Building Green with Wood

MODULE 2

Life Cycle Assessment

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. 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. The best way to understand the full environmental impact of any product or structure is to analyze impacts at every stage of its life, including:

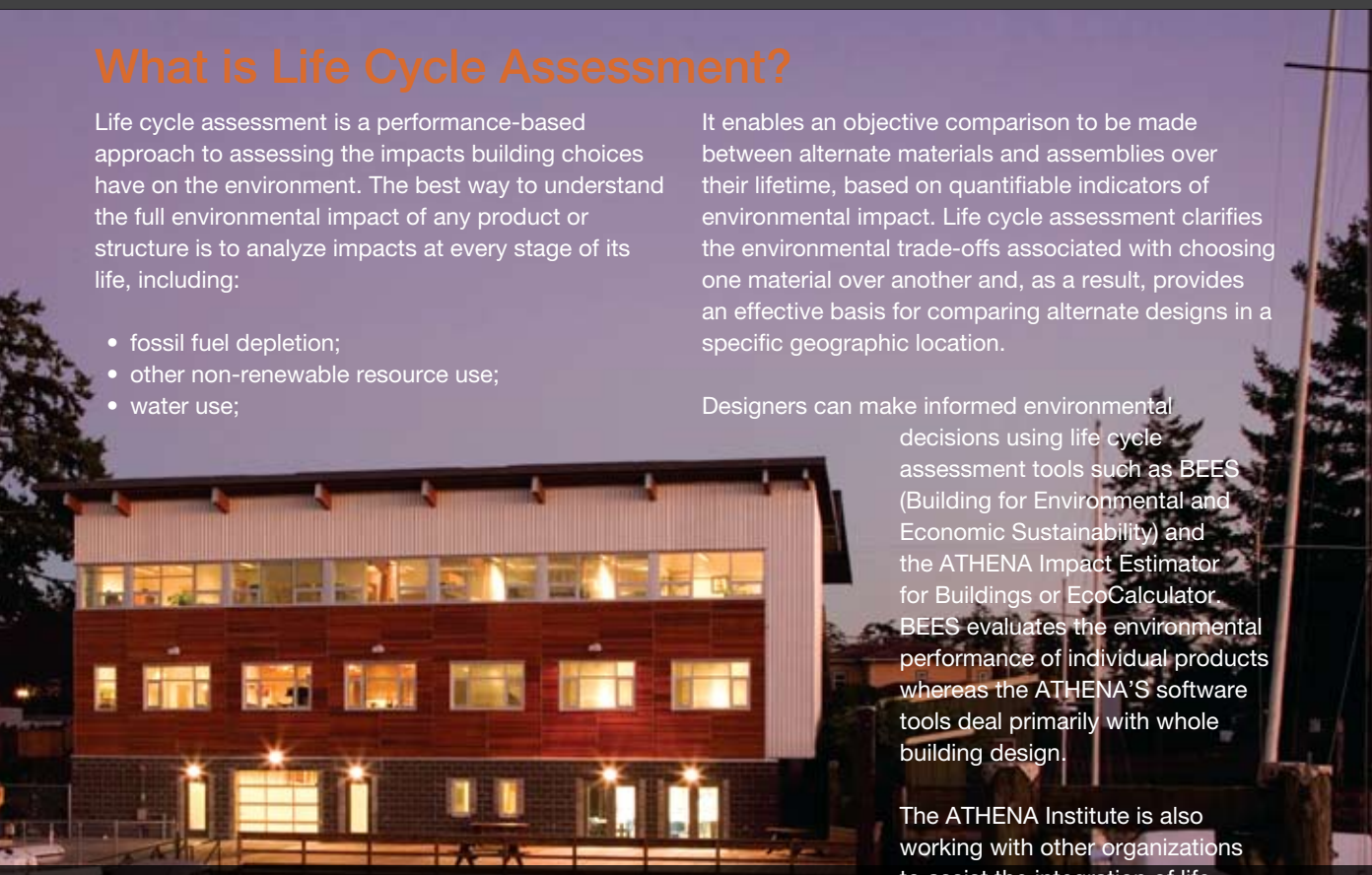
- fossil fuel depletion;
- other non-renewable resource use;
- water use;
- greenhouse gas emissions;
- stratospheric ozone depletion;
- ground level ozone (smog) creation;
- and toxic or other harmful releases to land and water.

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

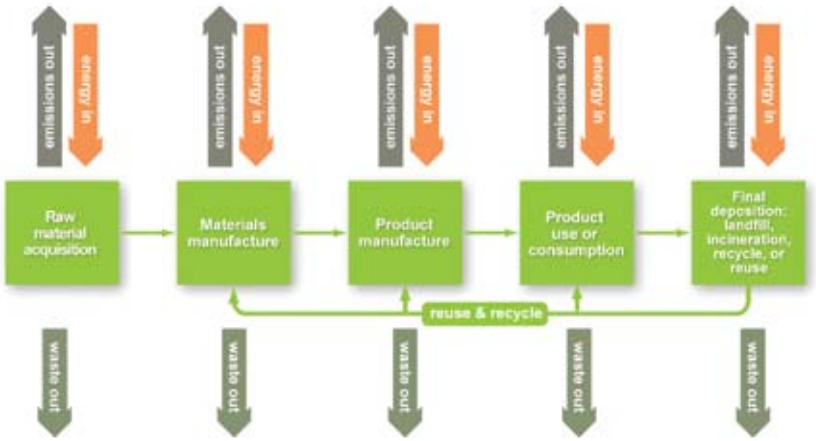
The ATHENA Institute is also working with other organizations to assist the integration of life cycle assessment methodology into third-party green building rating systems such as LEED (Leadership in Energy and Environmental Design) and Green Globes.



Gulf Islands Operation Centre, Sidney, British Columbia LEED Platinum 2006, Larry McFarland Architects

Life cycle assessment considers every input and output

This diagram illustrates the general concept of life cycle assessment, where all of the environmental inputs and outputs are measured at each stage of a product's life.



Life Cycle Assessment and Wood

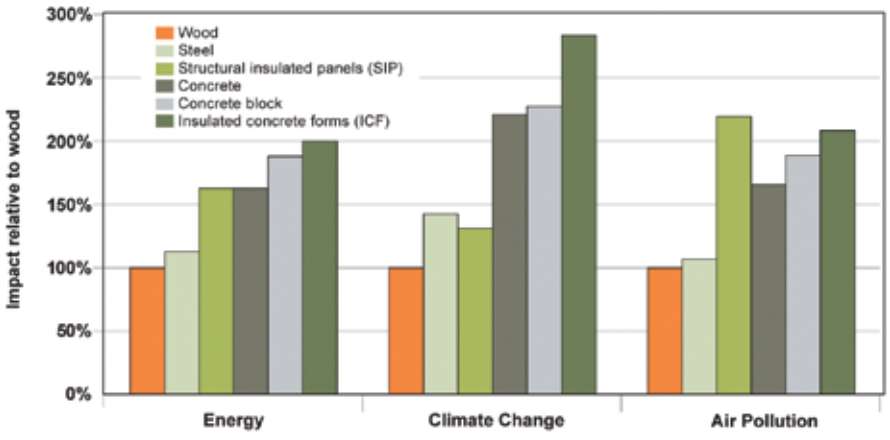
Numerous life cycle assessment studies worldwide have shown that wood products yield clear environmental advantages over other building materials at every stage. Wood buildings can offer lower greenhouse gas emissions, less air pollution, lower volumes of solid waste and less ecological resource use.

A recent comprehensive review of scientific literature looked at recent research done in Europe, North America and Australia pertaining to life cycle assessment of wood products.[1] It applied life cycle assessment criteria in accordance with ISO 14040-42, and concluded, among other things, that:

- Fossil fuel consumption, the potential contributions to the greenhouse effect and the quantities of solid waste tend to be minor for wood products compared to competing products.
- Wood products that have been installed and are used in an appropriate way tend to have a favourable environmental profile compared to functionally equivalent products out of other materials.

Similar results were achieved for whole buildings in a comparative study undertaken for the Canadian Wood Council by the ATHENA Institute. This study compared three hypothetical homes of identical size and configuration with structural systems of wood, steel and concrete (poured into insulated forms). The life cycle assessment was for a 20-year period, and concluded that, when compared with wood construction, steel and concrete embody and consume 12 per cent and 20 per cent more energy, emit 15 per cent and 29 per cent more greenhouse gases, release 10 per cent and 12 per cent more pollutants into the air, and generate 300 per cent and 225 per cent more water pollutants.

1 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.



Embodied environmental impacts of various exterior wall assemblies

Comparing Environmental Impact of Wood to other Building Assemblies

This graph compares a typical wood-frame exterior wall with five alternative building systems, in terms of environmental performance in three categories (energy consumption, climate change, greenhouse gas emissions, and air pollution). Source: Data compiled by Forintek using the ATHENA EcoCalculator with a data set for Vancouver, BC.

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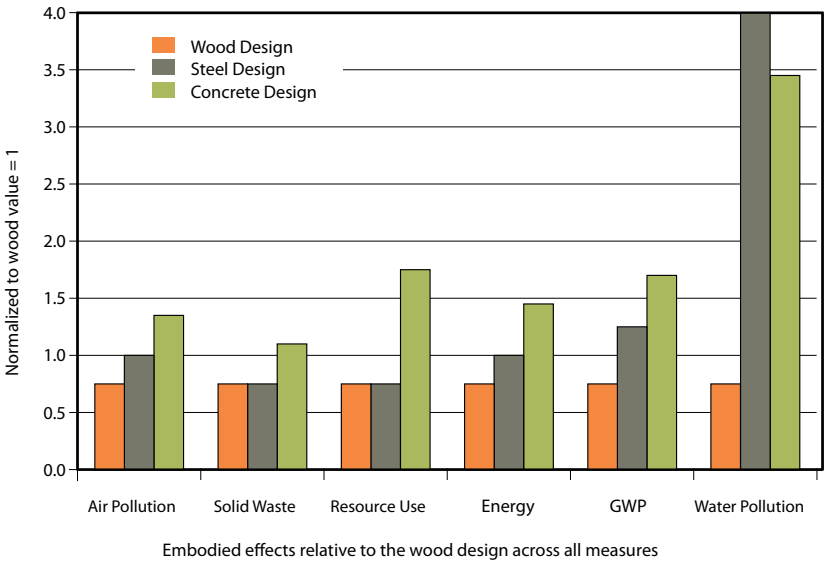
Green buildings

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



Embodied effects relative to the wood design across all measures

Comparing Environmental Impact of a Wood, Steel and Concrete Home

In this graph three hypothetical homes (wood, steel and concrete) of identical size and configuration are compared. Assessment results are summarized into six key measures covering total primary, weighted raw material use, greenhouse gas potential, measures of air and water pollution, and solid waste emissions during the first 20 years of operating these homes. Source: Data compiled by Canada Wood Council using the ATHENA EcoCalculator with a data set for Toronto, Ontario.