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NZEB AND PASSIVE BUILDINGS: DILEMMAS AND CHALLENGES UNDER THE PRISM OF SUSTAINABILITY

Katerina G. Tsikaloudaki*, Michalis T. Pliatsikas, Efi K. Platirachou

Department of Civil Engineering, Aristotle University of Thessaloniki
PO BOX 429, Thessaloniki, Greece
katgt@civil.auth.gr

ABSTRACT

It is globally accepted that the climate crisis constitutes a serious threat to our lives and planet and that without a radical reduction of greenhouse gas emissions, global warming will exceed the limits set in the Paris agreement by the end of the century. Buildings are responsible for a significant share of emissions, and also consumed energy and resources. In fact, it is estimated that almost 1/3 of CO_2 emissions, 40% of energy consumption, 50% of all extracted materials and 30% of water consumption are produced during the building use phase. For this reason, the optimization of the building energy performance was set as a priority for tackling climate change in many countries worldwide.

Pursuing such a goal shaped concepts, frameworks and requirements for assessing and evaluating the building energy performance. For example, the EU introduced the concept of the nearly zero energy building (nZEB) in its directives and the state members developed regulations, tools and methods for calculating and assessing the building energy performance, taking into account the economic feasibility of the measures that would lead to the minimization of consumed energy. At the same time, other concepts developed by individual institutions, such as the Passive House, gain wide acceptance and recognition by promoting even more energy efficient buildings, a goal that is achieved through the application of strict requirements for the building envelope and the building systems.

The question is whether the satisfaction of such stricter requirements result in a sustainable building throughout its whole life cycle, given that the environmental footprint of the building does not involve only the use phase, but includes the embodied energy/carbon from the materials' production phase, as well as the energy/emissions from the deconstruction and waste phases, which are also dependent on the materials' quantities and characteristics.

The proposed study will attempt to provide answers to this question through the comparative assessment of the application of the nZEB and the Passive House concepts in a small single family building. The assessment will be based on the energy and the environmental performance of the case study building, which is examined with both concepts through its whole life cycle under the climate conditions of a warm and a cold region of Greece. The analysis will also include indications of the building performance when the expected future climatic conditions are taken into account, in order to provide a rough outlook on the changes on building performance and requirements in the future.

In this way, the study will highlight the ways and the required legislative frameworks that would constitute our buildings more energy-efficient and less carbon-intensive over their life cycle.