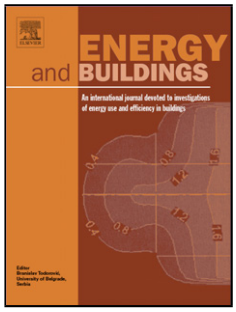

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Impact of climate change on heating and cooling energy demand in houses in Brazil

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ABSTRACT

Energy consumption and thermal comfort in buildings are heavily affected by weather conditions. This study investigated the impact of climate change on thermal comfort conditions and on heating and cooling energy demand in dwellings in three cities in Brazil. Scenario A2 of the Intergovernmental Panel on Climate Change was selected to be used in the study. To quantify the impact, the Climate Change World Weather File Generator was used to produce weather data for future typical meteorological years, such as 2020, 2050 and 2080. The EnergyPlus computer programme was used to estimate the indoor air temperature and the annual heating and cooling energy demand in the future. In order to maintain the energy consumption in the houses at the level it is nowadays, passive design strategies such as solar shading, low absorptance and thermal insulation were assessed. Results show that there will be an increase in the annual energy demand ranging from 19%–65% among the three cities in 2020; 56%–112% in 2050; and 112%–185% in 2080. In the coldest city, the annual heating energy demand will decrease by 94% in 2080 due to an increase in the average temperature and global solar radiation. The use of passive design strategies may reduce up to 50% the future annual cooling and heating energy demand in houses in Brazil.

Keywords: Climate change impact, Energy efficiency, Houses.

1. Introduction

The last few decades have seen a growing concern about climate change and global warming as a potential threat to the ecosystem and to humans; 2015 was the hottest year in history [1]. The average global temperature of the planet, in 2015, was 0.75°C above the average temperature for the 1961–1990 period, the highest since 1850 [1]. Also, the fifth assessment report of the Intergovernmental Panel on Climate Change (IPCC) showed an increasing atmospheric concentration of greenhouse gases (GHGs) and consequently global warming in the last century [2]. The emissions of gases such as carbon dioxide, methane, nitrous oxide, etc. are the main cause of rising global temperature. The last three decades have been the warmest since 1850. If emissions continue such as the current trends, average air temperature over the period 2081–2100 will be 4.8ºC higher than that over 1986–2005 [2].

To analyse possible implications of climate change in the future, the IPCC released – in 2000 – a set of six illustrative 'emissions scenarios' which can be used to drive climate models for determining potential changes to the future climate [3]. The emissions quantified in these scenarios