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104_Evacuated Tube Solar Collector Performance with Combined Effect of Triple Integrated Helix, Thermal Energy Storage

CFP

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New Delhi, India, November 25-26, 2021

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Evacuated Tube Solar Collector Performance with Combined Effect of Triple Integrated Helix and Thermal Energy Storage

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Abstract. Evacuated Tube Solar Collectors (ETSC) are increasingly in use worldwide because of their high thermal efficiency and high working temperature. Being a passive system, its usage in rural areas are increasing. So, in order to improve the performance of ETSC, the heat pipe evacuated tube solar collector being utilized for experimentation. The insulated reservoir tank accommodating the manifold is provided with twisted tape and outside of manifold is completely filled with phase change material. Additionally, the parabolic reflectors are added to improve absorption of incident radiation on the evacuated tube over 360 degree. The experimentation will be performed with different flow rates 0.3,0.5, 1 and 2 LPM of water. The performance with twisted tape shows improvement in temperature rise by 10°C in respect to normal ETSC. Due to addition of reflector, the performance could be further improved showing efficiency 24.5% at 2 LPM. The improvement in the efficiency could be quantified and plotted. Phase change material plays crucial role owing to which the fall in temperature in post noon session is in range of 5-8 degree only.

Keywords: Evacuated tube solar collector, parabolic reflector, solar water heater, twist tape, phase change material.

1 Introduction

A solar water heater which acts as an alternate and renewable energy source for water heating application. Evacuated tube solar water heating system is one of the most proven and effective method of solar thermal energy collection systems. The main constructional feature of ETSC is the heat pipe. The material used for heat pipe is a copper, owing to its better thermo-physical properties. The function of ETSC consist of absorbing the incident rays falling on the evacuated tube and heating of the primary working fluid in evacuated tube. This heated fluid raises against gravity and reach the transmission zone to distribute the heat to the secondary fluid. In order to increase the rate of heat transmission from primary working fluid to the secondary working fluid, the heat pipe has a bulb like protruded part which is highly sensitive to rapid change in temperatures. In order to achieve maximum heat transfer different techniques were adopted by researchers. Thianpong et al. explains the procedure of inserting twisted tape as a swirling flow generation for more heat transfer enhancement and obtained 86.7% heat transfer with respect to plain tube [1]. Chai et al. performed experiments on ETSC with inner

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Recent Trends in Thermal and Fluid Sciences pp 179–187

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Conference paper | First Online: 05 November 2022

Part of the Lecture Notes in Mechanical Engineering book series (LNME)

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Cite this paper

Patel, V.D., Churi, A., Davane, S., Dhangar, A., Patil, A., Chaudhari, A.J. (2023). Evacuated Tube Solar Collector Performance with Combined Effect of Triple Integrated Helix and Thermal Energy Storage. In: Mishra, D.P., Dewangan, A.K., Singh, A. (eds) Recent Trends in Thermal and Fluid Sciences. Lecture Notes in Mechanical Engineering. Springer, Singapore. https://doi.org/10.1007/978-981-19-3498-8_16

.RIS .ENW .BIB

DOI	Published	Publisher Name
https://doi.org/10.1007/978-981-19-3498-8_16	05 November 2022	Springer, Singapore

Print ISBN	Online ISBN	eBook Packages
978-981-19-3497-1	978-981-19-3498-8	Engineering Engineering (R0)

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