Life cycle assessment of a Danish office building designed for disassembly

The building industry is responsible for a large proportion of anthropogenic environmental impacts. Circular economy (CE) is a restorative and regenerative industrial economic approach that promotes resource efficiency to reduce waste and environmental burdens. Transitioning from a linear approach to a CE within the building industry will be a significant challenge. However, an insufficient number of quantitative studies exist to confirm the potential (positive) environmental effects of CE within the built environment as well as a consistent method for characterizing these effects. This paper considers key methodological issues for quantifying the environmental implications of CE principles and proposes a life cycle assessment (LCA) allocation method to address these issues. The proposed method is applied to a case study of a Danish office building where the concrete structure is designed for disassembly (DfD) for subsequent reuse. The potential environmental impact savings vary between the different impact categories. The savings are significantly influenced by the building's material composition, particularly the number of component-use cycles as well as the service life of the building and its components. The substitution of other material choices (e.g. glass and wood) for the concrete structure exhibited a potential increase in impact savings.