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CARBON FOOTPRINT OF A NEARLY ZERO ENERGY BUILDING IN ACCRA (GHANA): AN LCA-BASED MODEL

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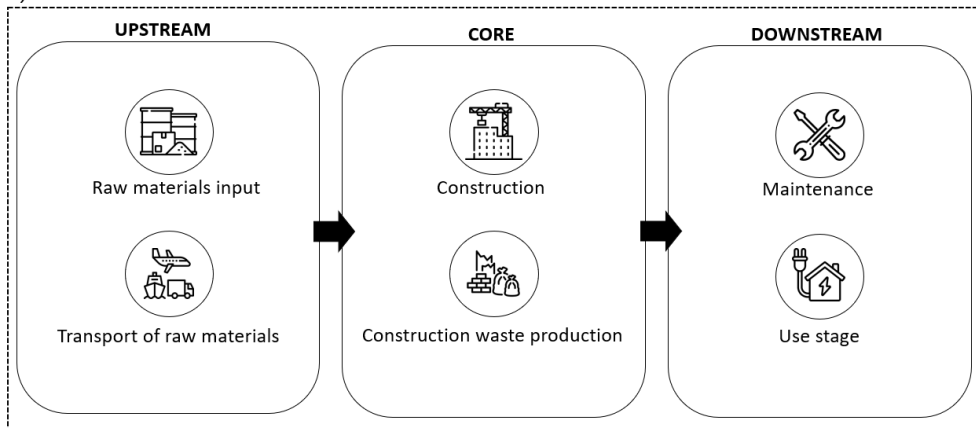
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Abstract – This study presents a comprehensive Life Cycle Assessment (LCA) of a Nearly Zero Energy Building (NZEB) in Accra, Ghana, comparing its environmental impact with a conventional BusinessAsUsual (BAU) building over a 50-year lifespan. Adhering to ISO 14040 and ISO 14044 standards, the research evaluates the carbon footprint and operational efficiencies essential to sustainable building designs. Utilizing SimaPro 9.5 software and the IPCC 2021 GWP100 method, the total carbon footprint was quantified at 1727 tons of CO₂-equivalent for the NZEB, significantly lower than the BAU comparison. The analysis highlights the operational phase, including waste generation as the most substantial contributor to the NZEB’s environmental impact, accounting for 725 tons of CO₂-equivalent emissions. Conversely, the strategic inclusion of solar panels and enhanced material selection for the NZEB markedly reduced energy demands, contributing to a net positive environmental outcome with an avoided carbon footprint of approximately –859.72 tons CO₂eq. This reduction underpins the NZEB’s effectiveness in leveraging eco-friendly materials and renewable technologies, setting a benchmark for future sustainable construction practices. The study ultimately advocates for an integrated approach, harmonizing technological innovation with environmental stewardship, to mitigate the carbon footprint of the built environment, steering the construction industry towards sustainability.

Keywords – Carbon Footprint; environmental impact; Nearly Zero Energy Building; Life Cycle Assessment; renewable energy; sustainable construction

System boundaries



System boundaries of the NZEB study.