Experimental Set Up of Parabolic trough Water Heating System

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Abstract

The growing need for energy and the depletion of conventional fuel has forced the man kind to think in direction of non-conventional energy sources. One of the largest sources of non-conventional energy is Sun. The Principle objective of our project is to generate hot water by using solar energy for various applications like processing, Agricultural, Wood treatment, Petrochemical refining. In this system we are using 'Parabolic trough collector'. A parabolic trough solar collector uses an aluminium polishing plate in the shape of parabolic cylinder to reflect and concentrate sun radiations towards the copper pipe located at the focus line of their parabolic cylinder. The receiver absorbs the incoming radiations and transforms them into thermal energy. Later being transported and collected by a fluid medium circulating within the copper pipe. The designing and fabrication of parabolic trough solar water for heating of water was executed, the whole procedure employed includes design, construction and testing stages. The model which is made up of reflector surface, reflector support, copper pipe and a stand with manual arrangement using locally sourced material for rural applications.

Keywords: Radiation Effect, Parabolic Shape, Zenith Angle, Heat Transfer in Tube

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I. INTRODUCTION

Solar water heating is the conversion of sunlight into heat of water heating using a solar thermal collector. A variety of configurations are available climates and latitude. Solar water heater are widely used for residential and some industrial application. Humans always use the rays of the sun to gather their energy needs. Energy needs of Today with increasing environment, alternative systems to be investigated to reduce the use of non-renewable and polluting fossil fuels and improve the design of the system to improve the output result. One such possibility is solar energy, which has become increasingly popular in recent years. Now-a-days solar energy has been strongly promoted as available energy source. One of the simplest and most direct applications of this energy is the conversion of solar radiation into heat. Hence, the domestic sector can lessen its impact on the environment is by the installation of solar parabolic trough collectors for heating water. Although it should be said that some of these collectors have been in service for that last 40-50 years without any real significant changes in their design and operational principles. We are solving the problem of producing hot water by renewable source such as sun rays with least initial cost and effort. So the observation of water temperature at different time zone is obtained by this experimental set up using various tube material such as copper and glass held at Vadodara city (22.30 N 73.19 E), township of Gujarat.

II. LITERATURE REVIEW

A. Performance of Solar Parabolic Trough (Jan 2015) By Mayur G Tayad, R E Thombre, Subroto Dutt

This paper was concerned with an experimental study of parabolic trough collector designed and manufactured. A parabolic trough solar collector uses Aluminium sheet in the shape of a parabolic cylinder to reflect and concentrate sun radiations towards an absorber tube located at the focus line of the parabolic cylinder. The receiver absorbs the incoming radiations and transforms them into thermal energy, the latter being transported and collected by a fluid medium circulating within the absorber tube.

B. Simulation Studies of Parabolic Trough Collector for Obtaining Solar Energy (April 2017) By Syed Ameen Murtuzaa,

One of the most important roles in providing clean non-polluting energy in domestic and industrial applications is played by solar thermal systems. Concentrating solar technologies, such as parabolic dish, compound parabolic collector and parabolic trough, have the ability to operate at high temperatures and are used to supply heat to the industrial process, off-grid electricity and huge electrical power. In a parabolic trough solar collector (PTSC), the reflective profile focuses sunlight on a linear receiver tube or heat collecting element (HCE) through which heat transfer fluid is pumped.

C. A Solar Water Heating System (April 2014) By Sachin Tadvi, Vishal R Jain, Kyur Thakkar

There are two main types of solar water heater systems: passive and active. Active systems integrate pumps and rotary elements and are therefore very expensive. Systems use natural water circulation, gravity, and/or pressurized water systems. Passive solar water heater systems are much less expensive than their active counterparts and are easier to maintain and repair. Recent

developments in heat pipe based solar collector technology exhibit a promising design to utilize solar energy as a reliable heating source for water heating applications in solar adverse regions. Heat pipe based solar water heating is influenced by many factors including the nature of the refrigerant, due to the environmental concerns.

D. A Solar Water Heating System (April 2014) By Sachin Tadvi, Vishal R Jain, Kyur Thakkar

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E. Solar Water Heating Systems (Jan 2016) Kishan Patel, Mrs. Pragna Patel, Mr. Jatin Patel

It presents the alternative method of solar water heating system. This automated system would allow the user to get hot water from the solar water heater as long as the solar water heater can supply hot water above a set temperature. If the solar water heater is unable to supply water above the set temperature, then only will the electric water heater come into action.

F. Solar Radiation: Correlation between Measured & Predicted Value (2016)

In this study, the correlation between measured and predicted values of solar radiation was made. A series of daily measurements of the global solar radiation on a horizontal surface was recorded in Mubi with the aid of a constructed pyranometer. The monthly average value was determined. The monthly average daily solar radiation on horizontal surface was also determined using sunshine duration. These parameters were input in some radiation models to compute the solar radiation. Finally, a prediction of the global solar radiation from climatological data has been attempted. The predicted values have been compared with the corresponding measured values.

III. CONSTRUCTION DETAIL

Fig. 1:

IV. RESULT TABLE

Table – 1

Sr. No.	*Time*	*3-5-18*	*5-5-18*	*7-5-18*	*9-5-18*	*11-5-18*	*13-5-18*	*15-5-18*
1.	*9 to10*	*36*	*37*	*38*	*39*	*40*	*41*	*42*
2.	*10 to 11*	*45*	*46*	*47*	*48*	*49*	*50*	*51*
3.	*11 to 12*	*54*	*54*	*55*	*55*	*58*	*59*	*59*
4.	*12 to 1*	*69*	*67*	*66*	*66*	*63*	*62*	*61*
5.	*1 to 2*	*70*	*70*	*69*	*68*	*65*	*65*	*64*
6.	*2 to 3*	*75*	*74*	*73*	*72*	*72*	*71*	*70*
7.	*3 to 4*	*80*	*76*	*76*	*75*	*72*	*71*	*70*
8.	*4 to 5*	*74*	*73*	*72*	*69*	*69*	*65*	*63*

V. CONCLUSION

We concluded that maximum temperature of water obtained by using multiple copper pipe in comparison to single copper pipe as well as single and multiple glass pipe and 80.8°c is the maximum water temperature achieve by the parabolic trough water heating

system. As the percentage of heat gain improved by using multiple copper pipe compare to single copper pipe, single as well as multiple glass pipe as the working fluid has to pass from maximum cross section area of high heat conductivity material. The Parabolic trough water heating system can developed at low cost in comparison with traditional solar water heating system and also it is long life and light weight system.

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