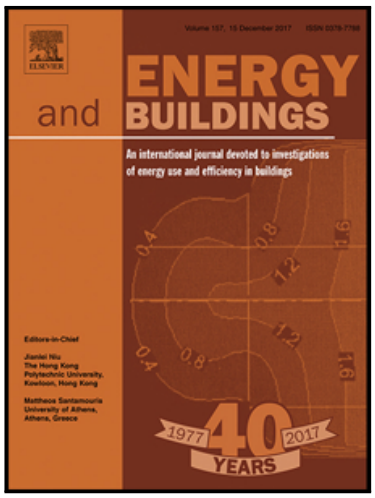

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Influence of user interaction with internal blinds on the energy efficiency of office buildings

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ABSTRACT

The objective of this study was to evaluate the influence of the interaction of users with internal blinds on the energy efficiency of an office building. Firstly, based on the results obtained from the application of questionnaires to users of an office building located in Florianópolis, southern Brazil, three behavioural patterns (two passive and one active) were identified. The first passive behaviour consists of maintaining the internal blinds open at all times while the second group of passive users is comprised of those who keep the internal blinds closed at all times, throughout the year. The active user tends to open the internal blinds upon arrival at the workplace and to close them when solar radiation higher than 50 W/m² is perceived on the work surface. The influence of behavioural patterns on the energy efficiency of buildings was investigated by performing computer simulations using DIVA 4.0 plug-in. Users who keep the internal blinds open are associated with greater daylight use, but also with increases in the thermal load inside the building. On the other hand, users who keep the internal blinds closed at all times contribute by reducing the energy consumption required for cooling, but they also reduce the daylight use. Active users tend to be associated with an intermediate energy consumption compared to the passive behavioural patterns for both lighting and cooling, as there is a balance between daylight use and thermal load when the blinds are adjusted. The increase in the average energy consumption, compared to the active users, was 5.3% for the users who keep the blinds open and 26.1% for those who keep the internal blinds closed. Thus, as a general trend, it was noted that user interaction with the internal blinds is important in terms of achieving gains in building energy efficiency. The behaviour of the active users results in lower energy consumption when compared to passive users and thus it is important to make users aware of their influence on achieving more energy efficient buildings.

Keywords: User behaviour; Offices; Internal blinds; Energy efficiency; Computer simulation; EnergyPlus

1. Introduction

The building sector is classified as the main contributor to energy consumption and greenhouse gas emissions worldwide [1], and this scenario applies to Brazil. According to the National Energy Balance (BEN) published in 2016, the building sector consumed 43.0% of the total electricity supply in Brazil in 2015. The commercial buildings sector accounted for a significant part of this consumption, that is, 14.8% of the total national electricity supply [2]. Although already high, energy consumption tends to increase continually due to population and economic growth. Thus, there is international concern in this regard, which highlights the need to obtain more energy efficient products and buildings [3].

Several strategies can be employed to obtain more energy efficient buildings and one widely accepted approach is to encourage the use of daylight. Several studies have demonstrated the possibility of making buildings more energy efficient with the application of this strategy [4-7] However, daylight use is dependent on the way the internal blinds are