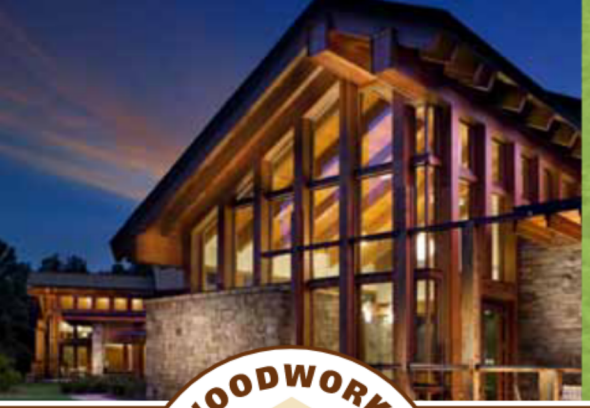

Wood and Carbon Footprint

WOOD DESIGN & BUILDING SERIES

Would you like to know how much carbon is stored in your wood building project? What about the greenhouse gas emissions avoided by not using steel or concrete? Or what these savings equate to in everyday terms such as vehicle emissions and home operational energy? If you'd like to calculate the carbon benefits of a U.S. non-residential or multi-family building project, email your request to resources@woodworks.org.

Given the impact of buildings on U.S. energy consumption and related emissions, design professionals are uniquely positioned to reduce greenhouse gases in the atmosphere by creating high-efficiency structures. However, in addition to operational energy efficiency, designing a building in wood can significantly lower its carbon footprint.

Forests and wood products reduce atmospheric levels of greenhouse gases in several ways:

- Most people know that trees clean the air by absorbing carbon dioxide (CO_2). They release the oxygen (O_2) and use the carbon (C) to produce sugars for growth, incorporating it into their leaves, twigs, solid woody stems and surrounding soil.
- Lesser known is the fact that wood products continue to store much of this carbon, which is kept out of the atmosphere for the lifetime of the product—even longer if the wood is reclaimed and used elsewhere. Wood is about 50 percent carbon by dry weight.
- Wood is produced using energy from the sun as opposed to fossil fuels. Manufacturing processes associated with wood products also require less fossil fuel-based energy and are responsible for far less greenhouse gas emissions than the manufacture of other major building materials.
- Forest and mill residues and other woody biomass are commonly used by the forest industry as a clean source of renewable bioenergy, further reducing emissions.

Increasingly, governments around the world are implementing policies that recognize these benefits and encourage greater use of both wood in buildings and renewable biomass to meet society's broader energy needs.

Supporting greater wood use, there is also a trend toward taller wood buildings that store even more carbon. In addition to the four, five and six-story podium designs that have become popular as a way to provide increased density at lower cost, a pending study[i] is expected to confirm the feasibility of a 20-story wood building in Vancouver, Canada. As of March 2011, the world's tallest modern wood building is a UK structure that includes eight stories of cross laminated timber over one story of concrete.

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.

The Role of Forests: Growth, Harvest and Renewal

Young, vigorously growing trees have a higher rate of CO_2 absorption than mature trees. Trees typically grow in what is described as a sigmoid curve, with growth rate being greatest in the early to middle years and dropping off as they reach maturity. In most U.S. and Canadian forests, this drop occurs when a tree is between 60 and 150 years old, depending on the species and environmental factors.

When a tree is harvested, about half the carbon stays in the forest and the rest is removed in the logs, which are then converted into forest products. Some carbon is released when the forest soil is disturbed during harvesting, and the roots, branches and leaves left behind release carbon as they decompose. However, once the harvested area is regenerated, either naturally or by planting or seeding, the forest once again begins to absorb and store carbon.

In the case of unmanaged forests, old trees will eventually stop capturing new carbon. They continue to store the carbon already absorbed until they start to decay—at which point they begin releasing the carbon in the form of CO_2.

THE CUMULATIVE EFFECT OF STORED CARBON

The amount of carbon currently stored in U.S. wood products (including those in landfill sites) is estimated at 3.5 billion metric tons—but it's the cumulative impact over time that is most impressive. The accumulation of carbon in U.S. wood products is about 60 million metric tons each year. Most of this resides in the nation's housing stock, 90 percent of which is wood-frame construction. Assuming that a greater number of homes and non-residential wood buildings are built each year than deconstructed, the amount of stored carbon can be expected to grow significantly.

Source: Carbon Storage in Wood and Wood Products, Dovetail Partners Inc.

The Carbon Benefits of Wood Buildings

When building designers choose wood, they are reducing the carbon footprint of the structure in two important ways. Wood is the only major building material that stores carbon, thus keeping it out of the atmosphere. And using wood instead of steel or concrete means less fossil fuel consumption—and, as a result, less greenhouse gas emissions.[ii]

Increasingly, architects and engineers are utilizing life cycle assessment (LCA) as an objective way to compare the environmental impacts of their material choices. Defined under ISO 14040/14044, LCA is a scientifically-based method of evaluating products, materials, assemblies and buildings, over the course of their entire lives, using quantifiable measures of environmental impact. LCA is rewarded to some extent in the Green Globes rating system and is part of the new American National Standard based on Green Globes, *ANSI/GBI 01-2010: Green Building Protocol for Commercial Buildings*. It is currently included as a pilot credit in the LEED system, and the state of California also recently included LCA as a voluntary measure in its 2010 draft *Green Building Standards Code*.

From a carbon footprint perspective, LCA studies show that wood buildings require less energy from resource extraction through manufacturing, distribution, use and end-of-life disposal, and are responsible for far less greenhouse gas emissions, air pollution and water pollution than buildings made from other materials.[iii]

Photo: Michael Arden - Arden Photography

Avalon Anaheim Stadium[iv]

Avalon Anaheim Stadium is a luxury apartment complex in California that includes five stories of wood-frame construction over a concrete "podium" deck. Developed by AvalonBay Communities, it includes 251 apartment units, 13,000 square feet of retail and restaurant space, and two levels of subterranean parking.

Volume of wood used:
183,600 cubic feet of lumber and sheathing

U.S. and Canadian forests grow this much wood in:
15 minutes

Carbon stored in the wood:
3,970 metric tons of CO_2

Avoided greenhouse gas emissions:
8,440 metric tons of CO_2

TOTAL POTENTIAL CARBON BENEFIT
12,410 metric tons of CO_2

EQUIVALENT TO:

Source: US EPA

2,369 cars off the road for a year

Energy to operate a home for 1,054 years