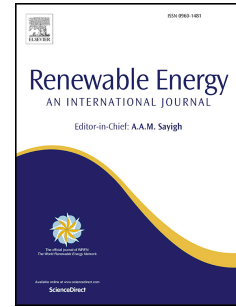


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1 Experimental performance Analysis of Low Concentration Ratio Solar 2 Parabolic Trough Collectors with Nanofluids in Winter Conditions

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11 ABSTRACT

12 Applications of solar thermal systems especially for heating are quiet reliable. At present the
13 domestic use of such technologies especially for hot water and space heating applications is
14 limited to flat plate collectors and evacuated tubes. Moreover, commercial use of nano-fluids is
15 also scarce in these applications. The present study is designed to evaluate the experimental
16 performance analysis of a locally developed Parabolic Trough Collector (PTC) system having
17 concentration ratio of 11 for domestic heating applications primarily. Two metallic oxides water
18 based nanofluids i.e. $\text{Al}_2\text{O}_3/\text{H}_2\text{O}$ and $\text{Fe}_2\text{O}_3/\text{H}_2\text{O}$ are used at three particles concentrations of
19 0.20%, 0.25% and 0.30% by weight at 1.0, 1.5 and 2.0 L/min flow rates. The experimentation is
20 performed under wide range of operating conditions in terms of solar radiation and ambient
21 conditions at Taxila, Pakistan. The maximum efficiencies achieved with Al_2O_3 and Fe_2O_3
22 nanofluids at 2 L/min are 13% and 11 % higher respectively compared to water under same
23 operating conditions. Al_2O_3 nanofluids seemed more favorable in the enhancement of efficiency
24 of PTC compared to Fe_2O_3 for domestic applications using PTC. The results offer significant
25 insight from the commercialization aspect for the working of locally developed linear PTC and
26 influence of nano-fluids for space heating application.

27 Keywords:

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

29 Nomenclature

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