collectors is also presented as well as methods to evaluate their performance. Additionally, typical applications are described in order to show to the reader the extent of their applicability. These include water heating, space heating and cooling, refrigeration, industrial process heat, desalination, thermal power systems, solar furnaces and chemistry applications. It should be noted that the applications of solar energy collectors are not limited to the above areas. There are many other applications which are not described here either because they are not fully developed or are not matured yet. The application areas described in this paper show that solar energy collectors can be used in a wide variety of systems, could provide significant environmental and financial benefits, and should be used whenever possible

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