International Journal of Ambient Energy ›
Volume 44, 2023 - Issue 1

Research Article

Multi-attribute decision-making tools for selection of PCMs as latent heat thermal energy storage integrated with solar-driven LiBr-H_2O vapor absorption system

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Pages 1767-1775 | Received 17 Dec 2018, Accepted 19 May 2022, Published online: 15 Mar 2023

Cite this article https://doi.org/10.1080/01430750.2023.2188257 Check for updates

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Abstract

The selection of PCM is quite decisive for the efficient and effective design of latent heat thermal energy storage to be coupled with a solar-powered single-effect LiBr-H_2O vapour absorption system. Aligned to the operating characteristics of a solar-powered LiBr-H_2O vapour absorption system, PCM must have a melting temperature between 80 and 100°C and high latent heat of fusion. A total of 14 PCMs are first scrutinised in the present research work based on melting temperatures ranging from 80 to 100°C. Further, their ranking is done and verified with the MADM examination. Thermophysical properties (latent heat, density, thermal conductivity, specific heat) and cost have been considered the criteria for selecting PCM. AHP is

used to calculate the relative weights among the criteria identified. After that, the ranking is done with the help of TOPSIS. MODM is used to optimise these PCMs by drawing variations between the objective functions of thermal energy storage density and thermal diffusivity. Xylitol, Acetamide, $(NH_4)Al(SO_4)\cdot 6H_2O$ have been ranked as the top three due to TOPSIS and MODM examination. This research output supports selecting the appropriate PCM when designing latent thermal energy storage systems to integrate an application.

KEYWORDS: Multi-attribute decision making phase change material solar vapour absorption system multi-objective decision making analytical hierarchy process

Disclosure statement

No potential conflict of interest was reported by the author(s).