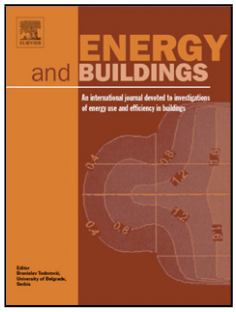

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Transformation of a University Building into a Zero Energy Building in Mediterranean Climate

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Abstract

In the context of environmental policy, the EU has launched a series of initiatives aimed at increasing the use of energy efficiency, as it has pledged to reduce energy consumption by 20%, compared with projected levels of growth of CO_2 emissions into the atmosphere by 2020. In Greece CO_2 emission levels in the atmosphere have risen significantly over the past two decades [45]. For the year 2011, CO_2 emissions per person in Greece correspond to 7.56 metric tons. According to the data, this increase in emissions is reflected to a 151.2% above from the levels of 1980 and a 756% increase from 1960 levels. The building sector consumes the largest amount of energy in Greece, therefore constitutes the most important source of CO_2 emissions. The energy upgrade of the building sector produces multiple benefits such as reduced energy consumption, which is consistent with the reduction of air pollution. Additionally, there is a significant improvement at the interior comfort conditions of the building, which promotes productivity and occupant health. Moreover, because of the large number of educational buildings in the country, the energy consumption of them present a significant amount of the country's total energy consumption and simultaneously has the effect of increasing the costs paid by the state budget for the operation and maintenance of public buildings. The investigation of alternative methods to reduce energy consumption in educational buildings is an important approach for sustainability and economic development of the country over time. The purpose of this paper is to study and evaluate the energy saving methods of a university building in Mediterranean climate with significant energy consumption. Additionally, through Building Information Modeling (BIM) and Computational Fluid Dynamics (CFD) software, studies considering the contribution of passive heating and cooling techniques were conducted, in order to minimize energy consumption in pursuit of desirable interior thermal comfort conditions.

Keywords: Zero Energy Building Building Information Modeling (BIM) Computational Fluid Dynamics (CFD) Trombe Walls Solar Analysis Daylight Analysis Weather Analysis University Building Sustainable Design Passive Techniques Photovoltaics