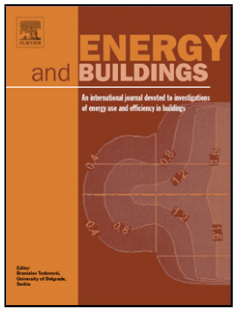

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Active thermal mass enhancement using phase change materials

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ABSTRACT

Buildings account for around 40% of energy consumption in the UK. For over twenty years active thermal mass systems have been a feature in low-energy buildings in northern Europe. By passing ventilation air, and utilising night ventilation, through the hollow core structures efficient heating and cooling has been achieved. Despite the success, such systems suffer from space overheating and efficiency losses during extended hot periods. Control strategies have largely mitigated this effect however low cost retrofit solutions that enhance the system are of interest. This research therefore investigates the benefit of using innovative phase change material (PCM) solutions to enhance thermal comfort and reduced energy usage of traditional active thermal mass systems.

A prototype PCM enhancement was constructed, with energy saving and comfort benefits investigated under controlled laboratory conditions. In absolute terms the PCM solution offered an additional 12.5% energy storage capacity and a 29% increase in active surface area, coupled with the existing sensible thermal mass. Under laboratory conditions the PCM addition saved an additional 0.1kWh per day, delayed AC onset by 1.2 hours and offered an average 1.0°C reduction in room temperature during eight hours of fixed internal heat gain, contrasted against the original active thermal mass system.

KEY WORDS

Active thermal mass, phase change materials, thermal mass, free cooling, night cooling, energy-efficient cooling