

Wood and Green Building



WOOD DESIGN & BUILDING SERIES

Whether you're designing a structure to achieve green building certification, adhere to new energy or climate change legislation, or simply set it apart as superior, wood can help to achieve your sustainability objectives.

Sustainability and the Built Environment

Much of the current activity related to green building is driven by the fact that buildings account for approximately 39 percent of total US energy consumption and contribute 38 percent of its carbon dioxide emissions. As such, there is a growing awareness that design and building professionals have an opportunity—and a responsibility—to help address climate change and other issues through sustainable construction.

In this context, wood has many attributes that make it an obvious choice. It grows naturally, using energy from the sun, and is the only major building material that's renewable, re-usable and sustainable. When considered over its life cycle, wood outperforms both steel and concrete in terms of embodied energy, air and water pollution, and other environmental impacts. It contributes to a building's energy efficiency and indoor air quality, and has an important role to play in the fight against climate change.

North American Forests: A Sustainable Resource

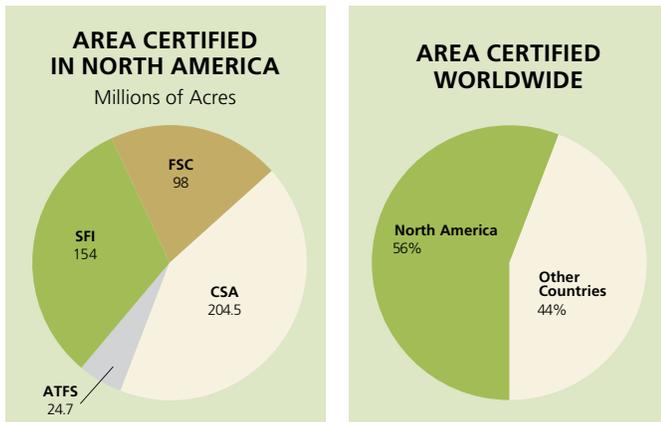
Some people are surprised to learn that North America has roughly the same amount of forested land now as it did 100 years ago,* and that illegal logging, which has a tremendous negative impact in tropical countries, is not an issue here. Over the past 50 years, less than 2 percent of the standing tree inventory in the United States was harvested each year, while net tree growth was 3 percent. In Canada, where most forests are publicly owned, less than 1/2 of 1 percent of the managed forest is harvested annually, and the law requires all areas to be promptly regenerated.

Wood is also the only building material that has third party-certification programs in place to verify that the products being sold have come from a sustainably managed resource. Sustainable forest certification is a voluntary tool that allows forest companies to demonstrate the sustainability of their practices by having them independently assessed against a standard that goes beyond regulatory requirements and takes into consideration environmental, economic and social values.

It's also an integral part of most green building rating systems. The Green Globes® system, for example, gives points for lumber and timber panel products certified through the Sustainable Forestry Initiative (SFI), Forest Stewardship Council (FSC), American Tree Farm System (ATFS), and Canadian Standards Association's Sustainable Forest Management Standard (CSA). The Leadership in Energy and Environmental Design (LEED®) system recognizes timber certified through FSC, though consideration is being given to including other systems.

Earn one AIA/CES LU (HSW/SD) by reading this document and taking a short online quiz. For details and learning objectives, visit the Online Training Library at woodworks.org. WoodWorks is an approved AIA provider.





Source: 2008 year-end data from www.pefc.org, www.fsc.org, www.fscscanada.org, www.certificationcanada.org, www.mtcc.com.my

Life Cycle Impacts

In terms of material selection, the last few years have seen a shift within the green building movement, away from a “prescriptive” approach—which assumes that certain prescribed practices, such as the use of locally produced materials or products with recycled content, are better for the environment—toward the scientific evaluation of actual performance.

Performance is measured through life cycle assessment, or LCA, which considers the environmental impact of materials, assemblies and even whole buildings, over the course of their entire lives—from extraction/harvesting through manufacturing, transportation, installation, use, maintenance and disposal or recycling. Widely recognized by the international scientific community, LCA takes into account a full range of impacts and is increasingly being integrated into green building rating systems.

Wood vs. Other Materials

Study after study has shown that wood outperforms other materials when considered over its lifetime using LCA.

One study conducted by the Canadian Wood Council compared the life cycle environmental impacts of 50,000 square foot office buildings constructed using wood, steel and concrete as the main structural materials. The results show that wood outperforms both materials in terms of energy use, greenhouse gases, air pollution, solid waste and ecological resource impacts (see graph below).

Numerous other studies conducted by independent LCA experts at the Consortium for Research on Renewable Industrial Materials (www.corrim.org) have reached the same conclusion: wood buildings offer clear environmental advantages.

Making LCA Accessible through User-friendly Tools

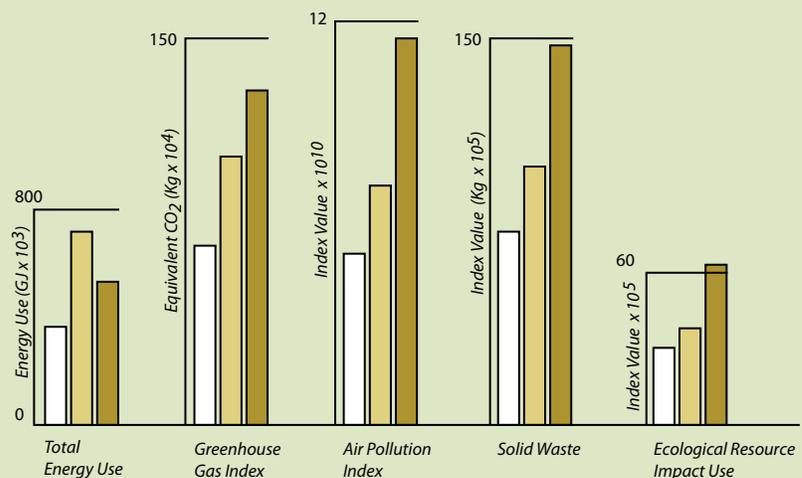
In the past, LCA has been considered too complex or time consuming for frequent use, but with the new ATHENA® *EcoCalculator for Assemblies*, that is no longer the case. *The EcoCalculator* provides instant LCA results for hundreds of common building assemblies, based on data generated by its more complex parent software, the ATHENA® *Impact Estimator for Buildings*. It is available free of charge from the Athena Institute (www.athenasmi.ca).

Athena software tools are especially useful early in the design process, when material choices have far-reaching implications for overall environmental impact. They allow designers to experiment with different material mixes to achieve the most effective combination.

A more product-oriented tool is the BEES® (Building for Environmental and Economic Sustainability) software, which combines environmental measures with economic indicators to provide a final rating. Particularly useful at the specification and procurement stage of a project, BEES 4.0 includes data on 230 products (including generic and manufacturer brands) such as siding and sheathing.

OFFICE BUILDING LIFE CYCLE COMPARISON CHART

Consistent with other LCA studies, a comparison of 50,000 square foot office buildings constructed out of wood, steel and concrete demonstrated that wood outperforms other materials when considered over its life cycle.



Source: Canadian Wood Council

Indoor Environmental Quality

The term biophilia, which a German psychologist introduced to describe the instinctive bond between humans and other living systems, helps to describe the contribution of wood to an indoor building environment. People feel an emotional response toward wood, which scientists are studying as part of a growing field called evidence-based design.

Increasingly cited as an influence in the construction of buildings such as schools and hospitals, evidence-based design studies the effects of building design—including material use as well as many other factors—on a variety of outcomes.

In Japan, for example, the Ministry of Education has an ongoing initiative to use wood structural materials and finishes in schools based on the belief that it has a positive impact on students. For similar reasons, the Thunder Bay Regional Health Center recently became the first hospital in Canada to gain approval for the use of wood as a primary structural element.



Blakeley Hall in Issaquah, WA was assessed using the Green Globes rating system and achieved two Green Globes.

ENERGY EFFICIENCY

Wood helps to minimize energy consumption in several ways. Life cycle assessment studies show that it has significantly less embodied energy than steel or concrete—which refers to the energy needed to extract, process, manufacture, transport and maintain a material or product.

Given that about a third of energy consumed in the developed world goes toward heating, cooling, lighting and the operation of appliances in non-industrial buildings, it makes sense that the central goal of sustainable design has been to reduce operational energy consumption. However, as buildings become more energy efficient, the significance of embodied energy will continue to increase.

Wood also contributes to energy efficiency because its cellular structure contains air pockets that limit its ability to conduct heat, which makes it a better insulator than other materials—400 times better than steel and 15 times better than concrete. Because of their higher conductivity, steel and concrete must overcome lower R-values associated with thermal bridging and require more insulation to meet the same level of energy efficiency. In some cases, energy codes also factor the cost of insulation into their requirements, which, because wood costs less to insulate, results in greater energy efficiency.

Wood and Emissions

In terms of indoor air quality (IAQ), the wood industry is sometimes asked about the release of formaldehyde gas from its products. While the answer is complex and deserving of more space than available here, the key points are as follows:

1. Formaldehyde is naturally occurring in people, animals and plants, and is also a byproduct of combustion. It is found naturally in all wood and is used in the manufacturing of many household and industrial products.
2. The issue of potential concern is related to adhesives containing urea formaldehyde, which are used for interior applications such as floor underlay, shelving and furniture. Emissions related to this type of formaldehyde have been reduced by 80-90 percent since the issue came to light in the 1980s and fall well under the limit determined as safe by the US Environmental Protection Agency. There are also many products available that do not use urea formaldehyde adhesives.
3. Most structural products use adhesives containing phenol formaldehyde, which are waterproof and highly durable for interior and exterior applications. Emissions are so low for these products that they easily meet or are exempt from regulation, including the US Department of Housing and Urban Development (HUD) regulations, the California Air Resources Board (CARB) Air Toxic Control Measure for Composite Wood Products, Japanese Agricultural Standards (JAS), and the EN 300 standard for European markets.

For more information, please visit the Composite Panel Association www.pbmdf.com or APA – The Engineered Wood Association, www.apawood.org/level_b.cfm?content=srv_env_form.

CONSERVING RESOURCES: THE FOUR Rs

For those interested in green building, the three Rs—*reduce*, *re-use* and *recycle*—represent a conservation mantra that together helps to ensure the responsible use of resources. However, a fourth R—renewal—is also an important part of the equation.

Reduce

Design and building professionals reduce waste through design optimization, using right-sized framing members, for example, or pre-manufactured and engineered components. The wood industry reduces waste in similar ways by optimizing sawmill operations and by using wood chips and sawdust to produce paper and composite products, or as fuel for clean bio-energy. North American wood producers use 98 percent of every tree harvested.

Re-use/Recycling

Wood offers excellent opportunities for re-use and recycling, whereas most concrete cannot be re-used, and re-using steel requires a significant amount of energy. Specifiers can increase recycling not only by using recovered wood, but by making it clear in their construction documents that clean job site waste should be separated and taken to a local recovery center.

Renewal

Wood is produced with the natural energy of the sun, and is endlessly renewable.

TACKLE CLIMATE CHANGE: USE WOOD

Although climate change is the subject of another WoodWorks information sheet, a discussion of green building is incomplete without taking into account the ability of both forests and wood products to reduce greenhouse gases in the atmosphere.

Most people know that growing forests help clean the air by absorbing carbon dioxide (CO₂) and releasing oxygen (O₂). The carbon is stored until the forest dies and starts to decay or is subject to wildfire, at which point it's released back into the atmosphere.

Lesser known is the fact that trees incorporate the absorbed carbon (C) into their wood, and products made from that wood, such as lumber and furniture, continue to store the carbon indefinitely. Because manufacturing processes associated with wood products require less energy, they are responsible for far less greenhouse gas emissions than materials such as steel or concrete. Forest and mill residues and other woody biomass can be used as fuel to produce clean bio-energy, replacing fossil fuels and further reducing emissions. And because forests are renewable and sustainable, forest management can help maximize the amount of carbon absorbed by growing forests and stored in wood products.

SUMMARY

Wood is a natural choice for green building. It's a renewable resource that's sustainable over the long term and has far less impact on the environment, from cradle to grave, than other building materials.

Neither the Wood Products Council nor its contractors make any warranty, expressed or implied, or assume any legal liability or responsibility for the use, application of and/or reference to the information included in this publication. Consult your local jurisdiction or design professional to assure compliance with code, construction and performance requirements.

ADDITIONAL SOURCES

American Wood Council/American Forest & Paper Association, www.awc.org

APA – The Engineered Wood Association, www.apawood.org

Canadian Wood Council, www.cwc.ca

Forestry Innovation Investment, www.naturallywood.com

FPIinnovations – Forintek Division, www.forintek.ca

Natural Resources Canada, <http://canadaforests.nrcan.gc.ca/?lang=en>

Southern Pine Council, www.southernpine.com

USDA Forest Service, <http://www.fs.fed.us/>

Western Wood Products Association, www2.wwpa.org

Life Cycle Assessment

The Athena Sustainable Materials Institute, www.athenasmi.ca

Consortium for Research on Renewable Industrial Materials, www.corrim.org

National Institute for Standards and Technology, www.bfrl.nist.gov/oa/software/bees/

Forest Sustainability

The State of America's Forests, Society of American Foresters

State of the World's Forests 2007, Food and Agriculture Organization of the United Nations

Photo credit (pg.1): Blue Ridge Parkway Destination Center, NC, designed by Lord, Aeck & Sargent Architecture. Photo: Jonathan Hillier © 2007.

