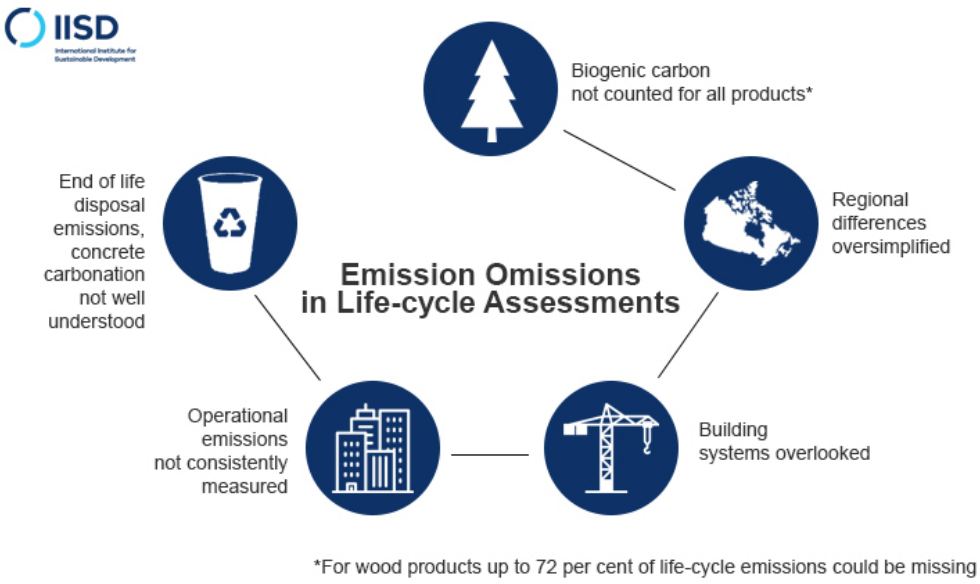
Emission Omissions in Life-cycle Assessments May Misdirect Efforts to Reduce GHGs

Policy makers and building professionals looking to decarbonize buildings should exercise caution when making decisions that advocate for one building material over another.

New Canadian research sheds light on some serious gaps in how greenhouse gas (GHG) emissions from building materials and products are being measured and accounted for. Failure to account for all carbon emissions may be undercutting today's climate change efforts and shortchanging future emission reduction opportunities.

Emission Omissions: Carbon accounting gaps in the built environment finds that life-cycle assessment (LCA) is the right approach to measure carbon emissions, but more data, transparency and robust LCA standards are needed, especially with respect to accounting for biogenic carbon from wood products.



Key Findings

When it comes to reducing carbon emissions from buildings, LCAs could misdirect decision makers.

LCAs can be an effective tool for reducing carbon emissions. But without proper care, they can produce results that are misleading or wrong, potentially leading to more GHG emissions, rather than less. Existing built environment LCAs produce widely variable results for similar projects for two main reasons: first, there remain important gaps in the data available; second, assumptions and uncertainties that may have significant impact on LCA results are typically not disclosed. This can lead to flawed conclusions, misdirected efforts and suboptimal GHG outcomes for Canadians.

LCAs ignore significant sources of GHG emissions from wood products.

LCA studies typically do not track the carbon emissions or sequestration of what is known as "biogenic carbon" from the extraction and end-of-life stages of wood building products. Biogenic carbon refers to carbon emissions from disturbances of living organic matter, such as carbon losses from soil disturbance, from the conversion of old-growth primary forest to less productive secondary forest, as well as losses from imperfect post-harvest reforestation efforts. Collectively, these emissions can represent up to 72 per cent of a wood product's total lifecycle emissions., challenging the prevailing assumption that wood construction materials are lower carbon than other construction materials, such as concrete and steel.

Important regional factors are often overlooked.

LCAs tend to discount significant regional variability in the GHG emissions of different materials. These factors include the regional variations associated with the extraction of raw materials, the carbon emission intensity of the production phase and the disposal conditions at the end-of-life stage. For example, while production intensities can vary significantly from site to site, LCAs typically use average national, continent or global data.

Existing LCA models may misrepresent embodied emissions.

LCAs comparing building materials can exaggerate the importance of embodied impacts when they discount or ignore the contribution of other significant life-cycle emissions, such as operational stage emissions and the GHG impacts of other buildings systems. Used in isolation, these results can lead to decisions that are too narrow in scope and shift focus away from a more comprehensive picture of GHG emission reduction opportunities in buildings.

Recommendations

Lifecycle assessments must look at the whole picture, supported by robust standards and data

More data, transparency and robust carbon accounting standards are needed, especially with respect to biogenic carbon from wood products. The federal government should invest in up-to-date regionalized, national life-cycle inventories, including a fulsome carbon accounting in LCAs for all building materials, with LCAs for wood products needing to consider regional biogenic carbon impacts against net carbon sequestered.

Energy efficiency, long service life and material efficiency should be the priorities for decarbonizing the built environment.

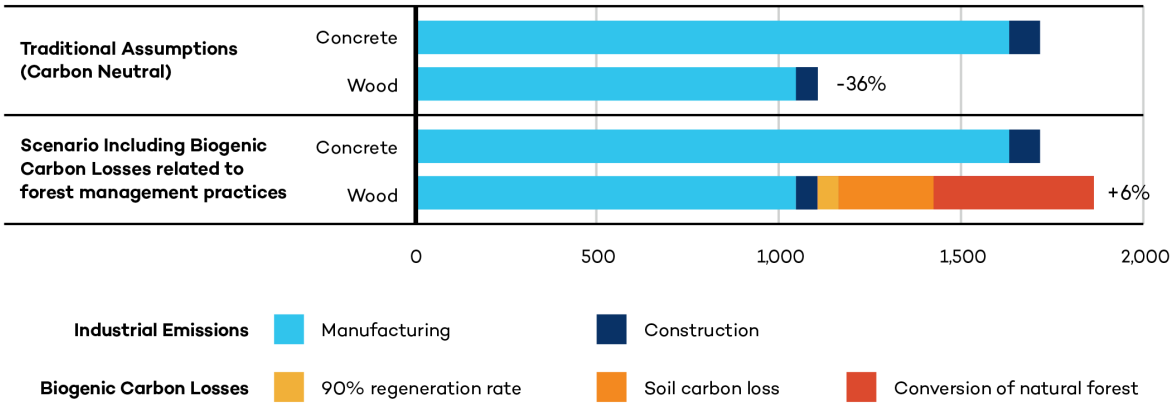
While embodied GHG emissions are important, improvements in energy efficiency and developing new low- or net-zero-energy buildings still offer the highest potential for decarbonizing the built environment. Policymakers should focus on promoting building durability, resiliency and energy efficiency improvements. To address embodied GHG emissions in buildings, policy-makers and building professionals should prioritize material efficiency and accelerating the adoption of emerging low carbon material production technologies.

About the Study

This study consisted of a review of existing LCA guidelines, methodologies and literature; an analysis of major documented uncertainties and major variabilities that can be expected in the Canadian context; and an analysis of the potential impacts of changes in technology and the built environment and how they fit with longer-term climate objectives.

To guide and challenge the research as it developed, the IISD research team worked under the guidance of an advisory group comprised of university-affiliated academics, notable environmental organizations and architects/designers from the green building community, including the Natural Resources Defense Council, Environmental Defence, CPAWS, Queens University, the University of Toronto, Athena Institute, the International Reference Centre of the Life Cycle of Products, Local Practice Architecture + Design, Buildgreen Solutions, Boreal Songbird Initiative and the Cement Association of Canada. The study was commissioned by the Cement Association of Canada (CAC) to explore the use of life-cycle assessments (LCAs) in the built environment – making a major contribution to improving science and decision-making. Funding was provided by the CAC.

Table ES1. Cradle-to-grave building embodied emissions (tCO_2e)



When combined factors such as forest regeneration rates, soil carbon loss and primary-to-new-growth-forest-conversion are all accounted for, the cradle-to-grave embodied emissions for a wood building could be 6% greater than for a concrete building.