

## ***Solar Water Heating System***

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### ***Abstract***

*Every house requires hot water especially in winters for completion of various activities like bathing, laundry purpose etc. whereas it is required in many industries for production of their goods. Conventional method of heating water has been used from ancient time which requires lot of fossil fuels or electricity which ultimately affect economy of any house or industry. But as solar radiation are available in plenty and it is the main alternative of conventional source of energy which can be harnessed and can be used for heating of water. This method is eco-friendly as well as economical method for heating of water. The size of solar system depends upon availability of sunradiation, temperature requirement, geographical condition and arrangement of the solar system etc. This paper represents a review on various methods through which we can use solar radiation for heating of water.*

***Keywords:*** *Nuclear Fusion, Solar heater, Solar energy collector, Active and passive system*

### **INTRODUCTION**

With the increasing population, the demand of the fossil fuels is increasing which forces a continuous rise of the price of fossils. It is expected that the demand of these energy will increase in future

therefore urgent need is there to research and develop a new alternative which substitutes the fossil fuels and to develop more focus on renewable energy research. Since the human existence on earth, sun is considered as the most powerful force and

ultimate source of life on this planet. Many experiments have been conducted in order for best utilization of this form of energy as it is the best renewable energy we have till now. It is extremely powerful and inexhaustible source of energy present on this earth. The energy i.e. heat and light from the Sun originates from a process called nuclear fusion which occurs inside the core of the sun. Inside the sun the protons or hydrogen nucleus fuses together result in the formation of helium. This fusion process results in release of huge energy which ultimately keeps the temperature of sun to maximum.

Solar heater is a device used for producing the steam for domestic as well as industrial purpose with the help of solar energy. This heating activity does not harm our climate in compared to other energy sources, hence it is a eco-friendly solution for today's world which is facing various problem like global warming, pollution etc.. For carrying out daily tasks the temperature and energy level required to be supplied will vary. Generally 50 to 60 degree Celsius is consider to be acceptable for domestic hot water supply (SOPAC Technical Report 1999).

## LITERATURE REVIEW

**SIVAKUMAR et. al.(2005)** designed a solar heating system which is "elliptical heat pipe flat plate solar collector" and tested it with a collector tilting at an angle of 110 with the horizontal. He analyzed the effect of ratio of condenser length ( $L_c$ ) and evaporator length ( $L_e$ ) of heat pipe, different mass flow rate of cooling water and different temperature of cooling water. In his experiment total 5 elliptical heat pipes with stainless steel wick were used as transport tube in collector. In Container material, copper tube has been used which was filled with methanol as working fluid of heat pipe that was fitted into absorber plate of solar collector. By this whole arrangement he studied the efficiency of "elliptical heat pipe solar collector" and compared the result of the system in different condition. He concluded that elliptical heat pipe solar collector having ratio of condenser length and evaporator length of heat pipe of 0.1764 gives higher instantaneous efficiency.

**Sivaraman and Mohan (2005)** observed the effect of length to diameter ratio of heat pipe on efficiency of solar collector by conducting various experiments. Two solar collectors have been manufactured having different value of length to internal diameter ratio.

Transport tube of solar collector has replaced by heat pipe with stainless steel wick. Container was made from copper and stainless steel whereas wick material and methanol act as working fluid in heat pipe. The heat pipes were designed such that these have heat transport factor of 194 watt and thermal energy of 260 Watt. He conducted the experiments in summer by keeping solar collector at an angle of 13 degree with the horizontal. Results shows that solar collector with heat pipe having L/Di ratio of 52.63 is more efficient then solar collector with heat pipe having L/Di ratio of 58.82. The reason behind the increase in efficiency was increase in heat transfer factor of heat pipe, which increase with reduction in length to internal diameter ratio.

**Madani and Hussain(2006)** studied a batch type solar water heating system in Bahrain which consists of an evacuated cylindrical glass tube. In this system water running through copper coils will be acting as collectors and it is located within the glass tube. On the other side, prototypes were tested whose result shows that maximum temperature difference between the outlet and inlet of the cylindrical batch system was 27.8 degree Celsius giving maximum efficiency of 41.8%. He also calculated the

manufacturing cost of cylindrical batch system which comes out to be \$318, which is slightly less costly than the manufacturing cost of typical flat plate collector which is \$358.

**Mangalet. al.(2010)** discussed "evacuated solar water heater" which is latest solar heater based on a thermo siphon principle for heating the water by absorbing solar radiation and using this water for domestic purposes to carry out day to day activities. As evacuation of air from solar tube take place it creates a vacuum, which help in reducing conductive and convective heat loss from the interior of tube. With this the cold temperature and wind have less effect on the performance of evacuated solar water heater and less heat loss will be noticed. Thus fast heating of water takes place as compared to flat plate solar water heater /collector.

Reduction of heat loss many other benefits of evacuated tube solar water system. This model is new for India but it can be used to carry out daily house hold activities and can reduce negative impact of global warming, climate change energy crisis etc. On comparing on the basis of the peak efficiency level only little difference is found between flat plate solar collector results into fast heating water in

comparison to the flat plate solar water heater/collector. This research paper has given and evacuated type solar collector. Normally flat plate will give higher value but this is during minimal heat loss condition. But on taking average for one complete year evacuated type solar collector may have a clear advantage.

## CONCLUSION

From this study we can get the following conclusion:

- Solar water heating system can help in reducing the energy demand for a household.
- A solar water heater is a long-term investment that may be costly initially but can reduce overall cost.
- Solar water heating systems can also be used to directly heat swimming pool water, with the added benefit of extending the swimming season for outdoor pool applications.
- Depending on the range of temperature use, solar thermal applications can be divided into the three broad categories:
  1. Low-temperature applications (below 100°C), such as solar drying, hot water supplies, cooking.
  2. Medium-temperature applications (below 150°C), such as refrigeration, industrial process heat, etc.
  3. High-temperature (above 150°C) applications, such as electricity generation.
- Heat pipe based solar water heating can be influenced by nature of the refrigerant, due to the environmental concerns.
- Elliptical heat pipe solar collector having  $L_c/L_e$  ratio of 0.1764 achieved higher instantaneous efficiency.
- The cost of manufacturing the cylindrical batch system to be \$318, slightly less expensive than typical flat plate collectors of \$358.
- When averaged over a year evacuated tube collector have a clear advantage over flat plate collector.
- The natural convection heat pipe system is capable of heating water to 100°C.

## REFERENCES

- I. Al-Madani, Hussain (2006). "The performance of acylindrical solar water heater." Renewable Energy Vol. 31,pp 1751-1763.
- II. B Sivaraman and N Krishna Mohan (2005). "Experimental analysis of heat pipe solar collector with different L/di ratio of heat pipe", Journal of Scientific & Industrial Research, Vol. 64, pp 698-701.
- III. Dharamvir Mangal, Devander Kumar Lamba, Tarun Gupta, Kiran Jhamb (2010). "Acknowledgement of Evacuated Tube Solar Water Heater Over Flat Plate Solar Water Heater" International Journal of Engineering (IJE), Vol. 4, pp 279-284.
- IV. K. Sivakumar, N. Krishna Mohan and B. Sivaraman (2005) "Performance analysis of elliptical heat pipe solar collector" Indian Journal of Science and Technology.