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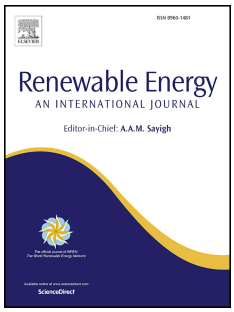

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Exergy analysis of a Naturally Ventilated Building Integrated Photovoltaic/Thermal (BIPV/T) System

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Abstract:

The efficiency of Building Integrated Photovoltaic/Thermal (BIPV/T) systems depends on various parameters such as the location, amount of incident radiation, orientation of the collector surface, slope of the system and the type of ventilation of the air gap between the Photovoltaic (PV) panels and the secondary skin of the building. However, in order to examine the performance of the system, apart from the energy efficiency, the exergy efficiency needs to be estimated as well. There are numerous studies about energy and exergy efficiency of PV systems, however, most of them are based on PV/T systems, water systems and mechanically ventilated air systems. This paper examines theoretically and experimentally the energy and exergy analysis of a naturally ventilated BIPV/T system. Experimental procedure is carried out to record the temperature distribution of a naturally ventilated BIPV/T system. The results from the experimental procedure are used to estimate the energy efficiency and exergy efficiency of the system. It is proved that the energy efficiency of the system varies from a minimum of 26.5% to a maximum of 33.5%, and the exergy efficiency varies from a minimum 13% to a maximum of 16%. It is also observed that the exergy input to the system is much higher than the exergy output of the system.

Keywords:

BIPV/T, exergy, photovoltaics, thermal behaviour, natural ventilation.

1 Introduction

Photovoltaics use has significantly increased the last years reaching the total installed capacity of 227 GW at the end of 2015 and it is expected to grow more in the next years. However, despite this growth, photovoltaics produce only 1.3% of the worlds electricity [1].