ANALYSIS OF SCHEFFLER CONCENTRATOR

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ABSTRACT

A scheffler type solar concentrator focuses the solar images at the focus point of the parabola where receiver is installed. The receiver takes the energy from the reflector and after being affected by heat loss the fluid is transferred to a Stirling engine that works through a cylindrical absorber plan.

The numerical results past research allows for the design of STCS and a comparison with parabolic dish that provides the same thermal demand. Our finding shows that the minimum power is required at centre of gravity to rotate the scheffler concentrator, which was observed in the parabolic dish, but as well the STCS receiver shows a 7% increase in the thermal efficiency compared with the efficiency of the parabolic dish receiver.

Keyword: - *Solar Energy , Solar Energy Conversation System , Solar Concentrators, Tracking mechanism, Intercept angle.*

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1. INTRODUCTION

Solar energy is energy that is present in sunlight. It has been used for thousands of years in many different ways by people all over the world. As well as its traditional human uses in heating, cooking and drying. Nowadays, it is used for power generation where other power supplies are absent or in scare, especially in the remote places and in space. It is renewable energy sources and environmental friendly.

It is becoming cheaper to make electricity from solar energy and in many situations it is now competitive with energy from coal or oil. After passing through the Earth's atmosphere, most of the Sun's energy is in the form of visible light and infrared light radiation. Plants convert the energy in sunlight into chemical energy through the process of photosynthesis.

Humans regularly use this store of energy in various ways, as when they burn wood or fossil fuels, or when simply eating plants, fish and animals. It takes the sun's energy just a little over eight minutes to travel the 93 millions miles to Earth. Solar energy travels at a speed of 186,000 miles per second, the speed of light. Only a small part of the radiant energy that the sun emits into space ever reaches the Earth, but that is more than enough to supply all our energy needs. Every day enough solar reaches the earth to supply our nation's energy needs for a year.

Use of solar energy

One of the promising options is to make more extensive use of the renewable sources of energy derived from the sun. Solar energy can be used both directly and indirectly. It can be used directly in a variety of thermal applications like heating water, crop drying, distillation and cooking.

The heated fluids can in turn be used for applications like power generation or refrigeration. Another option to use solar energy directly is through the photovoltaic effect in which it is converted to electrical energy.

Solar concentrator

Solar concentrator is a device that can be used to generate electricity using solar resources. It has been developed by concentrating the solar images coming from the sources on the surface of the parabola that is fixed by sun tracking mechanism. These images are then concentrated onto the device called as receiver, and then this energy is converted into usable form.

Type of solar concentrator

There are so many types which are developed for this purpose and these are

- Parabolic concentrator
- Parabolic trough
- Fresnel lens concentrator
- Compound parabolic concentrator
- Dish stirling
- Solar power tower

This concentrator can also be categorized according to their optical principles.

Performance of solar concentrator

There are numerous projects regarding the implementation of the solar concentrators. These projects have been done by research centers, universities and companies to investigate and analyze the reliability and the performance of the concentrator. Table shows some of the projects which have been conducted throughout the world, showing the principle investigator's name and the location of the project. It presents the estimated output obtained as well as the overall efficiency of the system.

Advantages and Disadvantages of solar concentrators

Types of concentrator	Advantage	Disadvantage
Parabolic concentrator	High concentration	Requires larger field of view. Need a good tracking system
Hyperboloid Concentrator	Compact	Need to introduce lens at the entra aperture to work effectively.
Fresnel concentrator	Thinner than convectional lens Requires less material than conventional lens. Able to separate the direct and diffuse light suitable to cont the illumination and temperature o building interior.	Imperfection on the edges of facets, causing the rays Improperly focused at the receiver.

Compound Parabolic Concentrator	Higher gain when its field of view is narrow.	Need a good tracking system.
Dielectric Totally Interna Reflecting Concentrator	Higher gain than CPC. Smaller sizes than CPC.	Cannot efficiently transfer all of the solar energy that it colle into a lower index media.
Flat High Concentration Devices	Compact. Very high concentration	Difficulty to create electrical connection and heat sinking due to the position of the cell.

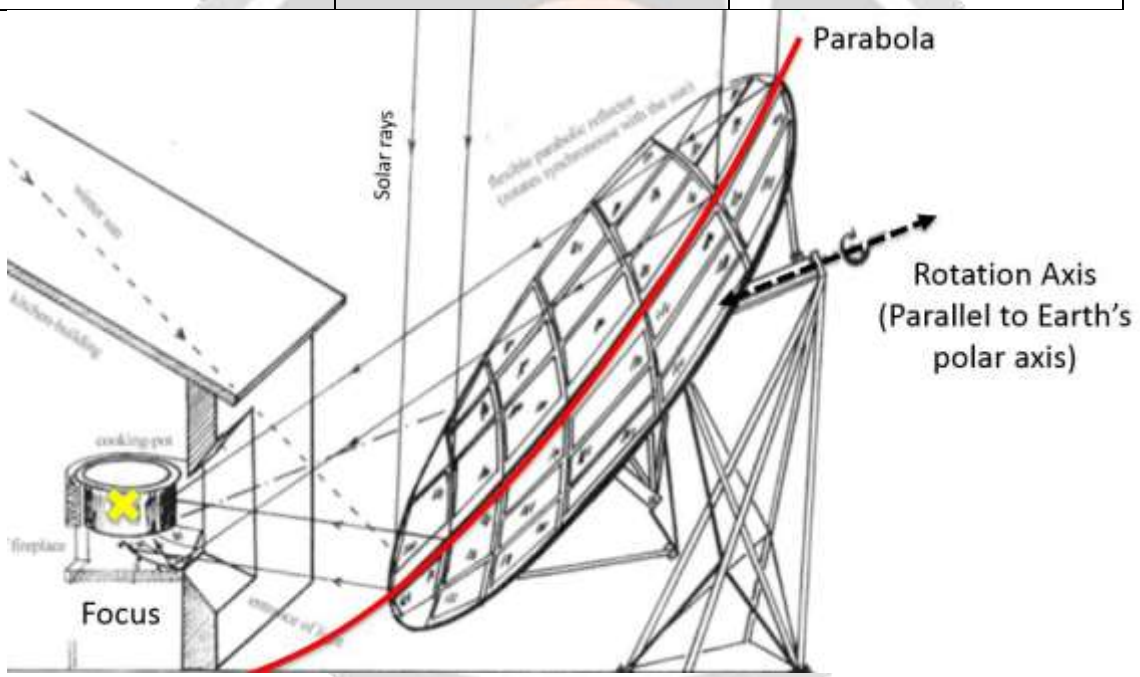

Figure 1 Scheffler reflector diagram showing integration with a cooking area

Design of Scheffler Reflector

The Scheffler reflector design is a proven design for concentrating sunlight for the purpose of cooking, used extensively in India, and elsewhere. It concentrates sunlight in two dimensions to a "point" or small area, allowing heat flow without a dedicated mechanism such as transfer fluid.

Our specific goal in investigating the Scheffler Reflector design is for implementation in cooking in developing countries, and for the continuing study of solar energy for multiple purposes. The Scheffler reflector is based on a similar principle to satellite dishes, using the side of a rotated parabola instead of the bottom (the main difference is that the satellite dish does not need to track, since TV satellites are in geosynchronous orbits) of the focus, the Scheffler can track on a single axis path through the sky defines a series of planes perpendicular to the earth's axis of rotation (the polar axis). These planes shift north and south based on the season. The innovation of the Scheffler is the adaptation to changing adjusted in altitude and its shape must be changed.

Results and Discussion

Tracking mechanism

Tracking mechanism is used to track the direction of sun on the concentrator. There are two type of tracking mechanism.

- Single axis tracking system and
- Dual axis tracking system

Single axis tracking system

With the help of this mechanism scheffler concentrator can be moved about only one direction which is parallel to the earth's axis that passes through N-S poles. Orientation is done on the hourly basis works.

Dual axis tracking system

With this mechanism scheffler can be tracked about 2- direction, one is earth's horizontal axis and other is axis of scheffler concentrator. As season change; the position of sun also changes. To track the changing position of the sun, dual axis tracking system is used.

Working of tracking mechanism

Tracking mechanism is used to focus the sunlight onto the collector. On the back side there is the rotational axis, the tilt of this axis is very important. It has to be equal to that place's latitude so that's parallel to earth axis. The daily movement of the reflector goes around this axis. During the day clock work makes it slowly drift following the sun. For the seasonal movement because during the year sun moves south and then back to north the whole thing has to move. Originally this was made with two telescopic bars- one in the lower end and other one in the upper end those has to be adjusted independently both manually. Now the idea of the new mechanism is to make the upper adjustment automatically so when the lower part is pushed backward during the winter the point near the receiver goes up relative to the surface of the mirror and that pushes the point on the receiver away from the mirror. That works somehow like when stretching the tent pulling both ends together and focusing the light onto the receiver, during summer the other way around. The lower part is pushed up towards the front and the point near the receiver gets closer to the surface of the mirror. The tip is pull toward the reflector bringing the tent down so both ends are split apart and the mirror flattens. This is how the tracking mechanism works. System can be moved on a single axis. Scheffler should be moved about Centre of gravity to assure minimum power requirement. If it does not move about its centre of gravity extra mass to balance the system is required that would lead to increase the power requirement.

CONCLUSION :

Solar energy has vast potential, but its contribution to the world's energy market is still very limited. Solar concentrators could bring down the total cost of the solar cell, thus making the solar technology cheaper and affordable, but at the same time does not compromise the overall performance of the solar technology. There are a lot of designs of solar concentrators. Each design has its own advantages and disadvantages. In spite of the advance designs achieved so far, there are still a lot of improvements that can be done especially on the concentrator designs, Among those we tried to sort it out to maximize its efficiency.

Thus we have how renewable energy can be used for generating electric power and also tracking power required for the scheffler concentrator can be minimized by estimating its centre of gravity at which tracking mechanism is installed to achieve maximum efficiency.

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