BACKGROUNDER

Emission Omissions:

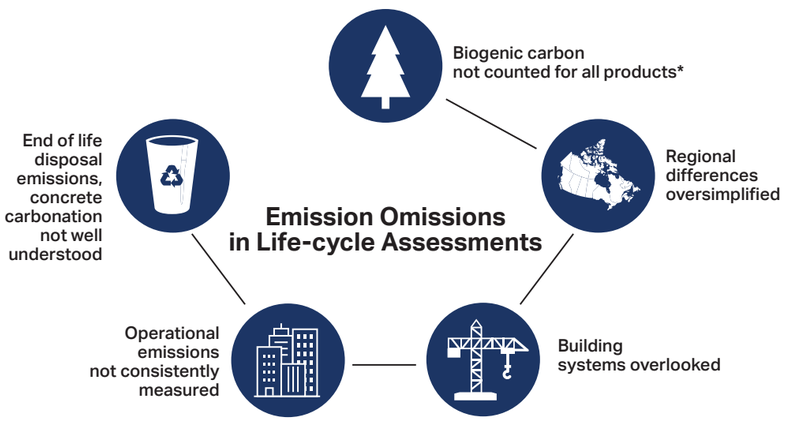
Carbon accounting gaps in the built environment

IISD REPORT

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.



*For wood products up to 72 per cent of life-cycle emissions could be missing

Key Findings

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.

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.

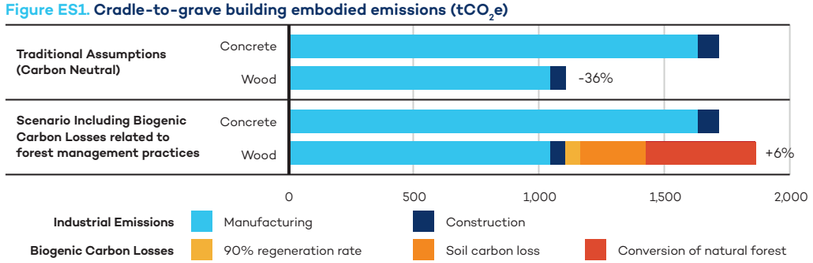
Important regional factors are often overlooked.

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.

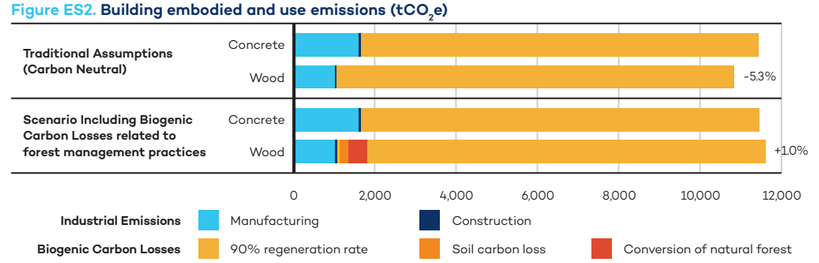
LCAs comparing building materials can exaggerate the importance of embodied impacts when they discount or ignore the contribution of other significant life-cycle emissions, such as operational stage emissions and the GHG impacts of other buildings systems. Used in isolation, these results can lead to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

Figure 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 per cent greater than for a concrete building.

Figure ES2. Building embodied and use emissions (tCO_2e)



When adding use phase emissions to the embodied emissions, the carbon impact of a wood building could be 1 per cent greater than for a concrete building.

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.

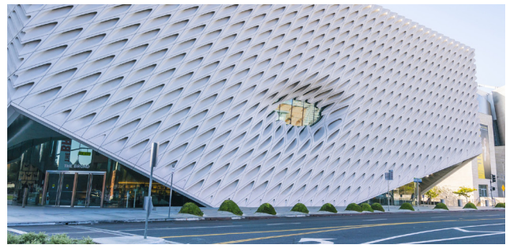
About the Study

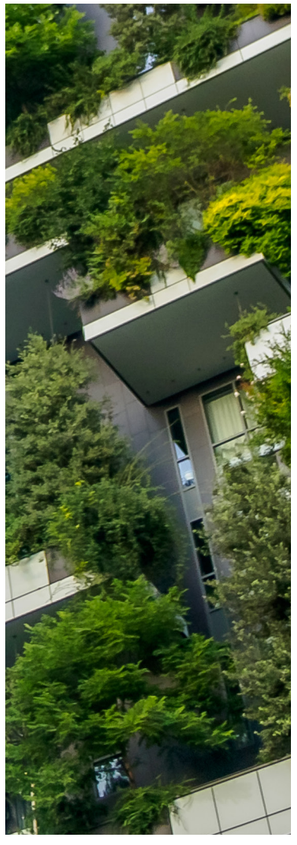
This study consisted of a review of existing LCA guidelines, methodologies and literature; an analysis of major documented uncertainties and major variabilities that can be expected in the Canadian context; and an analysis of the potential impacts of changes in technology and the built environment and 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, Queen's University, the University of Toronto, Athena Sustainable Materials Institute, the International Reference Centre of the Life Cycle of Products, Local Practice Architecture + Design, BuildGreen Solutions and Boreal Songbird Initiative.

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.

This backgrounder as well as the full report and executive summary for this study are available at *www.iisd.org/library/emission-omissions*.





Concrete is more than a material. It's about life.

When it comes to reducing carbon emissions from the places where we live, work and play, innovations in cement and concrete are leading the way.

Today's concrete is made with lower carbon cement and using lower carbon fuels recovered from wastes. Together, these innovations help reduce greenhouse gas emissions by up to 30%. Our investments in transformative carbon capture, storage and utilization technologies promise even deeper reductions. What's more, concrete naturally absorbs GHGs throughout its life.

Historic durability and resilience together with low carbon innovation means concrete plays a vital role in building a sustainable future for Canadians.

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Canada's cement and concrete industry applauds recommendations from international environmental think thank

New study identifies serious gaps in the way carbon is being measured in our built environment.

In communities across the country, the buildings where we live and work are responsible for over 30% of Canada's GHG emissions. We can make a real difference in the fight against climate change, by aligning construction practices, building and energy codes and other regulations to reduce the carbon footprint of our structures.

The Cement Association of Canada (CAC) has been a vocal champion for putting science at the centre of a national effort to reduce carbon emissions from the built environment. To build a sustainable future, we must base the decisions we make today on reliable facts, not assumptions.

Whether builders use steel, concrete or wood, they need an accurate assessment of how their choices will affect the environment. In turn, the building materials industry needs to understand the impact of its products for improvement to take place. That's why Canada's cement companies have supported this important independent research by the International Institute for Sustainable Development (IISD). We wanted to do our part in making sure that everyone with influence or responsibility for our buildings and infrastructure has the best possible environmental information and data to guide their decisions.

The IISD study *Emission Omissions: Carbon accounting gaps in the built environment* confirmed that Life-cycle Assessment (LCA) is the best approach we have for analyzing the carbon cycle in the built environment and reducing emissions.

However, the research found that current LCA tools have serious shortcomings. They overlook significant sources of carbon and these gaps could result in misdirected efforts to reduce GHGs.

The researchers identified the need to correct poor assumptions about embodied carbon in wood, steel and concrete building products. However, they singled out forestry products for urgent attention because current LCAs typically ignore emissions from "biogenic carbon". The study found that these omissions could represent up to 72% of the life-cycle emissions of wood products.

It is a clear warning that efforts to reduce carbon emissions from the built environment will fall short of potential if we continue to rely on incomplete data and incorrect assumptions.

The point is not to single out one material over others, but that more data, greater transparency and robust methods and standards for carbon accounting are needed in the fight against climate change.

Michael B. McSweeney

Michael McSweeney
President and CEO, Cement Association of Canada

What experts are saying*

The IISD study *Emission Omissions: Carbon accounting gaps in the built environment* was conducted under the guidance of an advisory group comprised on academics, environmental organizations and architects/ designers from the green building community.

"This study identifies serious gaps in the way we currently account for carbon emissions from building materials, particularly emissions from forestry products. Soil disturbance, conversion of old-growth primary forest and variable silvicultural success rates are potentially significant sources of carbon that current LCAs don't account for. We need to strengthen our metrics to make sure our strategies to reduce carbon from buildings hit their mark."
— Dr. Jay Malcolm, Professor with University of Toronto Faculty of Forestry and member of the study's Advisory Committee

"This study demonstrates the importance of applying the best life-cycle evidence to policy decisions related to how Canada's public forests and products interact with our atmosphere. Forests are complex systems that belie simple assumptions about renewability and carbon neutrality. When it comes reducing carbon in buildings and infrastructure, our policy frameworks and choices – including about how building materials are harvested, produced and used – need to reflect a more rigorous assessment of climate impacts, or they may be flawed and counterproductive."
— Janet Sumner, Executive Director, CPAWS Wildlands League

"It's clear that LCAs are an important tool, but they have their limitations as well. More work needs to be done to unpack some of the assumptions that go into them. The study has a clear message for the building industry and for policy makers. We have to get the carbon accounting right, get the evidence that we need and put it to work on reducing Canada's greenhouse gas emissions."
— Keith Brooks, Programs Director, Environmental Defence and member of the study's Advisory Committee

"LCA approaches are integral to understand how buildings and the materials they are made of will impact GHG emissions. However, there are still several uncertainties in the LCA process that building designers and policymakers need to be aware of and should be taking into consideration, especially with respect to the embodied biogenic carbon and biodiversity impacts of wood products."
— Philip Gass, Senior Policy Advisor, International Institute for Sustainable Development

"Whether builders use steel, concrete or wood, they need an accurate assessment of how their choices will affect the environment. In turn, the building materials industry needs to understand the impact of its products for improvement to take place. That's why Canada's cement companies have supported this important independent research by the IISD. We wanted to do our part in making sure that everyone with influence or responsibility for our buildings and infrastructure has the best possible environmental information and data to guide their decisions. "
*— Michael McSweeney, President and CEO, Cement Association of Canada***

**Quotes from the news release issued by IISD*
***Quote from the cement and concrete industry's response to the IISD study*