Generation of Steam Using Concentrated Solar Power

[1]Karan Sapkal, [2]Nilesh Pingale, [3]Tushar Shinde, [4]Prof.A.J.Patil

Department of Mechanical Engineering
Smt. Kasibai Navale College of Engineering

Abstract— **The conventional sources of energy are getting costlier and results in environmental impacts and so renewable energy production came into existence where the resources are available naturally and in abundant. One of such proven technologies is solar energy generation by solar concentrated solar power (CSP). Now a days in power generation plants lot of the fossil fuels are used so the pollution is also increasing accordingly, So it has become necessary to develop power by reducing the pollution. Solar power is the best solution for reducing pollution while generation of power. Which is widely available, free of cost and non-pollutant? So we are going to use solar energy in this project for generating steam required for different application. The report highlights the design and manufacturing of the concentrated solar power.**

Index Terms— **Concentrated Solar Power, CSP, Steam, Renewable Energy**
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I. INTRODUCTION (HEADING 1)

Man has needed and used energy at an increasing rate for his sustenance since he came on earth. The needs of energy of primitive man were limited in the form of food which he derived by eating plant and animals. Today the world over is using various sources of energy for economic development of their country. Even the further sustainable economic growth and our future existence will even more be dependable on energy.

So, solar energy is alternative source of energy. Solar energy as the most promising new energy has been used widely in a variety of fields. Power plants with solar concentrators are one of the main renewable energy alternatives for the production of electricity. Concentrating solar power (CSP) is almost unique amongst renewable energy technologies in that it can supply controllable power on demand to consumers. Through the integration of hybridization or thermal energy storage, CSP plants can continue generating power during cloud passages or at night, which makes them ideally suited to form the backbone of a future low-carbon electricity grid, providing reliable generation capacity to support other renewable energy technologies.

II. MAIN COMPONENTS

1) Concentrated Parabolic Trough : Used to concentrated the solar energy received from sun. Aluminum foil is used as a reflecting surface. Which will heat the oil (Heating Medium) present in the **Receiver tube?**

2) Heat ex-changer(Radiator Type): Radiator is placed in a container. Oil received from the trough will transfer heat to the water and generate the steam.

III. EQUATIONS

1) $\tan \psi = \dfrac{a/f}{2 - \frac{1}{8}(\frac{a}{f})^2}$

2) $S = \left\{ \dfrac{a}{2}\sqrt{1 + \dfrac{a^2}{16f^2}} + 2f\left(\ln\ \dfrac{a}{4f^2} + \sqrt{1 + \dfrac{a^2}{16f^2}}\quad \times l \right) \right\}$

3) $\cos \psi = \dfrac{2f}{\sqrt{(0.5a)^2 - (d-f)^2}} - 1$

4) $R_{min} = \dfrac{2L\sin\delta}{1 + \cos\psi}$

Where,
Ψ – Rim Angle.
a – Aperture width.
f – Focal Length.
l – length of collector.
S – Surface Area.
d – Depth of parabola.
δ – Acceptance angle.

L – Latus rectum.

R_{min} - Radius of Receiver tube.

IV. SELECTION OF OIL

The heat transfer fluids play an important role in indirect mode of power production where it delivers heat to the water when comes in contact inside the heat exchanger. The steam that is generated from the heat released by heat transfer fluids is then sent to the turbine for power production. The turbine will operate only when there is sufficient rated pressure of fluid is passed through it. So the desired pressure and temperature has to be obtained when the heat is released from the HTF in heat exchanger. There are certain criteria's for a suitable HTF to be selected and those are as follows.

- High operating temperature
- Stability at high temperature
- Low material maintenance and transport costs
- Non-corrosive
- Safe to use
- Low vapour pressure
- Product life cycle
- Low freezing point.
- Low Viscosity.

The present day heat transfer fluids in use are noted with its properties which can be used for comparing it with the criteria mentioned for selection. Considering the above criteria Propylene Glycol is most suitable for our application.

Chemical Formula: $C_3H_8O_2$

TABLE I
PROPERTIES OF OIL

Sr. No.	Properties	Value	Unit
1	Density	1.036	g/cm3
2	Boiling Point	188.2	°C
3	Melting Point	-59	°C
4	Thermal Conductivity	0.34	W/m-K

V. Construction & Working.

Parabolic trough is used to concentrate the solar energy, to get high reflection aluminum foil is used. As thickness of aluminum foil is very less, so it requires support. To achieve it M.S sheet in shape of parabola is mounted on frame. Frame is supported by stand by using nut and bolt system. Nut and bolts are fitted loose enough for manual tracking purpose. Manual tracking is done according to the direction of sun for getting maximum heat from it. To receive the reflected solar rays, receiver tube is placed at focal points supported by frame. Receiver tube consists of copper tube and glass tube both are fitted concentric, copper tube is surrounded by glass tube. Copper tube carries the thermal fluid which is to be heated. Glass tube minimizes the losses and provides the green house effect.

Solar rays coming from sun are reflected by parabolic trough (Aluminum foil) and gets concentrated at receiver tube. The heat energy received is transferred to thermal fluid. Then heated thermal fluid is transferred to heat exchanger through pipe. In heat exchanger, heat energy is transferred to water which converts water into steam. Steam can be used for further applications.

VI. Conclusion

In order to reduce the use of fossil fuel, which are the cause for global warming its is required to make the maximum use of non renewable energy. For power Generation most suitable method is Concentrated Solar Power (CSP).
Using of Concentrated Solar Power will reduce the use of fossil fuel ultimately reduces the pollution.
Concentrated Solar Power makes the use of renewable energy which is available free of cost.

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