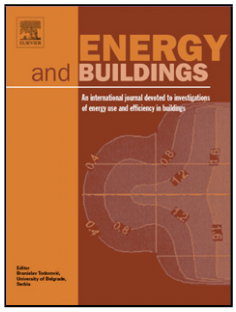

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Exergy analysis applied to performance of buildings in Europe.

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Abstract

Energy performance of buildings generally assesses the energy consumption of buildings such as heating, domestic heat water, ventilation systems, etc. However, this approach is based on the first law of thermodynamics and considers only the quantity of energy used without considering its 'quality' and leads to a lack of information about the energy conversion processes. This is particularly true in the new low-energy buildings where sometimes high temperatures sources are used to meet low-temperature needs. The exergy analysis of a system, based on first and second thermodynamic laws, can be used to overcome this. In this work, it is proposed to compare the energy and the exergy consumption and the related CO_2 emissions of several kinds of buildings to determine the best systems in terms of energy and exergy needs. The energy demand calculations are performed using the official software available in Belgium and some assumptions are implemented to consider the exergy approach. As exergy calculations require a reference state, some different climatic conditions are also investigated. Finally, some conclusions are discussed to rank the sources of energy and their related exergy losses.

Keywords: exergy analysis, building performance, exergy, CO_2 reduction, heat sources.

1. Introduction

About 40% of the Europe energy is dedicated to the buildings [1, 2] and represents about 36% of the CO_2 emissions. Therefore European Union sets up the Directive 2002/91/EC, reinforced in 2010 by Directive 2010/31/EU to try to improve the performance of the buildings and to reduce the energy