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Comparing the Embodied Carbon Impacts of a Passive House with the BC Energy Step Code Using Life Cycle Assessment

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Abstract : The construction industry accounts for approximately 40% of total GHG emissions worldwide. In order to limit global warming to 1.5 degrees Celsius, ambitious reductions in the carbon intensity of our buildings are crucial. Passive House presents an opportunity to reduce operational carbon by as much as 90% compared to a traditional building through improving thermal insulation, limiting thermal bridging, increasing airtightness and heat recovery. Up until recently, Passive House design was mainly concerned with meeting the energy demands without considering embodied carbon. As buildings become more energy-efficient, embodied carbon becomes more significant. The main objective of this research is to calculate the embodied carbon impact of a Passive House and compare it with the BC Energy Step Code (ESC). British Columbia is committed to increasing the energy efficiency of buildings through the ESC, which is targeting net-zero energy-ready buildings by 2032. However, there is a knowledge gap in the embodied carbon impacts of more energy-efficient buildings, in particular Part 3 construction. In this case study, life cycle assessments (LCA) are performed on Part 3, a multi-unit residential building in Victoria, BC. The actual building is not constructed to the Passive House standard; however, the building envelope and mechanical systems are designed to comply with the Passive house criteria, as well as Steps 1 and 4 of the BC Energy Step Code (ESC) for comparison. OneClick LCA is used to perform the LCA of the case studies. Several strategies are also proposed to minimize the total carbon emissions of the building. The assumption is that there will not be significant differences in embodied carbon between a Passive House and a Step 4 building due to the building envelope.

Keywords : embodied carbon, energy modeling, energy step code, life cycle assessment
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