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Thermal Performance Evaluation of Combine Solar Water Heater and Gas Geyser System

Nilesh Tiwari [1], Srijesh Gajjar [2], Chandresh Bhagat [3], Ayush Chauhan [4]

[1, 2, 3, 4]Mechanical Engineering Department, ITM Universe, Vadodara. 391510, India

Abstract: ***The solar energy is free energy and available in the ample amount and solar energy can be used for cooking, heating and power generation purpose. In the solar water heater the water which is heated can be used for bath purpose and to maintain temperature in the winter days is difficult and so in the present work the water stored in the insulated tank of solar water heater will be supplied to gas geyser and as water is pre heated so the gas consumption will decrease in case of gas geyser.***

Keywords: Solar Energy, Gas Geyser, Solar Water Heater

1. Introduction

1.1 Solar Water Heater

All forms of energy on the earth are derived from the sun. However, the more conventional forms of energy, the fossil fuels received their solar energy input eons ago and possess the energy in a greatly concentrated form.

A solar water heater consists of a collector to collect solar energy and an insulated storage tank to store hot water. The solar energy incident on the absorber panel coated with selected coating transfers the hat to the riser pipes underneath the absorber panel. The water passing through the risers get heated up and are delivered the storage tank. The re-circulation of the same water through absorber panel in the collector raises the temperature to 80 ^{0}C (Maximum) in a good sunny day. The total system with solar collector, storage tank and pipelines is called solar hot water system. Broadly, the solar water heating systems are of two categories. They are: closed loop system and open loop system. In the first one, heat exchangers are installed to protect the system from hard water obtained from bore wells or from freezing temperatures in the cold regions. In the other type, either thermo syphon or forced circulation system, the water in the system is open to the atmosphere at one point or other. The thermo syphon systems are simple and relatively inexpensive. They are suitable for domestic and small institutional systems, provided the water is treated and potable in quality. The forced circulation systems employ electrical pumps to circulate the water through collectors and storage tanks. The choice of system depends on heat requirement, weather conditions, heat transfer fluid quality, space avail F ability, annual solar radiation, etc. The solar water heating systems are economical, pollution free and easy for operation in warm countries like ours.

Solar water heating systems for domestic, industrial and commercial application are at present available. Except in the hilly regions and in the northern latitudes, the potential for domestic water heaters is somewhat limited. In commercial establishments however, there is great potential especially in hotels, hospitals, guest, tourist bungalows, Canteen etc. [1].

1.2 Gas Geyser

Gas geyser is device which is used for a water heating purpose. In which the temperature of cold water is increased by utilization of heat from combustion of gases. Journey of tank type gas geyser to tank less gas geyser increases efficiency but it increase cost of gas geyser. The cost of tank less gas geyser is three times more than the tank type gas geyser. This increase of cost is due to use of copper used in tank less gas geyser. Also size of burner is increased in tank less gas geyser so gas consumption is more. Thermal efficiency of tank less gas geyser is 82 to 85% as compared to the thermal efficiency of tank type gas geyser which is about 67.4 %. So tank less gas geyser increase thermal efficiency but it's cost is more due to use of copper [2].

The main objective of the present research work is to evaluate thermal performance combine solar water heater system with gas geyser unit.

Budihardjo, G.L. Morrison [3] studied the thermal performance of water-in-glass evacuated tube solar water heaters and is evaluated using experimental measurements of optical and heat loss characteristics and a simulation model of the thermo syphon circulation in single-ended tubes. Y. Taheri, BehroozM.Ziapour,K.Alimardani [4] investigated a new techniques for solar water heater using black coated sand and all experiments results, the collector averaging daily efficiencies achieved higher than 70%. N.M. Nahar [5] focused on effect of selective surface on the performance of solar water heater the overall efficiency of the heater is 57%. The predicted performance at various Indian stations revealed that hot water is required at most places for domestic use only during winter season and it can provide 100 l of hot water at an average temperature of 50–70 ^{0}C, which can be retained to 40–60 ^{0}C till next day morning use. K.K. Chong, K.G. Chay, K.H. Chin [6] studied solar water heater using stationary V-trough collector. Integrating the solar absorber with the easily fabricated V-trough reflector can improve the performance of solar water heater system. In this paper, optical analysis, experimental study and cost analysis of the stationary V-trough solar water heater system are presented in details. Rakesh Kumar, MarcA.Rosen [7] carried out thermal performance of integrated collector storage solar water heater with corrugated absorber surface. In this investigation, the surface

of the absorber is considered to be corrugated, with small indentation depths, instead of plane.

Gurmohan Singh, Dr. Beant Singh [8] developed a new method by providing economizer on the chimney of gas geyser to recover heat and can be utilized for water heating purpose.JaytiArora, P.R. Arora[9] discussed about the role of solar water heater in the comparison of conventional fuels are used for heating purpose.Yogesh Kumar, P K Paliwal B. L. Sirohiwal, Vijay Pal Khanagwal, Luv Sharma [10]discussed about the dangerous point associated with utilization of gas geyser. The main presence of carbon monoxide in the exhaust gas emitted from gas geyser.Tajwar, A.R. Saleemi, N. Ramzan, S. Naveed[11] had improving thermal and combustion efficiency of gas water heater, Studied the thermal performance of conventional gas geyser with instant water heater on the basis of environmental design and home economic point of view. The attempt has been made to conserve energy and water in domestic type has geyser and for which experimentation has been carried out for five winter. The experiment shows that amount of gas consumption depends on length of pipe and to improve the performance of gas geyser a length of tubes (pipes) of gas geyser play a vital role.
Table 1

2. Experimental Set up

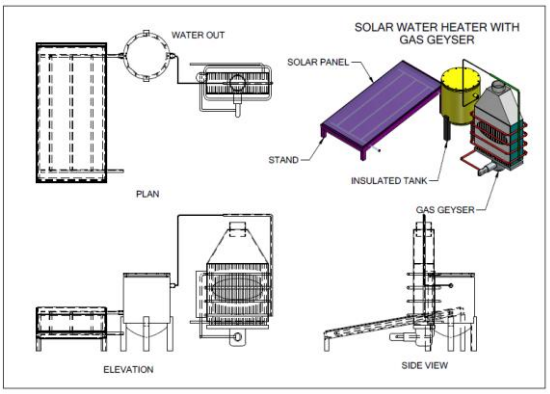

Figure 1: Conceptual Design of Combine Solar Water Heater with Gas Geyser

In this work during day time with the help of solar energy the water get heated and the hot water is stored in the tank which is insulated and finally that water will be used in the gas geyser in the morning for bath purpose. As the water is pre heated the gas consumption will decrease. K type thermocouples are used for temperature measurement purpose.

Figure 2: Internal Detail of Gas Geyser Gas Geyser

Figure 3: Solar Water Heater

3. Result and Discussion

The experiments have been carried out for different ambient condition and due to solar heating better temperature can be obtain and due to insulation in the storage tank better temperature can be obtained and so due to such pre heated water the gas consumption of the gas geyser will reduce.

Table 1: Result Table

Ambient Temperature	*Temperature after solar water heater*	*Temperature in Insulated Tank in morning*	*Temperature at outlet of Gas geyser*
26	58	48	65
28	59	46	64
27	61	50	68
25	57	47	66
28	59	48	69

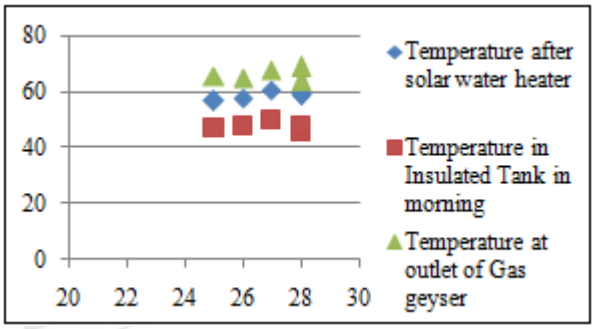

Figure 5: Temperature Variation with respect w.r.t Time

4. Conclusion

Due to pre heating of water the fossil fuel consumption in case of gas geyser can be reduced and so this system become very good option for combining renewable energy sources to the conventional thermal system.

5. Acknowledgment

This work was done as a part of final year project review carried out on a unique defined problem to carry out experimental setup for gaining more efficiency.

References

[1] Rai G.D. Solar Energy Utilisation, 5th edn. Khanna Publishers Delhi, India, 2005

[2] I. Budihardjo, G.L. Morrison, "Performance of water-in-glass evacuated tube solar water heaters", Solar Energy 83 (2009) 49–56
[3] Y. Taheri, BehroozM.Ziapour,K.Alimardani, "Study of an efficient compact solar water heater", Energy Conversion and Management 70 (2013) 187–193
[4] N.M. Nahar, "Year round performance and potential of a natural circulation type of solar water heater in India" Energy and Buildings 35 (2003) 239–247
[5] K.K. Chong, K.G. Chay, K.H. Chin, "Study of a solar water heater using stationary V-trough collector", Renewable Energy 39 (2012) 207-215
[6] Rakesh Kumar, MarcA.Rosen, "Thermal performance of integrated collector storage solar water heater with corrugated absorber surface", Applied Thermal Engineering 30 (2010) 1764-1768
[7] Hussain Al-Madani, "The performance of a cylindrical solar water heater", Renewable Energy 31 (2006) 1751–1763
[8] Er. Gurmohan Singh, Dr. Beant Singh, An Experimental investigation of Gas Geyser's Heat Exchanger with addition of Economizer, IJAERT, Volume 3 Issue 7, July 2015
[9] JaytiArora', P.R. Arora, Use Solar Heat for Prosperity, Healthy and Pollution Free Life International Journal of Scientific and Research Publications, Volume 3, Issue 10, October 2013
[10] Yogesh Kumar, P K Paliwal B. L. Sirohiwal,Vijay Pal Khanagwal, Luv Sharma, Gas Geyser a Silent Killer in Bathroom: A Case Report of Carbon Monoxide Poisoning, Indian Acad Forensic Med. January-March 2014, Vol. 36
[11] Tajwar, A.R. Saleemi, N. Ramzan, S. Naveed,
[12] Improving thermal and combustion efficiency of gas water heater, ELSEVIER, 2010

Author Profile

Nilesh Tiwari is currently working as assistant professor in ITM universe in mechanical department and as a project guide of group.

Gajjar Srijesh studying in mechanical engineering department of ITM universe

Chandresh Bhagat studying in mechanical engineering department of ITM universe

Ayush Chauhan studying in mechanical engineering department of ITM universe