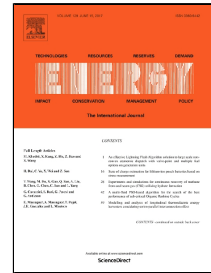


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Natural Ventilation Systems in 21st-century for near Zero Energy School Buildings

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ABSTRACT

Recently built school buildings present an increased air-tightness and have adopted mechanical ventilation systems, operating several hours daily to achieve adequate Indoor Air Quality. Nevertheless, in warm regions, the hours per year for which heating systems are required remain moderate. In these climates, natural ventilation systems present a viable alternative to the design of near Zero Energy Buildings maintaining indoor comfort conditions.

In this paper, experimental tests are performed on two school buildings in southern Spain that comparatively analyse the effectiveness of air renewal by a mechanical ventilation system in comparison with a natural ventilation system. Indoor CO₂, temperature and humidity levels are studied in terms of classroom occupation. Following the analysis, measured data is validated with running simulations in a third school building in which an NVS based on cross ventilation and stack effect is designed and tested.

Results show that, by using a Natural Ventilation System, and even when heat losses due to winter operation are taken into account, the energy use over the academic year is clearly lower than when a Mechanical Ventilation System is used. The primary energy savings lie within the range of 18-33% with the natural ventilation system while maintaining classroom comfort levels.

KEYWORDS

School Buildings; natural ventilation; Zero Energy Buildings; NZEB; Mediterranean climate.

1. Introduction

The building sector accounts for a large proportion of the total primary energy requirement (PER) in developed economies [1], in which the energy use is mostly used in heating and cooling systems, hot water production, lighting, and electrical appliances[2]. Heating, ventilation and air-conditioning (HVAC) accounts for 60–70% of the total energy used in non-industrial buildings [2]. Between 30–50% of this energy use is related to ventilation and infiltration issues. The type of installation which uses the lion's share of this energy depends

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