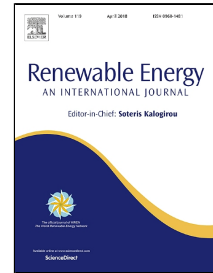


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Performance of an unglazed transpire collector in the facade of a building for heating and cooling in combination with a desiccant evaporative cooler

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1 Performance of an unglazed transpire collector in the facade of a building for heating and
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9 Abstract

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

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

28

29 Nomenclature

30 A_c collector area (m^2)

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

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

33 C_F fuel cost ($€ kWh^{-1}$)

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

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

36 E_{elec} electrical energy used (kWh)

37 F fraction of heating or cooling load covered by solar energy

38 F_{cg} collector to ground view factor

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