A Review Study on Solar Water Heating Systems

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Abstract: The current solar water heating systems are explored with their apps in the current review article. Hot water is now used for national, commercial and industrial reasons. Various resources are used for heating water and steam manufacturing, i.e. coal, diesel, gas, etc. Solar energy is free, socially safe and is therefore recognized as one of the most successful alternative energy sources. Effective use of solar energy is hindered by the intermittent nature of its supply, restricting its use and efficiency in national and industrial systems, particularly in water heating. Nowadays, plenty of hot water is used for domestic, commercial and industrial purposes. Various materials, i.e. coal, diesel, gas, etc., are used for heating water and sometimes for steam manufacturing. Solar energy is the primary solution to replacing conventional energy sources. The accessible literature is evaluated to comprehend the design, structure, applications and size of the solar thermal system.

Keywords: Solar energy collector, Solar water heating systems, Flat plate collector, Thermal effect.

I. INTRODUCTION

The importance of energy in our modern environment cannot be overemphasised, as energy plays a crucial part in the well-being of any community and human existence. Effective energy use and supply plays an important part in economic development as well as in society's growth. Energy sources are usually categorized into two types: non-renewable and renewable. Non-renewable energy is energy that originates from the floor and is not substituted after exhaustion in a comparatively short time, while renewable energy is energy that automatically replenishes itself from continuing natural procedures. For instance, fossil fuels (such as coal, petroleum, and natural gas) and certain aquifers are all non-renewable energy sources, while sunlight, wind, moving water, biological procedures, and so on are types of renewable energy sources. Solar hot water system was already at the edge of the BRAC University construction. The scheme can be completely applied when a system has a higher effectiveness value. The motivation of this thesis is to obtain an effective hot water system with a restricted price and natural resource like gas and diesel and how to reduce electricity consumption. The scheme can be produced effective by reducing the temperature gap between the solar fan and the tank by offering a suitable insulating layer.

II. SOLAR WATER HEATING SYSTEM

A solar water heating scheme (SWHS) consists of several significant components: one or more solar collectors, a pump, a heat exchanger, a storage tank (or various reservoirs) and a back-up storage tank. Solar heating can be regarded as passive or active. The general practice is to use flat-plate solar energy collectors (FPC) for water heating reasons. Although the Evacuated Tube Collectors (ETC) and Evacuated Tube Heat Pipe Collectors (ETHP) are more effective, the original price is relatively greater.

Figure 1: Cross-section of the storage tank

III. LITERATURE REVIEW

Mohamed Abu Waseem et. al. (2018) This plan seeks to enhance the effectiveness of the heat transfer rate from the absorber pipe wall to the working fluid by using different kinds of inserts and inner caps. Some of the techniques of enhancing the effectiveness of the heat transfer rate to the operating environment are: increasing the contact region of the fluid with the absorber pipe, using certain barriers, such as introduction, which raises the residual time of the fluid and thus reduces the stress across the pipe, decreasing the speed of the working fluid. The analysis was carried out to investigate the impact of heat transfer in absorber pipes with different kinds of fine profile and also to compare the outcomes with the absorber pipe without fine.

D Prakash et. al. (2018) This research concentrated on the efficient use of solar energy through a new solar water heating scheme and the flow of heat in the indoor construction is detained by adequate ceiling insulation material. The altered isolated ceiling with solar water heater is intended and numerically simulated with validation in the commercial computational fluid dynamics software. Through this research, the variables affecting the efficiency of the solar water heating scheme and thermal insulation capability are analysed and the optimal layout of the adapted ceiling structure is defined. The modified roof system produces 25 L of hot water per day with a temperature

increase of 60 ° C in the summer season. The same roof system also maintains the ceiling temperature at about 27 ° C for a full day in the summer season.

S. Sadhishkumar et. al. (2018) The present work was initiated to study the possibility of using Phase Change Materials (PCMs) to store solar energy and to use this energy during the night to heat water for domestic purposes. In this research, the efficiency of an enclosed water-in-glass pipe solar water heater was explored using three techniques (i.e.) with no reflector, reflector and reflector cum PCM (Paraffin wax). Factors influencing the efficiency of water-in-glass evacuated tube solar receiver pipes will be discussed and a numerical analysis of water circulation through the pipes will be provided. The findings of the simulation were then output with those of the test outcomes. It was found that the use of the suggested arrangement can result in 5 °C to 7 °C benefits over prolonged phases of moment in the stored warm water temperature.

Ankit S. Gujrathi et. al. (2017) In this research, an attempt is produced to use Ansys 15.0 Workbench software to model a Parabolic Trough Collector. The PTC has been intended for a concentration ratio of 25. The PTC has been simulated at distinct mass flow speeds of 0.25 kg / hr, 0.5 kg / hr, 0.75 kg / hr and 1 kg / hr respectively, and the outcomes are discussed. The heat transfer features such as heat transfer coefficient, Nusselt number and thermal flux are also researched for distinct mass flow speeds. The peak water temperature is discovered to be 3670 K for a mass stream speed of 0.25 kg / hr with a collector effectiveness of 51.2%. The mass flow speed of water through the receiver pipe is diverse and all the outcomes achieved have been observed. The peak water outlet temperature is 3660 K and is discovered to decline to 3180 K with a rise in the mass flow rate from the mass flow frequency of 0.25 kg / hr to kg / hr respectively. Although the temperature reduces, the heat transfer rate increases with the rise in the mass flow rate shown by the enhanced heat transfer ratio and the Nusselt number.

Arun K. Raj et. al. (2017) Experimental investigation on flat table solar water heater raiser pipe with and without fine. In addition, investigation on Raiser pipe with increasing fine contact region such as raiser tube with standard fine (90 ° contact area), reversed raiser tube with standard fine, raiser tube with altered fine (270 ° contact area) and inverted raiser tube with modified fine. As the surface area increase heat transfer from fins also get increases. Comparing the outcomes of these five distinct propellers, it is discovered that the region of touch between the raiser pipe and the fine heat transfer rises. The reversed raiser pipe also provides more water production temperature than the conventional raiser pipe. Thus, the application of the fine in panel flat panel collector (FPC) is also the most successful methods that boost the heat transfer rate and reduce the region of touch between the fine and the raiser pipe arising in a rise in water supply temperature through the raiser pipe.

K. Vasudeva Karanth et. al. (2017) This research analyses the heat efficiency consequences when distinct sizes and shapes are chosen for the absorber plate pipes. The CFD analysis shows that the circular cross-section tube of the collector having flattened the contact surface with that of the absorber plate provides significantly better thermal performance vis-à-vis other settings in terms of the Nusselt number. The numerical research demonstrates that the heat efficiency differences are important while for the solar panel pipes distinct shapes and sizes are regarded based on the criteria of steady cross section area and steady perimeter. The criterion with a steady cross-sectional region indicates that the pressure drops and absolute temperature increase across the pipe is comparatively big for triangular pipe construction.

Mohammed Abdul Junaid et.al. (2017) The main objective of this study is to present the design of the solar flat plate collector using CAD software to perform thermal analysis at 11 am, 12, 1 pm & 2 pm in the month of March and keep the mass stream frequency as steady. GAMBIT 2.4 is used for modelling purposes and ANSYS FLUENT 14.5 is used for evaluation. It is calculated from the time-related simulation of FPC at 11.00am to 2 pm. The input temperature is higher in the 12:00 collector i.e. 40.89 ° C when the water inlet temperature is 25 ° C so that the temperature rises to 15.890C and as the time increases the output temperature declines.

V. Y. Chaudhary et. al. (2017) The research demonstrates the use of solar energy with the assistance of CFD Analysis containing evacuated tube heat pipe which transforms radiation energy into helpful heat. The current use of nanofluids in solar thermal technology to improve heat transfer is of concern. Geometry is made up of two heat pipes. The working fluid used for heat pipes is water and Al_2O_3 respectively. Nanofluid thermal output includes closed tube heat pipe solar water heater is enhanced than standard evacuated tube heat pipe solar water heater (SWH). The impact of the mass flow rate over the condenser and the inclination angle on the results of the evacuated tube heat pipe is also researched.

Kumavat Mukesh Manilal et. al. (2016) This research tries to show numerical simulation of solar collector designed for drying meat products and how to boost their effectiveness. Technically and economically, solar drying is highly viable. Due to continuous research and development connected with the implementation of sophisticated techniques, there has been a notable accomplishment in solar drying of meat products. The Computational Fluid Dynamics (CFD) tool was used to simulate the condition of different types of absorber plates with different shapes and configurations to achieve better efficiency than ordinary solar collectors. The solar flat panel collector's 3D model is modelled by UGS NX and then exported in STEP format, then exported into ANSYS Workbench and then the meshing was developed in ANSYS ICEM. Results were acquired using ANSYS fluent software.

M. Dinesh Babu et.al. (2016) An effort was produced to explore the impacts of a solar water heater with fins externally connected to the riser pipe on the battery effectiveness. Then analyse the solar collector utilizing Computational Fluid Dynamics (CFD) either with or without inner fins to detect the solar collector for a better insight of the collector's heat exchange capabilities. The results for finned pipe obtained from the CFD are validated with the CFD and experimental values for plain tube and found a temperature increase of about 3-4 ° C for finned tube. Based on this, manufacturing is performed and experimental assessment is performed with fresh collection of collectors. The findings acquired from the experimental evaluation show that there is an improvement in effectiveness of about 3-5 percent when we go to the finned pipe rather than the simple tube.

Shrikant G. Pise et. al. (2016) The present work shows that loss of energy between collector and receiver is due to convection and radiation heat loss. Heat loss between the two is mainly because of the temperature of liquid paraffin produced which is heated due to solar irradiations. Due to that, as temperature of liquid paraffin increases, directly affecting the percentage loss, which also increases along with rise in temperature. Experimental findings indicate that about 70 percent of the energy loss in the form of heat occurs when

the temperature inside the liquid paraffin pipes is 3000 C and higher. CFD models can indicate that the current set-up can generate about 1180C temperature at the plant, whereas practically only it exceeds 1080 C temperatures.

Jignesh A. Patel et. al. (2015) The present work includes conducting a comparative thermal performance study of the straight tube solar water heater with the proposed experimental set-up of the spiral tube solar heater; it consists of a spiral-shaped copper tube, flat plate collector, K type thermocouple, changing water temperature for 100 liters per day water capacity. Thermal efficiency was widely assessed throughout the month of May; a peak temperature difference of 16 C between the inlet and outlet of the solar water heater, the effectiveness of the solar water heater spiral pipe was calculated. During the test era, the highest value was discovered to be 47.63%, which was more than the straight pipe solar air heater.

K A Muhammed Yarshi et. al. (2015) The aim of this study was to evaluate the effects of pipe shape variations on the effectiveness of flat panel solar receiver. The effect of important parameters such as mass flow rate, absorber material was also studied. The numerical analysis is conducted using ANSYS CFD Fluent software. Inlet and outlet temperature comparison for distinct heat fluxes. The outcome demonstrates excellent consensus on the impact of different parameters. 3-D numerical simulation was performed to explore the effectiveness of a plain plate solar collector. Different geometries and working circumstances were examined to evaluate the impact of pipe region form on stack performance and the impact of mass flow rate and absorber content on thermal efficiency.

IV. CONCLUSION

Selecting the right solar water heating system for a facility depends on three key factors like climate, budget, and water usage requirements. Solar water heating systems are economical, especially in commercial buildings when the energy used to heat water is significant. Although, the sun is capable of heating, its applications in water heating will be much effective when various factors such as safety, maintainability, and also efficiency of the system are considered. Solar water heating systems are mounted with distinct settings and agreements at present. The fundamental technology of these devices is researched and it is discovered that there is a need to work on the produced layout method to pick, mount and track the solar water heating scheme according to accessibility.

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