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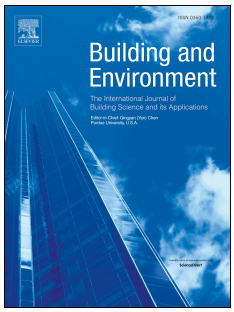

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Building energy audit, thermal comfort, and IAQ assessment of a school building: a case study

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Abstract

In France, the total heated surface area of educational buildings represents 19.5% of non-residential buildings, with an average total final energy consumption of 142 kWh/m²/y. Of this, the energy usage for heating is 97 kWh/m²/y. To save energy, building energy assessment seeks a trade-off between energy savings and the indoor environmental quality (IEQ) of the buildings. A long-term post-occupancy study was conducted on a two-story educational building with a total floor area of 3200 m^2 located in Troyes, France. The Building Management System (BMS) programme was used to analyse the energy consumption for a period of three years from January 2015 to December 2017. Although the building complies with High Environmental Quality (HQE®) standards, the post-occupancy energy demand exceeded the predicted consumption levels owing to the auxiliary equipment. Furthermore, the indoor air quality (IAQ) was assessed by monitoring and analysing CO_2 levels, which were satisfactory for 95% of occupancy period. Moreover, further investigations were performed in the building's foyer, area where indoor thermal comfort was assessed experimentally and numerically. Subjective evaluation was also conducted according to survey questionnaires completed by 41 students between the ages of 17 and 22. The results indicate that increasing the indoor temperature by 1 °C can improve the indoor thermal sensation but led to increased energy consumption of about 12%.

Keywords: Energy audit, indoor environmental quality, indoor air quality, thermal comfort, school building