Thermal performance improvement of solar air flat plate collector: a theoretical analysis and an experimental study in Biskra, Algeria

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Abstract

This article presents the results of the first experimental investigation of the performance of solar air flat plate collector at Biskra (latitude 34°48'N and longitude 5°44'E), Algeria. The thermal efficiency between absorber plate and air in flat plate solar collector has been enhanced by introducing obstacle rows in the dynamic air vein of the collector. For this objective, a flat plate solar collector, of 1.73 m2 area and 25 mm air gap, has been designed and constructed. These obstacles formed with two parts: first part is perpendicular to fluid flow and the second part is inclined, they are mounted in a staggered pattern, oriented perpendicular to the fluid flow and soldered to the back plate. The solar air heater was mounted on a stand facing south at inclination angle, and it was tested under the environmental conditions. Moreover, a theoretical approach is employed for determination of the thermal performances of this collector where the temperatures of all components of the collector and outlet air are predicted. Comparisons among the experimental and theoretical results considered are reported.

Keywords: solar energy, flat plate collector, obstacles, heat transfer, oriented flow.

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