# PCM-assisted energy storage systems for solar-thermal applications : Review of the associated problems and their mitigation strategies-

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**ABSTRACT**

Latent heat energy storage (LHES) system is identified as one of the major research areas in recent years to be used in various solar-thermal applications. However, there are various challenges associated i.e., low thermal conductivity, leakage issues, stabilization concerns, etc. In this work, a comprehensive review of studies dealing with these problems and their mitigation strategies. Various design parameters influencing the performance of PCM-assisted systems are also discussed. This article further presents a detailed review of several mathematical models, based on system enthalpy and heat capacity-based modeling schemes along with the techno-economic analysis. The review results reflect the application of porous foams increasing thermal conductivity values of PCM composites relative to pure PCM working mediums. Moreover, the use of extended surfaces with appropriate geometries reduces the phase transition durations for the working medium significantly which enhances the thermal performance. Additionally, PCM encapsulations are identified as one of the widely accepted procedures intensifying the thermal performance of energy storage systems. However, the selection of appropriate encapsulation shell material and shell geometries are some of the important factors to be considered to ensure optimum system performance. This review focuses on the significant aspects of PCM encapsulation design parameters for several solar-thermal systems.

**KEYWORDS**

Latent heat energy storage; Mathematical models; Phase change materials; Techno-economic analysis

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