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Investigation of Solar Water Heating System in Erbil City: An Experimental and Numerical Study

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Abstract

Solar energy is one of the most important sources of energy, and Erbil, city in north of Iraq (Kurdistan region), has a good location for solar radiation throughout the whole year. In which the maximum average monthly solar radiation in winter was found to be around 700 W/m². In this study, a solar water heating system has been built to heat a hall with a dimension of (14.5×7×3.5) m. The hall is located in the Scientific Research Centre building in Erbil Technical Institute. This system consists of 10 flat plate collectors, two storage tanks, three fan-coil units used for heating the hall, and measuring devices. A TRNSYS program was used to simulate this model and the results were validated with the experimental part. The results showed that using this system will reduce the energy consumption to 8% in December and to 14% in January and February. While in the remaining nine months, there was no consumed energy. Also, using this system will reduce the amount of CO₂ emission. Where, 86.4% reduction in CO₂ emission was found in January, and this percentage reduction increased for the other months until reaching 100%. The estimation of the payback period in years was found to be 4.65 which is acceptable relative to the size of the system and the number of people benefiting from it.

Keywords

Solar energy; solar water heating system; flat plate solar collector; energy consumption; gas emission; payback period

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