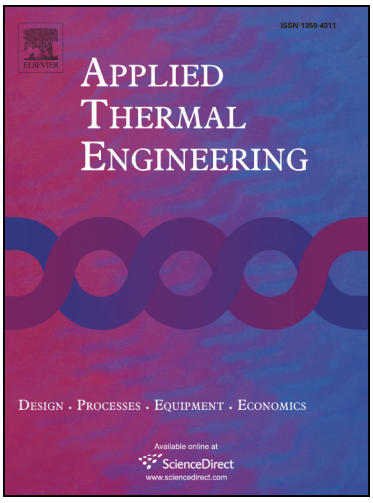

Feasibility of a hybrid BIPV/T and thermal wheel system for exhaust air heat recovery: Energy and exergy assessment and multi-objective optimization

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Feasibility of a hybrid BIPV/T and thermal wheel system for exhaust air heat recovery: Energy and exergy assessment and multi-objective optimization

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Highlights:

An innovative exhaust air energy recovery system consisting of a BIPV/T and a TW.

Pre-heating/pre-cooling ambient air in winter/summer and producing electricity.

Genetic algorithm-based multi-objective optimization approach for BIPV/T-TW system.

Optimization leads to a 563.8% enhancement in the annual useful energy output.

Optimization leads to a 1394.1% enhancement in the annual useful exergy output.

Abstract

In this paper, a numerical study is conducted to examine the energy and exergy performance and multi-objective optimization of a novel exhaust air heat recovery system made up of a building integrated photovoltaic/thermal (BIPV/T) collector and a thermal wheel (TW) system. The innovative BIPV/T-TW system is capable of pre-heating/pre-cooling the ambient fresh air in winter/summer and also producing electricity. Comparisons are carried out on the basis of energy and exergy by considering three different exhaust air heat recovery systems including the BIPV/T-TW system, the conventional BIPV/T collector, and the convectional TW system. It is observed that the BIPV/T-TW system has the best energy performance among the considered systems in all months of the year, while its exergy performance is lower than the BIPV/T system. Then, the multi-objective optimization technique is utilized to obtain the optimal values of