

STUDY OF FLAT PLATE SOLAR WATER HEATER WITH FORCE CIRCULATING PUMP

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Abstract- Use of solar energy has become more popular because it is major example of Renewable energy source. A flat plate solar water heater has been designed and the capacity of water heater is 60 liter. This solar water heater start the heating of water from initial temperature to final temperature approximate 70 degree in certain period of time by using solar energy getting from sun radiation. The efficiency are basically depends on specific arrangement of the solar setup and radiation absorbing capacity of flat plate collector. This is an ongoing project in which all the requirement as higher efficiency, low cost, durability, safety & maintenances etc. are achieved day to day with specific design of solar water heater. In The specific arrangement of the solar water heater are flat plate collector are designed with reducing heat loss and tilt the flat plate collector at specific angle so large sun radiation absorb. Use of pure water and low dissolved solid contained water play good role in increase efficiency of heated water.

Keywords- Solar water heater, Flat plate solar collector, Sun radiation, Steal tank, Thermocouple, Solar heater efficiency, Heat losses.

I. INTRODUCTION

In recent year's solar energy are widely used in various fields as: solar water heater, solar light, solar cooker, solar oven, solar energy in automobile, solar watch, etc. Solar energy is used for large system to smallest system.

The major advantages of solar energy are that it has lower cost. The solar radiation incident on the surface of the earth can be used for fulfill human requirement. Solar water heater is one of the popular devices of solar energy. According to the Mecrom Capital Group is a global clean energy communications and consulting firm, the solar installations in india are approximately 1000 mw in 2014. There was very slow rate of installations in india year-over-year. The market survey on growth of solar installations might be again in 2014 similar to 2012 and 2013.

There are number of several factors for the slow rate of solar growth in india according to Mecrom. In india there are no Jawaharlal Nehru National Solar Mission (JNNSM) PV projects to come online based until mid of 2015.

Solar water heating technology is not new: Actually, solar water heating is hardly a newcomer to the Inland Empire. Before the World War II, there were not many houses with water heater based on solar energy, but there were two companies in this field .William J. Bailey a man, who noticed the efficient way of sun radiation utilization. Use the sun radiation to heat water and keep it in specialized storage tank. Like today's concept, system had collectors placed on roofs of houses using copper pipes painted with low refractive black color .This concept was became more

popularity into the 1920s and 1930s. In Southern California homes approximately 25,000 solar water systems.

Advantages of Evacuate type Solar Water Heater

Fuel Savings: Solar water heaters with 100 liters capacity it can be replace an electric energy based geyser so it saves 1500 units of electricity in one year. **Avoid cost of utility on generation:** The use of 1000 Solar water heaters of 100 liters capacity each can contribute to a peak load shaving of 1 MW electricity.

Environmental Beneficial: A Solar Water Heater with the capacity of 100 liters it can be prevent the emission of 1.5 tons of carbon dioxide gas per year.

Life: The life time solar water heater is 15-20 years
The system has incorporated freeze and over heat up protection strategies that:

- (i). No manual operation are require on building occupant.
- (ii). No need of electricity and gas for recirculation oh heated water during winter season.
- (iii). finally no loss of electricity and gas in process of drain of heated water
- (iv). The limit of the heated water in storage tank not more than 180°F

In this paper a flat plate solar water heater has been designed and described which heat water by using of sun radiation. After the collection of sun radiation the final temperature of water reached nearly approximate 70 degree. This water can be used for domestic purpose in family and as well as for industrial purpose. This is better treatment of heating water with economical way.

II. EXPERIMENT SETUP

Basically the solar water heating systems are two type. One is closed loop system and second is open loop system. In the closed loop system, heat exchangers are helpful to protect the system from hard water which obtained from bore wells or from freezing temperatures in the cold regions. In the open loop type system, in his system either thermosyphon or forced circulation system by pump, the water in this system is open to the atmosphere at one point or other point. In the open loop system the thermosyphon systems are simple and relatively inexpensive. They are used for domestic and small institutional systems, the water which provided by thermosyphon is treated and potable in quality. A electrical pump employ in force circulation process though collector to storage unit.

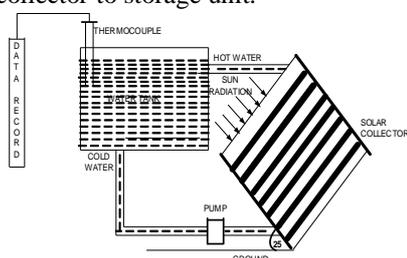


Figure.1.1 Solar Water Heater With Continuous Data Recorder

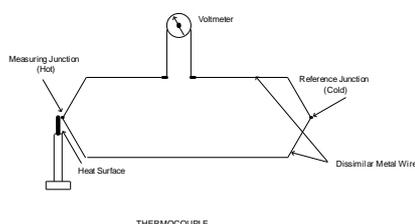


Figure 1.2 A Thermocouple with Two Junction

Thermocouple Temperature Ranges

Calibration	Temperature Range	Standard Limit of Error	Specific Limit of Error
J	0°C to 750°C (32°F to 1382°F)	Greater than of 2.2°C or 0.75%	Greater than of 1.1°C or 0.4%
K	-200°C to 1250°C (-328°F to 2282°F)	Greater than of 2.2°C or 0.75%	Greater than of 1.1°C or 0.4%
E	-200°C to 900°C (-328°F to 1652°F)	Greater than of 1.7°C or 0.5%	Greater than of 1.0°C or 0.4%
T	-250°C to 350°C (-328°F to 662°F)	Greater than of 1.0°C or 0.75%	Greater than of 0.5°C or 0.4%

In this experiment setup there are two major components (i) Flat plate collector (ii) Storage unit for increase the efficiency of the system both components collector and storage unit are integrated on same system. A flat plate solar collector is special kind of heat exchanger convert solar energy into internal energy of the transport medium .A flat plate solar collector contains copper pipes of certain diameter of and length.

These pipes are black painted of low reflection light property. Black painted copper pipes are usually used as the absorber plates of collectors. The glass cover of the collector plates has 5mm thickness and the absorber plate as a black painted copper plate 2mm thick. The spacing between the glass cover and the absorber plate was 25mm. There is glass cover of flat plate collector act as transparent cover which transmits the sun radiation to the plates but reduces the heat losses through the collector. The glass wool and cork sheet can be used for heat insulation purpose in back side of the system.

III. WORKING PROCEDURE

In this experiment we are taken 40 liter water in specific tank of length 120 cm and diameter 60 cm. After the study and performing this project there is main factor of tilt angle of the flat plate collector to the ground surface which is specifically set at approximately 25 degree and face towards the south direction. When sun radiation is absorbed by collector plates then this heat energy transmit by water as fluid. This process will continue of heating water in presence of sun shine. There are two types of systems, active and passive. Active systems use electricity for pumping the fluid and have a reservoir or tank for heat storage and subsequent use. Passive systems rely on natural convection and water pressure during draw to move fluids, and require no circulation hardware. In this paper the circulation of cold water to solar collector by using a small dc pump of 0.5HP. This circulation of water starts in close loop from the specific designed tank made as sandwich of glass wool in between mild steel and stainless steel to the collector plates and go to this heat water inside the tank by other way, thus continuous circulation of water convert the cold water into heated water with some specific temperature. The temperature measured by using thermocouple which show continuous temperature reading of water.

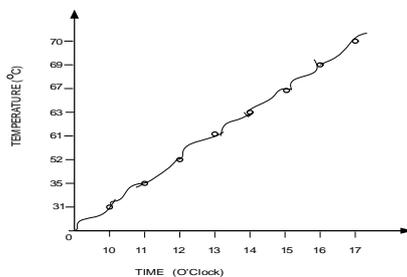
IV. PRELIMINARY RESULT OF EXPERIMENT

In this project paper the initial temperature of water are taken at 31 degree after the circulation of water through the solar collector plate water stars heat up continuously. This experiment done on 25 June 2013 time at 10 am. After certain period of time water

temperature rise gradually. A table show continuous reading of rise temperature with respect to time. The temperature measured by thermocouple.

TIME	TEMPERATURE OF WATER(In degree)	SOLAR ISOLATION (W/m ²)
10	31	758
11	35	1044
12	52	1096
13	61	974
14	63	544
15	67	416
16	69	384
17	70	312

A graph reading of water temperature with time period.



CONCLUSION

Solar water heating is now a mature technology. Wide spread utilization of solar water heaters can reduce a significant portion of the conventional energy being used for heating water in homes, factories and other commercial and institutional establishments. Internationally the market for solar water heaters has expanded significantly during the last decade. In this paper collector efficiency depends on collection of large radiation with low heat losses.

Heating water with solar energy can be a cost effective and environmentally responsible way to generate hot water, Minimizing the expense of electricity or fossil fuels to heat water and reducing the associated environmental impacts.

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