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ASSESSING THE GREENHOUSE GAS EMISSIONS OF BUILDINGS IN BRAZIL: A CASE STUDY OF A HOUSING COMPLEX

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Abstract

Buildings play a central role in the low-carbon future and pose challenges for integration with sustainable development, especially in Brazil, where urban areas are still expanding and the implementation of environmental tools, such as Life Cycle Assessment (LCA), faces more difficulties. The present paper aims at assessing the greenhouse gases (GHG) emissions during the whole life cycle of a housing complex located in Rio de Janeiro, Brazil. For this purpose, a life cycle-based analysis was carried out to estimate the GHG emission from the production of the most commonly used building materials, such as steel, cement, ceramic, wood, among others; transport activities; and the construction, use (energy consumption during 50-year useful life), maintenance and demolition of the housing complex. According to the results, the GHG emissions generated during the housing complex's life cycle are 282.62 $tCO_{2eq.}$, which can be expressed as 1,009.34 $kgCO_{2eq.}/m^2$/50-year or 20.19 $kgCO_{2eq.}/m^2$/year. These emissions are dominated by the use stage (56%), which is followed by the pre-use (30%) and end-of-life (14%) stages. Indirect emissions accounted for more than half of GHG emissions (57%), mainly driven by emissions from building materials (85.47 $tCO_{2eq.}$; or 30%). Cement was responsible for 22% of embodied GHG emissions from building materials. These findings are relevant to the Brazilian context in which environmental issues have not determined the choice of building materials. Furthermore, this paper supports the improvement of the LCA usefulness in Brazil as it contributes to the mitigation of the lack of national datasets.

Keywords: building materials, greenhouse gases, life cycle approach, residential building

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