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Design and simulation of a novel solar air-conditioning system coupled with solar chimney

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Highlights

- Development of a new sustainable (environmentally friendly and fossil energy saving) design of a solar air-conditioning system coupled with a solar chimney. The recovered heat of the solar chimney is used to regenerate the desiccant dehumidifier and to drive the adsorption chiller.
- Detailed description of the designed sustainable solar air-conditioning system as well as its operating principle is presented.
- Numerical investigation of the performance of the proposed design is carried out to assess, technically, the efficiency and the technological utility of such a design as well as its ability to provide a sustainable air-conditioning under the climate of the region of Gafsa-Tunisia (and all regions around the world having about the same climate).
- The simulation of air streamlines and air temperature distribution in the conditioned room is carried out to evaluate the ability of such a design of solar air-conditioning system to provide thermal comfort under the climate of the region of Gafsa-Tunisia (and all regions around the world having about the same climate).

Abstract: This work proposes an original design for a solar air-conditioning system with adsorption chilling and desiccant dehumidification. The proposed design permits to ensure thermal comfort in residential and office buildings. A detailed technical description is presented. A particular interest is given to the explanation of the operating principle of the proposed design. The new design is based on the coupling between solar chimney and solar air-conditioning system. The waste heat of solar chimney is recovered in order to be used to regenerate desiccant dehumidifier and to drive adsorption chiller. Theoretical investigations are carried out on the proposed system, under the meteorological conditions of the region of Gafsa-Tunisia, in order to simulate and assess

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