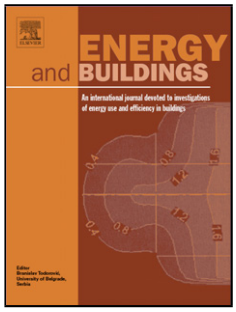

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Thermal Performance Investigation and Optimization of Buildings with Integrated Phase Change Materials and Solar Photovoltaic Thermal Collectors

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Abstract: This paper presents the thermal performance investigation and optimization of buildings with integrated phase change materials (PCMs) and solar photovoltaic thermal (PVT) collectors. PCMs are embedded into building envelopes to increase local thermal mass while PVT collectors are used to generate both electricity and low grade thermal energy for winter space heating. The thermal performance of a typical Australian house with PVT collectors and three different types of PCMs is simulated and analyzed by comparing with that of the house using PVT collectors only, using PCMs only, and without using PVT collectors and PCMs. The results showed that using PVT collectors and PCMs simultaneously can substantially improve the indoor thermal performance of the house. The Coefficients of Thermal Performance Enhancement (CTPE) of the house using PVT collectors and PCMs of RT18HC, SP21E and SP24E with a thickness of 20 mm were improved to 43.4, 48.8 and 46.2% respectively, compared to that of the house using the PCMs only (-9.1, 2.6 and 0.2% for RT18HC, SP21E and SP24E, respectively). The CTPE of the house can be increased to 70.2% if Taguchi method is used to determine the optimal air flow rate of PVT collectors, thickness of PCM layers, PCM type and additional wall