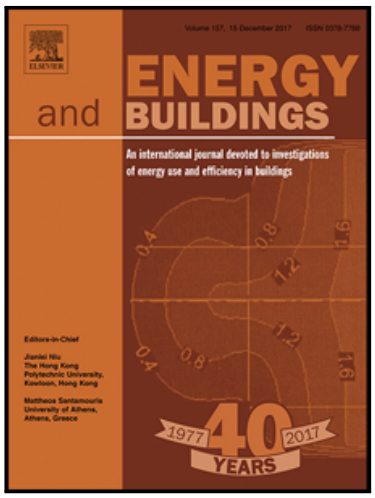

Modelling the long-term effect of climate change on a zero energy and carbon dioxide building through energy efficiency and renewables

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Modelling the long-term effect of climate change on a zero energy and carbon dioxide building through energy efficiency and renewables.

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ABSTRACT:

Over the last few years, studies have predicted an increase in the overall air temperature due to climate change. Today's society is already sensing this change, which could have a negative impact on the environment and efforts are being made to seek all possible measures to curb it. One of the consequences of this temperature rise would be its effect on indoor comfort within buildings, which may cause higher energy consumption and operational costs, while reducing the useful lifetime of air-conditioning equipment. In this paper, an existing zero energy building (ZEB) is being studied to understand the possible effects of climate change on its zero energy status. The building is also a zero carbon building because all of its generated energies come from renewable sources (biomass, geothermal and solar photovoltaic systems). The building LUCIA has the highest innovative technologies in energy systems, design and construction elements and is currently considered as one of the top three buildings with the highest LEED certification in the world. According to current European regulations, buildings will tend to become self-sufficient in terms of energy after 2020, and therefore this study will help us to understand the changes in energy consumption within a long-term timeframe, for such zero-energy buildings. With the aid of the DesignBuilder version 5 software and its EnergyPlus building energy engine, a building model is simulated and energy consumption is analyzed for the years 2020, 2050 and 2080 timeframe. The climatic conditions pertain to the city of Valladolid, Spain, which has a continental climate, while the expected changes in climatic conditions have been produced through the methodology developed by the University of Southampton, called CCworldweathergen.

Results have shown that the cooling demand would significantly increase for the years 2050 and 2080, while space heating would drop. This will increase the overall demand for burning more biofuels to cover the added demand in absorption cooling systems. Moreover, the previously excess generated electricity of the building by photovoltaics would then be totally consumed within the building due to increased demand. This implies that the installed systems will operate for longer hours, which will increase maintenance and replacement costs. As a result of this study, it becomes possible to quantify the expected changes in energy consumption and prepare preventive actions to anticipate this change, while improving the management and control of both the energy systems and the building.