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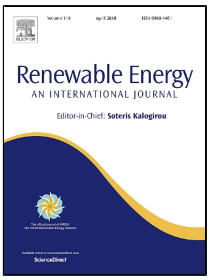

Performance of an unglazed transpire collector in the facade of a building for heating and cooling in combination with a desiccant evaporative cooler

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Performance of an unglazed transpire collector in the facade of a building for heating and cooling in combination with a desiccant evaporative cooler

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Abstract

Refurbishment of energy inefficient buildings is an effective way of reducing energy consumption in urban areas. This can be done by taking advantage of the renewable energy sources available, mainly, solar energy. Desiccant evaporative cooling combined with unglazed transpired collectors, UTC's, allows covering the heating demand in the cold season and cooling demand in the hot season. UTC's can be installed on the facades of buildings, meeting a double goal: refurbishing the building exterior and providing heating and cooling to indoor spaces. In this paper, a model of this system was implemented using TRNSYS and the energy savings obtained were evaluated in different climatic conditions, different façade orientations and different building shapes. The objective was to find the best conditions to install this system and estimating the energy savings that can be reached, and its costs. The results showed that the reduction of heating demand was possible in all climatic conditions, weakly depending on the shape and orientation of the UTC façade installed. Cooling was also possible, but it depended more on the shape of the building. The higher energy savings were found for the linear shape buildings. Therefore, refurbishment using a UTC façade could be an interesting alternative for energy saving throughout the year in these cases.

Keywords: Desiccant evaporative cooling, unglazed solar collector, ventilated façade, building energy saving, solar façade.

Nomenclature

A_c collector area (m^2)

C_A cost of the UTC façade per unit area (€ m^{-2})

C_E initial cost of the UTC installation apart from cost per unit area (€)

C_F fuel cost (€ kWh^{-1})

c_p specific heat (J kg^{-1} K^{-1})

E_{del} heating or cooling energy delivered (kWh)

E_{elec} electrical energy used (kWh)

F fraction of heating of cooling load covered by solar energy

F_{cg} collector to ground view factor

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