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Zero emission /energy building heating through parabolic dish collector focused KNO_3–$NaNO_3$ and KNO_3–$NaNO_3$–$NaNO_2$ PCM absorber: A case study

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Abstract

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Abstract

Globally During the winter of the year, having a warm place to stay is a necessity, especially true in mountainous regions. Electric heating and biomass burning are the most common methods for this purpose. However, solar PV-based electric heating is a sustainable way to eliminate the cost of heating, which requires more panels and a large floor area. Alternatively, a solar thermal system is used for building heating during the winter season. But the effectiveness and duration of heating support depend on the system's features and the researchers' efforts to maximize them. This research aims to develop a zero-emission/energy-building heating system with a PCM. The influence of PCM choice is validated experimentally to maximize winter heating. Solar parabolic dish collectors (14 sq. m) with two distinct PCM embedded absorbers, such as KNO_3–$NaNO_3$ and KNO_3–$NaNO_3$–$NaNO_2$, were considered for the investigation to optimize the PCM for the best performance with respect to building heating. The experimental results reveal that the KNO_3–$NaNO_3$ PCM outperformed by exhibiting a higher heat transfer rate than the PCM of KNO_3–$NaNO_3$–$NaNO_2$. Hence the maximum output water temperature was recorded as 94 °C, and the quantity of heat transfer was 6273 W. The system's energy efficiency was 50.6%, and the exergy was 5.99% with the absorber, which embedded KNO_3–$NaNO_3$ PCM. It was found that the black coating decreased heat loss from the absorber's surface, and net heat transfer to the absorber was improved significantly. © 2023 The Authors

Author keywords

Energy efficiency; Exergy efficiency; Parabolic dish collector; PCM; Zero emission building heating; Zero energy

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