Energy and thermal comfort performance evaluation of PCM ceiling panels for cooling a renovated office room

The performance of suspended ceiling panels with phase change materials (PCM) for comfort cooling applications in office rooms was studied. The panel consisted of a metal casing, which encapsulates the PCM. Water can circulate through the pipes embedded in the panel to influence the latent energy storage of the material. To evaluate the performance of the PCM panels, a comparison with an all-air system and a thermally active building system (TABS) was made. Using TRNSYS 17, a recently renovated room in the Technical University of Denmark was modelled. The room was simulated during the cooling season with each of the three cooling systems in which the thermal environment and the corresponding energy use were determined. Operative temperature was maintained between 22°C to 27°C at least 90% of the occupied period with each system. Similarities were observed between the PCM and TABS systems. Energy savings of 15% and peak cooling power reduction of 30% compared with the all-air system were observed. This study proved the common claim that PCM ceiling panels and TABS perform similar in terms of the created thermal indoor environment and energy savings, as well in terms of heat removal from the indoor space. Therefore, PCM ceiling panels could be used as an alternative for TABS in renovation projects while providing similar benefits to TABS.

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