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Short Communication

Health Benefits and Environmental Impacts: Perspectives of the Proposal for the New Energy Performance of Buildings Directive

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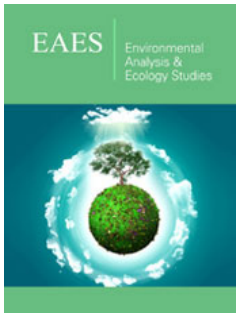

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Abstract

Energy Performance Certificates should be vital in enhancing buildings' energy performance, the health benefits for the occupants, and the environmental impacts. The construction sector consumes 50% (by weight) of the materials used in the European Union and is responsible for 30% of the waste generated. These are very high figures, but the potential for savings is significant. Additionally, good indoor air quality levels in buildings are among the essential benefits and drivers as they lead to better health and comfort of the occupants. The general purpose of ventilation in buildings is to provide healthy air for breathing by diluting the pollutants in the building and removing the contaminants. This study analyzed the perspectives of the new Energy Performance of Buildings Directive proposal concerning health benefits and environmental impacts of energy renovation of buildings. The European Commission now considers, on the Energy Performance Certificates, the Global Warming Potential as a function of emissions over the entire life cycle. Furthermore, most existing buildings will inevitably require significant energy renovations to become more energy efficient, improving thermal comfort and indoor air quality.

Keywords: Embodied energy; Energy performance of buildings directive; Energy performance certificates; Environmental impacts; Health benefits

Introduction

Buildings in the EU are responsible for 40% of final energy consumption and 36% of energy-related Greenhouse Gases (GHGs) emissions, not including emissions incorporated in the production, construction, renovation, and end-of-life. In residential buildings, 80% of energy consumption is due to heating, cooling, and Domestic Hot Water (DHW) preparation. The construction sector consumes 50% (by weight) of the materials used in the EU and is responsible for 30% of the waste generated [1].

Although the European Parliament and the Council have not formally published a new Directive that will recast Directive No. 2018/844/EU, a legislative proposal for the new Energy Performance of Buildings Directive (EPBD) was presented in December 2021 by the European Commission [1]. With this proposal, the Commission intends to establish the legislative requirements to meet the EU's goal of reducing at least 55% of GHGs by 2030, compared to 1990. In addition, 75% of existing buildings are energy inefficient and will inevitably require significant energy renovations to become more energy efficient. The Renovation Wave aims to reduce dependence on fossil fuels, lower energy consumption, and GHGs emissions, and improve thermal comfort and indoor air quality.

Embodied energy accounts for the energy needed in all stages of a building. Hence, not only in the operational phase. In many cases, building materials' embodied energy may surpass the energy for assuring occupants' thermal comfort [2] in a cost-benefit analysis. In addition, indoor Air Quality (IAQ) may determine how comfortable and healthy occupants may be inside buildings. IAQ refers to the contribution of the building components to the good

health and well-being of the occupants, and enhancing ventilation effectiveness may improve IAQ [3].

The main objective of this study is to analyze the perspectives of the proposal for the new EPBD concerning health benefits and environmental impacts of energy renovation of buildings. The final goal is to highlight if the proposal still lacks issues to respect people and a sustainable planet. The structure of this paper is as follows. First, Section 1 introduces the problem. Secondly, in Section 2, the methodology and results are presented.

Methodology and Results

EPCs have the potential to track the global environmental impact of building components and enhance the health benefits for the occupants [4]. Thus, the methodology adopted compared the previous literature review results [5] and the conclusions achieved with the legislative proposal for the new EPBD. Concerning the global environmental impact of building components, traditional retrofitting focuses on reducing operational costs. Nevertheless, this strategy might increase embodied carbon and energy [5]. Moreover, some measures, like high insulation thicknesses, may generate similar or even higher embodied energy than the potential reductions during the operation stage [6].

Regarding occupants' health, a bad IAQ can lead to sleep disorders, headaches, loss of concentration, allergies, eye irritation, dry throat, or respiratory problems. In addition, high thermal insulation and insufficient ventilation may become a breeding ground for molds, viruses, and bacteria. Among the health risks are also a variety of Volatile Organic Compounds (VOCs), Particulate Matter (PM), and Carbon Dioxide (CO_2). Also, biomass-burning stoves significantly contribute to fine particle matter ($PM_{2.5}$) concentrations that may cause cancer and respiratory diseases. In Portugal, in dwellings' EPCs, the ventilation is based on the Air Changes Per Hour (ACH) in the whole house, so it does not consider minimum fresh air flows in the main rooms [7].

The EPBD revision aims to respond to the strategy for a Renovation Wave, published by the European Commission on October 14, 2020, which target is to double building renovations by 2030. In short, the objective is to renovate about 35 million inefficient buildings. Therefore, with zero CO_2 emission buildings always in mind, the future EPBD proposal mentions, among other requirements and conditions: buildings should consume little energy, maximize the use of energy from renewable energy sources, and indicate in the EPC the Global Warming Potential (GWP) as a function of emissions over the entire life cycle; buildings should not produce CO2 emissions from fossil fuels; all new buildings will have to have zero CO2 emissions. In addition, a new definition of a Zero Emission Building (ZEB) has emerged as a very high-energy performance building. Thus, zero carbon emissions from on-site fossil fuels and zero or very low operational GHGs emissions align with the energy efficiency concept. This new definition will replace nearly Zero Energy Building (nZEB).

Comparing the previous literature review results and the conclusions achieved with the legislative proposal for the new EPBD, the result is that the building's life cycle global warming potential (GWP) must be calculated and presented in the building's EPCs. Additionally, as 75% of existing buildings will inevitably require significant energy renovations, this will improve thermal comfort and indoor air quality.

Conclusion

To reach the 55% emission reduction target by 2030 adopted by the European Union in September 2020, the EU has to reduce GHGs emissions from its buildings. The Renovation Wave will improve thermal comfort and indoor air quality. Concerning the environmental impacts, the building's life cycle GWP will have to be calculated and presented in the building's EPCs. Thus, the EPCs will be much more helpful for the end users as they will be informed about embodied energy. However, the revision of the EBPD should explicitly consider an airflow of fresh air in bedrooms and living rooms. Otherwise, the Portuguese methodology of evaluating the ventilation through the ACH of the whole dwelling will hardly ensure that new air enters the main rooms, especially when buildings become increasingly tight due to renovations.

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