# THE USE OF PHASE CHANGE MATERIALS WITH WASTE MATERIALS FOR SUSTAINABLE ENERGY STORAGE IN BUILDINGS

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| **ABSTRACT**  This study provides an overview of the utilization of phase change materials (PCMs) with waste materials in buildings for thermal energy storage. PCMs, with their unique ability to absorb and release latent heat during phase transitions, present a revolutionary solution for mitigating temperature fluctuations in diverse climates [1]. However, some issues including leakage and stability need to be considered when integrating them into building materials. To prevent or minimize these issues, PCMs could be used with some carrier mediums such as capsules, shells, pouches, pipes or porous materials [2]. The use of waste materials, particularly those with porous structures, has become the subject of research as they have a great potential to be used as carrier mediums of PCMs. Apart from these, repurposing industrial by-products, biomass, wood-derived materials and other kind of wastes offer economic feasibility and environmental benefits aligned with circular economy principles [3-5].  While the benefits of PCM application in buildings have been recognized, there is still a paucity of studies specifically addressing their combination with waste materials. This study aims to inspire further research, innovation, and mainstream adoption of the use of PCMs with waste materials, driving progress toward energy-efficient and environmentally conscious buildings.  **References:**  [1] Wang, R., Kang, Y., Lei, T., Li, S., Zhou, Z., and Xiao, Y. (2021) Microcapsules Composed of Stearic Acid Core and Polyethylene Glycol-based Shell as a Microcapsule Phase Change Material, *International Journal of Energy Research*.  [2] Sparavigna, A. C. (2021) Phase-Change Materials and Biochar: Some New Composite Materials in Recent Literature, *SSRN Electronic Journal*.  [3] Chen, B., Han, M., Zhang, B., Ouyang, G., Shafei, B., Wang, X., and Hu, S. (2019) Efficient Solar-to-Thermal Energy Conversion and Storage with High-Thermal-Conductivity and Form-Stabilized Phase Change Composite Based on Wood-Derived Scaffolds, In *Energies*.  [4] Liu, P., Zhang, Z., Gu, X., Rao, J., Shi, J., and Bian, L. (2020) Fabrication of a novel shape-stabilized composite phase change material based on multivariate supporting materials by using typical solid wastes, *Construction and Building Materials* *240*.  [5] Anagnostopoulos, A., Navarro, M. E., Stefanidou, M., Ding, Y., and Gaidajis, G. (2021) Red mud-molten salt composites for medium-high temperature thermal energy storage and waste heat recovery applications, *Journal of Hazardous Materials* *413*, 125407. |

# Keywords: Phase change material, Thermal energy storage, Latent heat, Waste materials, Thermal energy efficiency in buildings