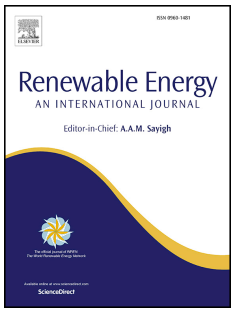
Accepted Manuscript



Experimental performance analysis of low concentration ratio solar parabolic trough collectors with nanofluids in winter conditions

Mirza Abdullah Rehan, Muzaffar Ali, Nadeem Ahmed Sheikh, M. Shahid Khalil, Ghulam Qadar Chaudhary, Tanzeel ur Rashid, M. Shehryar

PII: S0960-1481(17)31163-1

DOI: 10.1016/j.renene.2017.11.062

Reference: RENE 9464

To appear in: *Renewable Energy*

Received Date: 26 May 2017

Revised Date: 14 November 2017

Accepted Date: 21 November 2017

Please cite this article as: Rehan MA, Ali M, Sheikh NA, Khalil MS, Chaudhary GQ, Rashid Tu, Shehryar M, Experimental performance analysis of low concentration ratio solar parabolic trough collectors with nanofluids in winter conditions, *Renewable Energy* (2017), doi: 10.1016/j.renene.2017.11.062.

Experimental performance Analysis of Low Concentration Ratio Solar Parabolic Trough Collectors with Nanofluids in Winter Conditions

Mirza Abdullah Rehan[1], Muzaffar Ali[1*], Nadeem Ahmed Sheikh[2], M. Shahid Khalil[1], Ghulam Qadar Chaudhary[1], Tanzeel ur Rashid[1], M.Shehryar[1],

[1]Mechanical Engineering Department, University of Engineering and Technology, Taxila, Pakistan

[2]Mechanical Engineering Department, Faculty of Engineering, HITEC University, Taxila, Pakistan

*Corresponding author: Muzaffar Ali; Email address: Muzaffar.ali@uettaxila.edu.pk

ABSTRACT

Applications of solar thermal systems especially for heating are quiet reliable. At present the domestic use of such technologies especially for hot water and space heating applications is limited to flat plate collectors and evacuated tubes. Moreover, commercial use of nano-fluids is also scarce in these applications. The present study is designed to evaluate the experimental performance analysis of a locally developed Parabolic Trough Collector (PTC) system having concentration ratio of 11 for domestic heating applications primarily. Two metallic oxides water based nanofluids i.e. Al_2O_3/H_2O and Fe_2O_3/H_2O are used at three particles concentrations of 0.20%, 0.25% and 0.30% by weight at 1.0, 1.5 and 2.0 L/min flow rates. The experimentation is performed under wide range of operating conditions in terms of solar radiation and ambient conditions at Taxila, Pakistan. The maximum efficiencies achieved with Al_2O_3 and Fe_2O_3 nanofluids at 2 L/min are 13% and 11 % higher respectively compared to water under same operating conditions. Al_2O_3 nanofluids seemed more favorable in the enhancement of efficiency of PTC compared to Fe_2O_3 for domestic applications using PTC. The results offer significant insight from the commercialization aspect for the working of locally developed linear PTC and influence of nano-fluids for space heating application.

Keywords:

Solar energy, Parabolic trough collector, Nano fluids, Thermal performance, Pakistan

Nomenclature