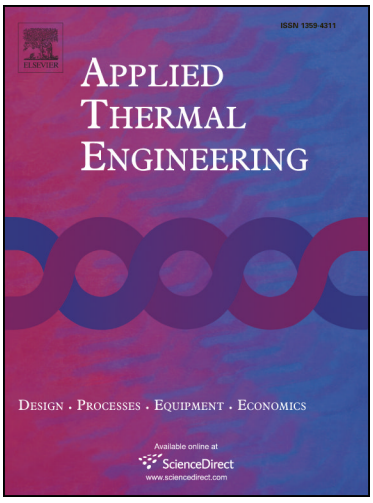

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Assessing Domestic Heat Storage Requirements for Energy Flexibility Over Varying Timescales

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Abstract

This paper explores the feasibility of storing heat in an encapsulated store to support thermal load shifting over three timescales: diurnal, weekly and seasonal. A building simulation tool was used to calculate the space heating and hot water demands for four common UK housing types and a range of operating conditions. A custom sizing methodology calculated the capacities of storage required to fully meet the heat demands over the three timescales. Corresponding storage volumes were calculated for a range of heat storage materials deemed suitable for storing heat within a dwelling, either in a tank or as an integral part of the building fabric: hot water, concrete, high-temperature magnetite blocks, and a phase change material. The results indicate that with low temperature heat storage domestic load shifting is feasible over a few days, beyond this timescale the very large storage volumes required make integration in dwellings problematic. Supporting load shifting over 1-2 weeks is feasible with high temperature storage. Retention of heat over periods longer than this is challenging, even with significant levels of insulation. Seasonal storage of heat in an encapsulated store appeared impractical in all cases modelled due to the volume of material required.

Keywords: thermal storage; sizing methodology; thermal demand; demand flexibility; building simulation