World Academy of Science, Engineering and Technology
International Journal of Energy and Power Engineering
Vol:19, No:09, 2025

# Integrating Phase Change Materials in Sydney Building Code: A Pathway to Reduced Energy Consumption and Enhanced Sustainability

**Authors :** Amirhossein Shafaghat, Jingjing Liu, Amirhossein Eisapour, Arianna Brambilla

**Abstract :** Incorporating phase change materials (PCMs) into building envelopes can enhance energy efficiency by stabilizing indoor temperatures and reducing the energy consumption of a building. This study employs ANSYS FLUENT to simulate the thermal performance of a Sydney-compliant building over a 24-hour period on the hottest day of the year, with and without double-layer PCM integration. The analysis considers various PCM thicknesses (0.5, 1, 1.5, and 2 cm) to determine the optimal configuration for energy savings. Simulations account for convection and radiation heat loss from the outer surface and convection heat loss from the inner surface, with an indoor temperature setpoint of 23°C. Additionally, the study evaluates PCM performance across different Australian cities—Sydney, Brisbane, Perth, Canberra, and Melbourne—to assess climate-specific efficiency. Results indicate that without PCM, the inner surface temperature in Sydney reaches 25.5°C, exceeding the setpoint by 2.5°C. Among the tested configurations, PCM 25 with a two-layer (1.5 cm) application demonstrates the best thermal regulation, minimizing temperature fluctuations (0.2°C) throughout the day. Canberra experiences the highest energy flux without PCM due to its intense solar radiation, with inner surface temperatures peaking at 26.5°C—1.5°C higher than in Sydney. However, with PCM 25, Canberra achieves the highest energy savings at approximately 18 MJ per day, followed by Sydney with 16 MJ. This corresponds to about 5 kWh of electricity savings, a significant portion (~20%) of a typical Australian household’s daily energy consumption. These findings highlight the effectiveness of PCM-enhanced walls in mitigating temperature fluctuations and reducing energy use, particularly in high solar radiation climates. The study underscores the potential benefits of integrating PCMs into building codes to enhance energy efficiency across diverse Australian climates.

**Keywords :** thermal energy storage, energy in buildings, phase change materials, numerical modelling
**Conference Title :** ICAESE 2025 : International Conference on Advances in Energy Systems Engineering
**Conference Location :** Toronto, Canada
**Conference Dates :** September 25-26, 2025