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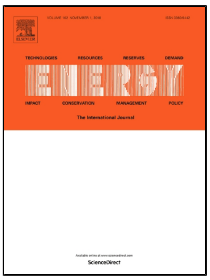

Theoretical models for wall solar chimney under cooling and heating modes considering room configuration

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Theoretical models for wall solar chimney under cooling and heating modes considering room configuration

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Abstract: Under the fact that previous studies have usually ignored the influences of room configuration, wall solar chimney under both cooling and heating modes were analyzed theoretically to fill the research gap. Solar chimney performance is dependent on the airflow rate and its temperature, where theoretical models were developed in this study to predict the performance of four typical types, including fresh-air cooling, fresh-air heating through chimney cavity and room, and sealed heating (without any fresh-air supply). It is known that the room configuration shows considerable influences on solar chimney performance, where a coefficient is proposed to address this. Different from the cooling mode, airflow rate under heating mode was found not only dependent on cavity height, but also the opening height of the room. To heat a typical room, fresh-air heating through the cavity shows the highest airflow rate but with the lowest temperature, which can be applied to regularly occupied building under cool weather conditions. Fresh-air heating through the room shows an opposite way, which is suitable for regularly occupied buildings under cold weather conditions. The performance of sealed heating is between these two, which can be used for non-regularly occupied buildings as there is no fresh air supply.

Keywords: Renewable energy; solar chimney; Trombe wall; natural ventilation; thermal buoyancy; theoretical model.

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