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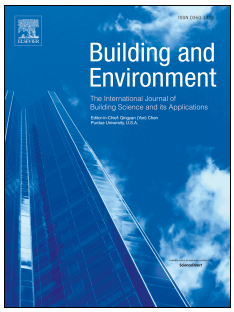

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Experiments and simulations on the thermal performance of a sunspace attached to a room including heat-storing porous bed and water tanks

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Abstract

In this paper, thermal performance of a room heated with an attached sunspace has been experimentally investigated and has been modeled using the EnergyPlus software. A fixed porous bed was placed beneath the room's floor to store the heat. To increase the heat storing capacity, water tanks was also used. The room with attached sunspace was built and tested in Karaj (Iran). Results illustrated that applying water tanks in the sunspace had a noticeable role in heat storing capacity. For example, the porous bed together with water tanks saved at least 37% (up to 87%) of energy cost compared to 10% (up to 15%) saved energy cost without water tanks. In addition, the simulation of annual thermal performance of the room by Energy-Plus software confirmed the applicability of the used configuration of sunspace along with added water tanks and porous bed made form arranged bricks as heat storing media a step forward to a completely green room (net zero energy building). The sunspace with water tanks showed a more stable condition (lower temperature variations) which is a base of thermal comfort.

Keywords: sunspace; porous bed; solar energy; EnergyPlus; thermal comfort; net zero energy building.