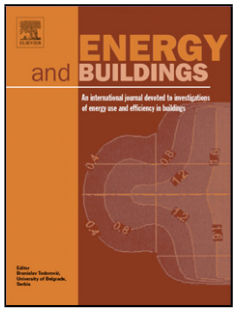

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Residential building energy demand and thermal comfort: Thermal dynamics of electrical appliances and their impact

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Abstract

Within a thermally well-insulated building, internal heat gains are getting more important on the point of the building thermal condition and its energy management [1, 2, 3]. In this study, we are focusing on thermal impact of heat dissipation of electrical appliances on buildings by applying a dynamic thermal model of electrical appliances. While a static model considers only power profile or power density of electrical appliances, the used dynamic model in this paper contains not only power profile but also thermal characteristics of electrical appliances. The thermal characteristics have been determined in previous study [4]. We shortly explain the methodology. The simulations are conducted with different values of thermal characteristics (power and RxC) representative of standard household appliances. The appliance thermal impact on the buildings in terms of heating energy demand and thermal comfort of occupants during a winter are investigated. This study is conducted within both a conventional residential building model and a thermally well-insulated residential building model. Two behaviors were identified: i) below critical appliance power (600W, 200W for the B1 and B2 respectively), we observe fully power substitution of the heating energy demand. ii) Above this critical power there is no fully substitution. Due to important temperature inhomogeneity within the different zones and the air renew flow structures coupled to the shift of appliance power