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## Review Article

### EXPERIMENTAL ANALYSIS OF PARABOLIC TROUGH SOLAR WATER HEATER BY USING DIFFERENT TUBE DIAMETER - A REVIEW

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#### ABSTRACT

Solar energy is a renewable source of energy. It does not contribute to emission of greenhouse gas and other pollutants to the environment. It is sustainable since it can not be depleted in a time relevant to primary source oil, coal, gas. In this paper a new parabolic trough collector system with manual tracking system has been developed for hot water generation. Which is covered by aluminium foil which works as a reflector. Two copper tubes of varying diameter for absorbing were taken. Experiment conducted on different diameter tube along with changing focal length of collectors so that maximum heat transfer from the receiver achieved. Performance evaluation of this system has been done during the month of December 2015 (winter season) at Gwalior (M.P.) (26.22° N latitude, 78.10° E longitude.)

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## INTRODUCTION

Solar energy is the primary source of energy for our planet. The solar power where sun hits atmosphere is  $10^{17}$  watts the solar power on the earth surface is  $10^{16}$  watts. The total world-wide power demand of all need of civilization is  $10^{13}$  watts. There for sun gives us 1000 times more power than we need. If we can use 5% of this energy, it will be 50 times what the world require. The energy radiate by the sun on a bright sunny day is approximately  $1\text{kw/m}^2$  in this experiment alternative use of solar energy has been studied. Solar energy is a high temperature high exergy radiant energy source with huge advantage over other alternative energy sources it is reliable, domestic, robust, renewable source with large undeveloped potential, and emit essentially none of the atmospheric emission that are dangerous for human race [1]. In this study the design and fabrication of parabolic through solar water heater for water heating was executed. The procedure employed include the design construction and testing at different flow rate and find optimum flow rate at which maximum outlet temperature attain. The incident solar radiation falling on collector is reflected by aluminum foil is utilized for piping heating inside the pipe. The thermal fluid flow and its temperature increase due to the incoming radiation a vacuum is created around the pipe by covered with glass tube. Test is carried on change the diameter of copper tube along with different focal length of collector. Calculate outlet temperature of fluid. Find that large diameter pipe gives more

temperature due to large area covered by the fluid. Efficiency of parabolic is a function of outlet temperature, pipe diameter, intensity of solar radiation. The improvement achieved at this project generate a new method to reduce the logistics times and labor for this type of solar thermal system as well as manufacturing cost [2]. While fossil fuels (coal, oil & gas) will be the main fuels for energy. There is a fear they will get exhausted eventually in the next century. There for other system based on non conventional and renewable sources are being tried by many countries. In India the energy problem is very serious. In spite of discoveries of oil and gas off the west coast, the import of crude oil continues to increase and the price paid for it now dominates all other expenditure. One of the promising option is to make more extensive use of renewable sources of energy derived from the sun. Solar energy can be use used both directly and indirectly. It can be used variety of thermal application like heating water, drying, distillation [3].

#### Some Important Parameter

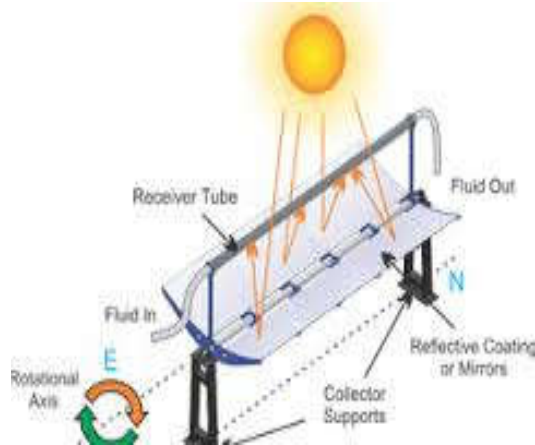
1. Solar Concentration Ratio(C) – The ratio of the effective area of the aperture to the surface area of the absorber. Values of the concentration ratio vary from unity to a few thousand. This quantity is also referred to as the geometric concentration ratio or simply concentration ratio.
2. The aperture (W) - Aperture is the plane opening of the concentrator through which the solar radiation passes.

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It is characterized by the diameter or width of the opening.

3. Intercept factor ( $\gamma$ ) - The fraction of the radiation, which is reflected or refracted from the concentrator and is incident on the absorber. The value of the intercept factor is generally close to unity.
6. Angle of attack - It is the angle between the chord line of the aerofoil and direction of free stream of air.
4. Rim angle ( $\varphi_{rim}$ ) - the rim angle is defined as the angle subtended by the edges of the reflector at the focus.



## LITERATURE SURVEY

K V and T shrinath, [4] - has carried out their valuable experimental investigation with different types of reflector material and absorbing material were analyzed in his study also the optical properties and degradation of the reflecting surfaces were assessed. For the design of the STPC frame, a finite element model had been developed and used to check the capability of the structure to absorb torsion and bending forces under dead and wind loads. The experimental result obtained have the absorbing tube. Shown that the obtained characteristic curve of the tested aluminium collector is considerably lower than that of a mirror collector which can be attributed to the higher thermal losses for the lack of the evacuated glass envelope around.

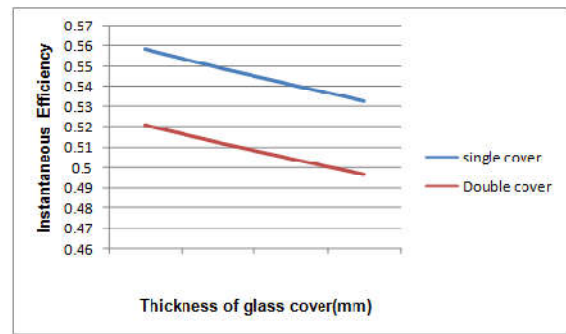
Vijayaraghavan *et al.* [5] - have carried out reports on the outdoor testing done to verify performance of a spectrally selective liquid under concentrated light. The design consist of a fresnel lens based concentrator that focuses radiation on to a glass absorber. Collector thermal performance was measured using copper sulfate solution as the heat collection fluid. Effect of various parameter on efficiency is also reported. It was found that parameter such as solution flow rate through the absorber and optical concentration as measured by the spot size have an insignificant impact on the thermal performance.

Mintsa Do Ango *et al.* [6] - this work presents numerical simulations aimed at optimizing the design of polymer flat plate solar collectors. Solar collectors' absorbers are usually made of copper or aluminum and, although they offer good performance, they are consequently expensive. In comparison, using polymer can improve solar collectors' economic competitiveness. In this paper they propose a numerical study of a new design for a solar collector to assess the influence of the design parameters (air gap thickness, collector length) and

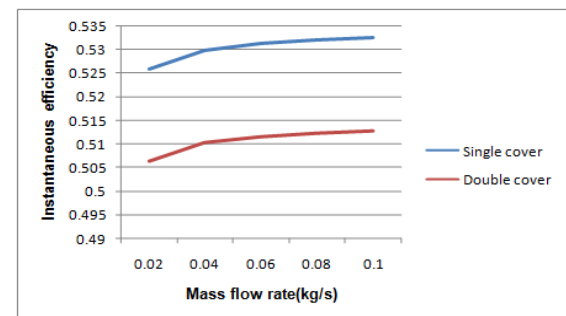
of the operating conditions (mass flow rate, incident solar radiation, inlet temperature) on efficiency.

Kumar Alok. [7] Cylindrical concentrator and a receiver tube. The selective cover system prevents the heat loss (convective and radiative) from the receiver tube and parabolic trough type collector consists of selective improves the performance of solar parabolic trough Also evacuated chamber is created to reduce the loss of heat and reduce the corrosion of concentrator.

### Graph of instantaneous efficiency Vs fundamental parameter



- 1- Thickness of glass Vs Instantaneous efficiency of single and double cover on receiver



- 2- Mass flow rate Vs Instantaneous efficiency single cover on receiver

Surface. Tracking system is embedded in the solar parabolic trough for tracking the sun energy movement. This report presents the evaluation of solar insolation in terms of monthly average hourly global radiation in Patna on 10th April, 2013. On the basis of this solar energy flux, comparative study of the instantaneous efficiency of solar parabolic trough is done. Here four different types of cover system are mathematically analyzed. (i) Single glass cover on receiver (ii) Double glass cover on receiver (iii) Single glass cover on aperture (iv) Double glass cover on aperture. This report contains many graphs to illustrate the effect on instantaneous efficiency on variation of primary parameter. With the help of MATLAB R201a software mathematical calculation is obtained.

### Problem Formulation

After study and analysis of above research papers, I appreciate Kumar Alok, K V pradeep kumar, T Shrinath, Singh Santosh Kumar, Yadav Santosh Kumar, Dutt Subroto, in solar energy. In research paper of Shrinath T shows that obtained characteristic curve for aluminium collector is lower than that

of a mirror collector and mirror collector efficiency is about 8% higher than that of aluminium. In research paper of kumar santosh yadav parabolic trough concentrator is made of an aluminium sheet which is covered by cloth on which rectangular mirror strip are posted two different absorber tubes were taken and the efficiency of the PTSE where compared without glass cover on the absorber tube. They were designed with principal focus at 0.3m so that the receiver heat loss was minimized. In all above research PTSC system most of the studies were focoused on different collector or receiver material along with local wether condition, solar radiation at particular place and give me a brief summry about construction of PTSC with highly conductive absorbing material and other parameters which necessary to consider while experiment is going to be conducted.

## CONCLUSION

Efficiency of parabolic trough solar collector is a function of solar radiation, receiver diameter, it is found that efficiency og parabolic collector could be increase by changing the focal length of collector with respect to change the diameter of absorber tube.

## References

1. Tayade Mayur G, Thombre R E, and Dutt Subroto, "performance evaluation of solar parabolic trough" *International Journal of Scientific and Research* January 2015 vol. (5).

2. Montes Irving Eleazar, Chavez Omar Mercado, and Benite Arturo Mejia "design and construction of a parabolic trough solar collector for process heat production" *Elsevier Energy Procedia* p.p 2149-2158. 2014.
3. Singh Santosh Kumar, Singh Arvind Kumar, and Yadav Santosh kumar, December 2012 "design and fabrication of parabolic trough solar water heater for hot water generation" *IJERT* vol. (1). December 2012.
4. K V Pradeep Kumar, T Shrinath and a Reddy Venkatesh, august 2013 "design, fabrication and experimental testing of solar parabolic trough collectors with automated tracking mechanism" *IJRAME* vol. 1 pp.37-55. August 2013.
5. Vijayaraghavan Sanjay, Ganapathisubbu S., and Santosh Kumar C, September 2013 "performance analysis of a spectrally selective concentrating direct absorption collector" [www.sciencedirect.com](http://www.sciencedirect.com)
6. Mints Do Ango A C, Medale M, and Abid C "optimization of the design of a polymer flat plate solar collector". 2013 *Elsevier Solar Energy* P.P. 64-67. October 2012.
7. Kumar Alok "improvements in efficiency of solar parabolic trough" *IOSR journal of Mechanical and Civil Engineering (IOSR-JMCE)* vol.7 pp.63-75 august 2013.

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