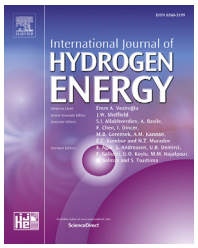
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Evaluation of thermal comfort in a test room equipped with a photovoltaic assisted thermo-electric air duct cooling system

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ABSTRACT

This study investigates the comfort performance of a test room equipped with the south-facing photovoltaic wall (PV-W) and north-facing thermo-electric air duct (TE-AD) system for the tropical climate. Both subjective and objective measurements were used to analyze the TE-AD system cooling performance when operated at variable input current supply (2–7 A) from a PV system. Indoor radiant and air temperatures, relative humidity, and air velocity were measured based on ISO 7730 for objective measurement. For subjective measurement, forty respondents were required to fill up the questionnaire that developed based on UNI EN ISO 10551 and UNI EN ISO 7730 guidelines in order to access their thermal comfort opinion. The results show that the thermal response of respondents associated with indoor situation of the test room have changed from (+1) slightly warm to cool (−2) when the input current supply rises from 2 A to 6 A. The overall predicted mean vote, predicted percentage dissatisfied indices, and acceptability vote shows that more than 90% of the respondents were thermally satisfied. Integration of the PV-W system with the TE-AD system increases the thermal comfort and reduces the thermal load of the test room with other benefits includes less fuel and energy consumption, high reliability, and less maintenance operation.

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Introduction

The global human population is increasing rapidly. This phenomenon leads to increase in the need for building and the construction industry, which plays a significant role in the global resource consumption [1]. Besides that, nearly 25–40% of the world energy is consumed in the operation process of buildings [2–4]. In light of this, more than 36% of CO_2 is

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