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Abstract

The energy efficiency of buildings is important. In order to reduce the energy demand for heating and cooling, a previously proposed flow-through wall element (FTWE) is enhanced with phase–change materials (PCM). By means of numerical modelling and simulation, the influence of the FTWE on both the peak loads and the integrated annual energies for heating and cooling is studied. Moreover the primary energy demand comprising heating, cooling, and the operation of the FTWE is considered. There are various parameter that have been varied, such as climatic conditions (different cities), flow speeds through the FTWE as well as phase–fraction and phase–change temperature of the PCM. The numerical model is reduced to a conduction–phase–change problem in the solid components and to an advection–diffusion problem in the channel of the FTWE. The heat transfer from the fluid to the solids is carried out with Nusselt number equations. This facilitates highly time-resolved annual simulations. The results revealed that the PCM-enhanced FTWE is beneficial for most of the conditions and cities. Especially, the cooling loads can be reduced significantly compared to FTWE without PCM. The annual

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