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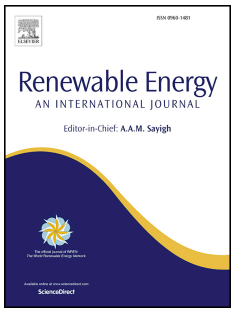

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Experimental Study on the Performance of Double Pass and Two Inlet Ports Solar Air Heater (SAH) at Different Configurations of the Absorber Plate

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Abstract

The effect of using different absorber plate configurations on the performance of double pass SAH with two inlet ports is presented. Moreover, the effect of using different air flow percentages through the inlet ports is studied for each studied configuration. Four absorber plate configurations are considered; (i) flat plate (ii) pin finned, (iii) corrugated finned, and (iv) corrugated-perforated finned. Moreover, four percentages of the inlet air are considered: (i) 0% of the air flows through the upper inlet port and 100% through the lower inlet port (0%Up), (ii) 33.3% of the air flows through the upper inlet port and the remainder through the lower inlet port (33.3%Up), (iii) 66.7% of the air flows through the upper inlet port and the remainder through the lower inlet port (66.7 Up), and (iv) 100% of air flows through the upper inlet port (100% Up). These percentages are studied at all absorber plate configurations and for the same total inlet mass flow rate of the air. The measurements are carried out during the day using the solar flux and at night using a solar simulator. The results indicate that increasing the upper air percentage decreases the absorber plate temperature and increases the SAH efficiency for all studied configurations.The efficiency of corrugated-perforated pin fin is the greatest and the flat plate absorber plate is the smallest. The maximum efficiency of the SAH is about 70% for flat plate configuration at (100% Up) and about 79% for the pin finned absorber plate at (100% Up). It is about 82% for the corrugated finned configuration at (100% Up) and about 83% for the corrugated-perforated finned absorber plate at (66.7% Up). The solar simulator analysis provides very near values of the efficiencies which assures the results. The cost analysis indicates that the cost of energy gained by the SAH for the flat plate configuration for 0% UP flow has the maximum cost (0.025 $/kW.h) and the corrugated perforated finned absorber plate of 66.7% has the minimum cost (0.021 $/kW.h).

Key words: SAH; Double pass; Inlet port; Absorber plate; Efficiency; Temperature