

Retrofit of a UK residential property to achieve nearly zero energy building standard

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Abstract. It is currently agreed upon that one of the major challenges in the construction industry is the energy efficiency of existing buildings. The World Meteorological Organisation (WMO) and United Nations (UN) have reported that the concentration of global atmospheric carbon dioxide has increased by an average of 50%, a record speed, from 2015 to 2016. The housing sector contributes to 45% of the UK's carbon emissions. To help tackle some of those issues the recast Energy Performance Building Directive (EPBD) has introduced Nearly Zero Energy Buildings (NZEBs) in the coming years (including buildings that will undergo refurbishment/renovations). This paper will explore the retrofitting of a UK residential dwelling using Thermal Analysis Simulation (TAS, EDSL) software by focusing on building fabric improvements and usage of on-site renewables. The CIBSE Test Reference Year (TRY) weather data has been selected to examine the performance of the building under current and future climate projections. The proposed design variables were finally implemented in the building altogether on TAS. The simulation results showed a reduction in the building's annual energy consumption of 122.64 kWh/m² (90.24%). The greatest savings after this were achieved for the annual reduction in carbon emissions and avoided emissions, which were 84.59% and 816.47 kg/CO₂, respectively.

Keywords: building performance; sustainability; near-zero; thermal analysis simulation; energy consumption

1. Introduction

Traditional properties are undergoing retrofitting to be able to compare to newer buildings' energy performance. Per UK's energy statistics, 2016, the domestic sector is responsible for 40-45 percent of energy consumption and contributes to approximately 45% of the UK's CO₂ emissions. Within this framework, in 2007, a policy stating that "...in the household sector we will continue to raise energy performance standards for new homes...through Part L of the Building Regulations with the aim of delivering zero-carbon homes by 2016" was introduced (although has not been

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