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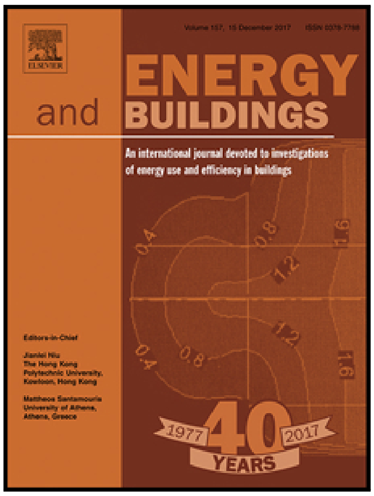

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Profiling Occupant Behaviour in Danish Dwellings using Time Use Survey Data

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Abstract

The human interaction with the building is a key cause of uncertainty when predicting energy consumption of buildings. Building occupants affect building energy use directly and indirectly by interacting with building energy systems, for example, by adjusting thermostats, switching lights on/off, using electrical devices and opening/closing windows. The occupants' daily activity profiles and occupancy patterns clearly shape the timing and magnitude of energy demand in households. Modelling energy-related human activities throughout the day, therefore, is a crucial task for prediction of energy use and, consequently, to reduce the gap between real and predicted building energy use.

This study modelled data gathered in the diary-based Danish Time Use Survey (TUS) 2008/09 of 9,640 individuals from 4,679 households. Individuals' daily activities were logged in 10-minute time increments for 24 h, starting and ending at 04:00, during both weekdays and weekends. The aims of this study were to (i) profile energy-related daily activities of occupants during different seasons and weekdays/weekends (ii) investigate time-related characteristics of activities such as starting and ending times and durations, and (iii) profile occupancy patterns for weekdays/weekends for different household types. The outcomes provide valuable input for building energy simulation for bridging the gap between simulated and real energy consumption in the Danish residential sector; typical occupancy profiles for different household types for different days of the week are freely available online [1].

Key words: Occupant behaviour, occupancy, Time Use Survey, residential buildings

1. INTRODUCTION

In the European energy expenditure balance, the residential building sector is a major consumer of energy and has therefore become a focus for various types of energy consumption efforts [2]. Within the wider building energy research community and among energy-aware designers, dynamic Building Energy Performance Simulations (BEPS) are increasingly used to gain a more precise understanding of the underlying processes of energy flows and to optimize building energy use. BEPS have become indispensable instruments to predict building energy use and are considered valuable design-support tools for energy experts in the building sector. However, simulation results are prone to errors since many of the fundamental phenomena are not sufficiently understood. A major challenge in simulation tool development and application is how to deal with difficulties associated with a large variety of parameters and complexity of factors such as non-linearity, discreteness, and uncertainty [3]. The stochastic nature of the human interaction with the building is a key aspect of uncertainty for building design, energy diagnosis, performance evaluation, and building energy simulation due to its significant impact on real energy use and indoor environment in buildings. It has attracted research attention in the International Energy Agency (IEA EBC