



# Making the Right Environmental Choice

The choice of products used to build, renovate and operate structures of all types has a huge impact on the environment, consuming more of the earth's resources than any other human activity, and producing millions of tonnes of greenhouse gases, toxic emissions, water pollutants and solid waste.

Obviously, building with the environment in mind can reduce this negative impact. But to be effective, decisions need to be based on a standardized, quantified measurement system that allows an impartial comparison of materials and assemblies

over their entire lives. Prescriptive approaches to green design often focus on a single characteristic, such as recycled content, with an assumption it will yield the greatest environmental advantage.

The most widely accepted scientific method to compare design choices and building materials effectively is life cycle assessment (LCA). It has existed in various forms since the early 1960s, and the protocol for completing life cycle assessments was standardized by the International Organization for Standardization (ISO 14040-42) in the late 1990s.

## What is Life Cycle Assessment?

Life cycle assessment is a performance-based approach to assessing the impacts building choices have on the environment. LCA can be used to analyze potential impacts of a product or structure at every stage of its life, including:

- fossil fuel depletion
- other non-renewable resource use
- global warming potential
- water use
- acidification
- stratospheric ozone depletion
- ground level ozone (smog) creation
- eutrophication
- hazardous and non-hazardous waste

Life cycle assessment is accepted around the world as a way to evaluate and compare the environmental impacts of different building materials, products and complete structures over their lifetime – from resource extraction through manufacturing, transportation, installation, building operation, decommissioning and eventual disposal.

It enables an objective comparison to be made between alternate materials and assemblies over their lifetime, based on quantifiable indicators of environmental impact. Life cycle assessment clarifies the environmental trade-offs associated with choosing one material over another and, as a result, provides an effective basis for comparing alternate designs in a specific geographic location.

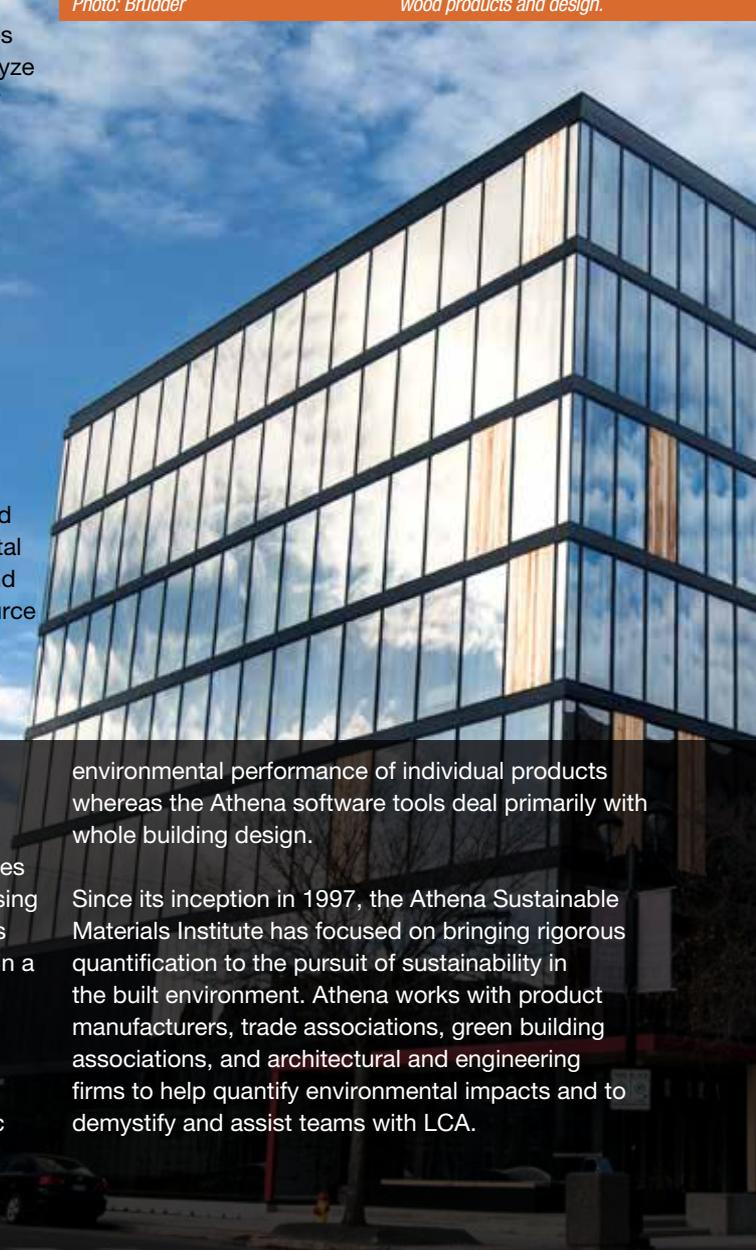
Designers can make informed environmental decisions using life cycle assessment tools such as BEES (Building for Environmental and Economic Sustainability) and the Athena Impact Estimator for Buildings or EcoCalculator. BEES evaluates the

*Wood Innovation and Design Centre,  
Prince George, B.C.  
Architect: Michael Green Architecture  
(MGA)  
Photo: Brudder*

*WIDC is an iconic six-storey wood  
structure that builds on B.C.'s expertise  
and global reputation as an innovative  
leader in wood construction, engineered  
wood products and design.*

environmental performance of individual products whereas the Athena software tools deal primarily with whole building design.

Since its inception in 1997, the Athena Sustainable Materials Institute has focused on bringing rigorous quantification to the pursuit of sustainability in the built environment. Athena works with product manufacturers, trade associations, green building associations, and architectural and engineering firms to help quantify environmental impacts and to demystify and assist teams with LCA.



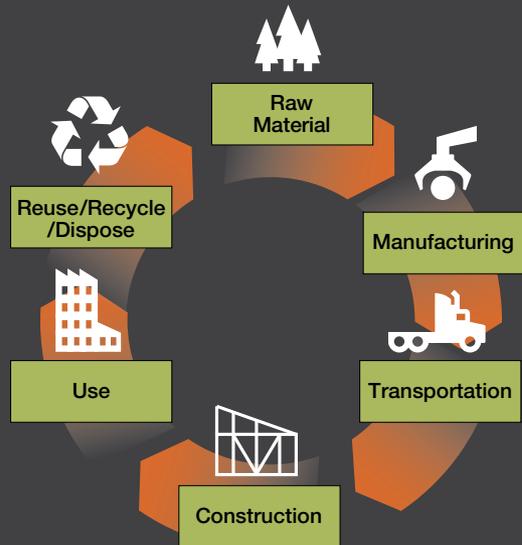
# Life Cycle Assessment and Wood

Life cycle assessment studies worldwide have consistently shown that wood products yield clear environmental advantages over other building materials. Wood buildings can offer lower greenhouse gas emissions, less air pollution, lower volumes of solid waste and less ecological resource use.

A comprehensive review of scientific literature looked at recent research done in Europe, North America and Australia pertaining to life cycle assessment of wood products.<sup>1</sup> It applied life cycle assessment criteria in accordance with ISO 14040-42 (now combined into ISO 14044) and concluded, among other things, that:

- Fossil fuel consumption, the potential contributions to the greenhouse effect and emissions to air and water are consistently lower for wood products compared to competing products.
- Wood products that have been installed and are used in an appropriate way tend to have a favorable environmental profile compared to functionally equivalent products made out of other materials.

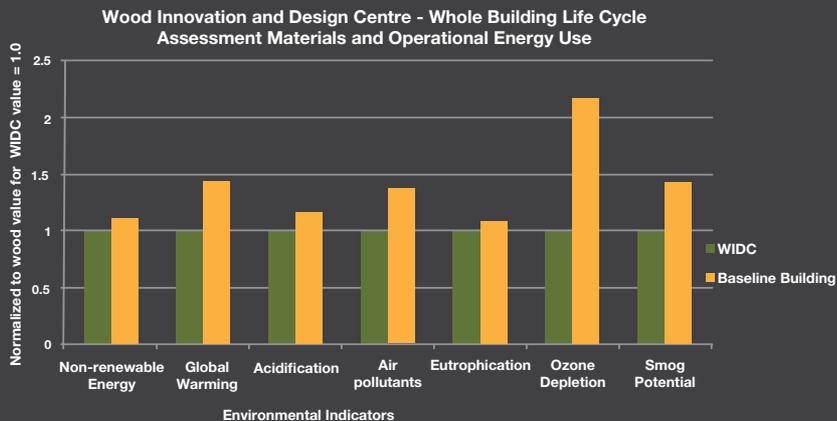
The chart below is a life cycle assessment by FPInnovations for the Wood Innovation and Design Centre (WIDC) in Prince George, B.C. and incorporates measurements for both building materials and operational energy<sup>2</sup>. A concrete baseline building was used as the comparative building for WIDC in this LCA. The baseline building is similar in height to the WIDC and has reinforced concrete with light gauge steel envelope walls which is the standard practice for this type of building in British Columbia. The WIDC is a mass timber structure with cross laminated timber used for the floors, walls and building core.



The environmental performance of the WIDC building, compared to the baseline building, was reduced by 10% or more in six of the seven reported categories, when both operational energy use and materials were considered. Eutrophication potential was the only category which did not improve by more than 10%. When considering impact contributions from *materials alone*, environmental performance improvements for WIDC were 10% or more for all environment indicators compared to the baseline building. Environmental performance differences between the two buildings were largely due to differences in the structural system used (wood versus concrete).

Results from the LCA suggest that multi-storey office buildings with mass timber structural systems and LVL curtain wall structures such as WIDC can outperform reinforced concrete structural systems with aluminum curtain wall structures in terms of environmental impact.

<sup>1</sup> Werner, F. and Richter, K. 2007. Wooden building products in comparative LCA: A literature review. *International Journal of Life Cycle Assessment*, 12(7): 470-479.  
<sup>2</sup> Grann, B. 2014. Wood Innovation and Design Centre Whole Building Life Cycle Assessment, FPInnovations.  
[https://fpinnovations.ca/Extranet/Pages/AssetDetails.aspx?item=/Extranet/Assets/ResearchReportsWP/3126.pdf#\\_Veib9BHBzRY](https://fpinnovations.ca/Extranet/Pages/AssetDetails.aspx?item=/Extranet/Assets/ResearchReportsWP/3126.pdf#_Veib9BHBzRY)





## Wood Reduces Environmental Impact of Buildings

When assessing building material sustainability, it is not enough to just look at recycled content. Its complete environmental profile should be taken into consideration. That is best achieved by using life cycle assessment (LCA).

### Green buildings

- Mitigate climate change
- Use less energy and water
- Use fewer materials
- Reduce waste
- Are healthy for people and the planet

#### **Left Image:**

*Quattro 3 Condominiums,  
Surrey, B.C.*

*Architect: Cotter Architecture Inc.*

*Photo: Martin Knowles*

#### **On the cover:**

*VanDusen Visitor Centre,  
Vancouver, B.C.*

*Architect: Perkins+Will Canada  
Architects Co.*

*Photo: KK Law*

naturally:wood®

British Columbia wood. Sustainable by nature. Innovative by design.

© 2015