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Abstract

Near Zero Energy Buildings Entropy Performance †

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Buildings are one of the main areas of energy consumption in Europe. At European level, last agreements and guidelines are focused to optimize energy efficiency. New architecture paradigm evolves towards nearly Zero Energy Building (nZEB). The aim of this contribution is to evaluate building energy performance in terms of entropy production and entropy flows. We projected an nZEB at La Roca del Vallès, close to Barcelona (Spain). Special attention was given to thermal envelope adapted to the location's climate, highly efficient radiant floor with aerothermal equipment both for heating and cooling, high energy-efficient appliances and illumination while keeping comfort conditions. Energy balance was investigated with Cypetherm software for all energy sources and flows with the environment. From this energy balance and taking into account the temperature of the building and environment, we investigated the entropy balance of the building in terms of the Gouy-Stodola theorem, both considering entropy generation due to thermal exchanges, electrical consumption and occupancy along with thermal flows through the envelope. We simulated the nZEB entropy performance under different efficiency designs and irradiance in order to establish guidelines between the entropy production and the energy efficiency in buildings. As expected, the energy and entropy balance for a whole year are zero. However, entropy generation is strongly affected by the efficiency of the building along with sun irradiance. Moreover, the standard models used in architecture for building energy characterization are found to be insufficient to describe internal entropy changes, and thus, building aging. These results would help to relate energy efficiency to building life cycle analysis.