# Green Wood

## Building Green with Wood

*By Ken Bland, P.E.*

*Green building design and construction has become the mantra of the environmental and architectural community. The North American forest products industry strongly supports the integration of science-based green building criteria into mainstream practice. U.S. forests are plentiful and abundant with wood fiber. Manufacturers are innovatively making products stronger, lighter and more fiber efficient. Species that were discarded or disregarded a century ago are now a viable part of the fiber supply. Green building rating systems are evolving to the point where wood products have, or will soon be, recognized for their environmental attributes. Although not all green building rating systems treat wood products equally, there is an increasing recognition of the way wood products contribute to a building's environmental performance.*

### Today's Forests

The volume of fiber in the forests of the United States is greater today than any time in recent history:

- One-third, or 747 million acres, of the U.S. is covered in trees
- There are more trees today than 70 years ago
- About 4 million trees are planted daily
- Today, fiber growth exceeds loss by 47%.

The trend toward establishment of a sustainable fiber/wood resource can be largely attributed to the forest certification program known as the Sustainable Forestry Initiative®. In 1994, members of the American Forest & Paper Association agreed to abide by a set of forestry management principles. Today, those principles are maintained by an independent, non-profit organization known as the Sustainable Forestry Board and are contained in the *Sustainable Forestry Initiative Standard*.

#### Carbon Sequestration

Specifying wood products for building construction adds value to the product and encourages land owners to plant more trees and practice good forest management. When properly managed and harvested, trees remove carbon dioxide from the air. Through photosynthesis, this $CO_2$, a leading indicator of global warming, is converted to carbohydrates and water, providing the oxygen in the air we breathe as a byproduct. The carbon is sequestered in the fiber of trees. In turn, our wood buildings become large reservoirs of sequestered carbon, storing it indefinitely, and preventing it from being converted back to $CO_2$ and released into the environment.

#### Life Cycle Assessment

There is a readily available, science-based system that evaluates a building material's impact on the environment. Using Life Cycle Assessment (LCA), potential building systems can be studied to determine the environmental impacts of their harvesting or extraction, manufacturing, transportation, use, and eventual disposal. The resulting impact measures are derived from a "cradle to grave" analysis of the products' burden on the environment. Although LCA has been used in practice for many years, it is only beginning to evolve into a mainstream tool. The Athena Institute's *Environmental Impact Estimator* (EIE) is an example of a whole building life cycle assessment tool.

[ Lippke, Bruce et al. Forest Products Journal, June 2004, CORRIM: *Life Cycle Environmental Performance of Renewable Building Materials.* ]

An in-depth study by the Consortium for Research on Renewable Industrial Materials (CORRIM) used LCA to explore the environmental consequences of homes built in two cities. For their analysis, CORRIM chose Minneapolis/St. Paul, Minnesota to represent a heating climate and Atlanta, Georgia to represent a cooling climate. Two primary structural systems were selected for each city. The Minneapolis houses were assumed to be

constructed of lightweight wood frame in one instance and light gauge steel in the other. Five environmental impacts were examined. *Charts 1* and *2* illustrate the environmental benefits associated with using wood framing.

*Chart 1*

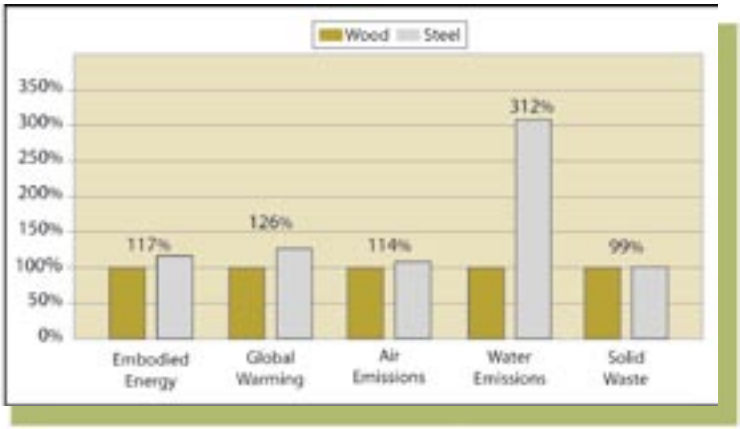
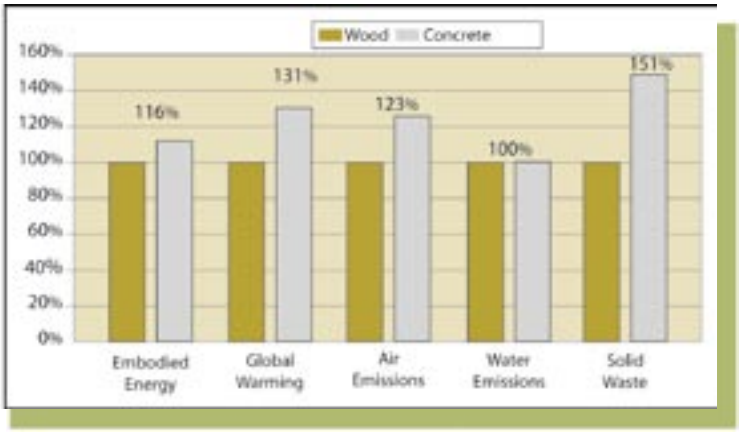



*Chart 2*




The two houses in Atlanta were modeled to be of lightweight wood frame and concrete construction respectively. In the LCA analysis comparing these two homes, the environmental indicators provided results shown in Chart 2. In both comparisons, the wood framed homes were superior performers when comparing these environmental burdens.

## Wood and Green Building Rating Systems

There are three nationally available green building rating systems in the US market, by independent non-profit organizations, and are widely available for use: two for commercial construction and one for residential. There are some state and local governments that have mandated, or are considering mandating, use of the various rating programs for certain construction.

The two national programs for commercial construction are:

- US Green Building Council – *Leadership in Energy and Environmental Design (LEED) for New Construction*® **www.usgbc.org**
- The Green Building Initiative™ – *Green Globes*® **www.thegbi.org**

For residential construction, there are a number of local programs run by various groups, but in most instances the program is administered by the local homebuilder association (HBA). For national application, the National Association of Homebuilders' Research Center (NAHBRC) has recently released the *Model Green Home Building Guidelines*. Development of the guidelines was sponsored by the National Association of Home Builders (NAHB) and serves as a model for any organization wanting to promote green buildings.

## Use of Wood in Various Rating Systems

Although all three national green building rating systems profess to advance the environmental performance of construction, how each addresses the use of wood differs somewhat.

### Use of wood in *Leadership in Energy and Environmental Design (LEED) – New Construction v2.1*

Resource Reuse: LEED Credit MR 3.1 provides one point if 5% of building materials comes from reused or salvaged building materials and products. MR3.2 awards an additional point for 10% salvage use. The USDA Forest Products Lab has developed a Directory of Wood-Framed Building Deconstruction and Reused Building Materials Companies (General Technical Report FPL–GTR–150), which is available from their website. It lists hundreds of companies engaged in deconstruction and selective dismantling of wood structures.

[**www.fpl.fs.fed.us**]

Local Manufacture: LEED Credit MR 5 provides credits for building materials that are manufactured locally, thus supporting the local economy and reducing environmental impacts related to transportation. One point is given if 20% of materials are manufactured within a radius of 500 miles, and a second point is given if 50% of those materials (that are manufactured within 500 miles) are made from materials harvested, extracted or recovered within 500 miles.

It is possible to source wood products that are manufactured within a 500 mile range. The most reliable source of information would be a building material supplier in the location where the building is being constructed. *(Note that reuse of materials, as discussed earlier, might be another way to earn this credit.)*

Rapidly Renewable Materials: LEED Credit MR 6 credit is given for use of rapidly renewable materials. One point is given if 5% of the total value of all building materials were manufactured from "rapidly renewable" sources. Rapidly renewable is defined as products that originate from plants that are harvested within a 10 year cycle

There is very little opportunity for traditional wood products to meet these criteria. Bamboo is often cited as a renewable resource that can be used to meet the rapidly renewable requirements of LEED.

Certified Materials: LEED Credit MR 7 grants credits only for use of Forest Stewardship Council (FSC) certified wood products.

Most domestic wood products are certified under the criteria of the aforementioned Sustainable Forestry Initiative program. Although FSC lumber can sometimes be obtained, it will add considerably to the cost of construction. A recent study by the General Services Administration (GSA) looked at the cost of achieving this credit for wood used in a San Francisco courthouse project. The Study indicated a marginal cost premium of just under $600,000 to supply one courthouse with FSC-certified wood. The FSC credit was the most costly LEED credit analyzed in the study. The higher cost is entirely associated with the premium for obtaining FSC certified wood products to the exclusion of wood products certified by other recognized and independent sustainable forestry programs.

[GSA LEED® Cost Study, Order No. P-00-02-CY-0065]

Low-Emitting Materials - Composite Wood: LEED EQ Credit 4.4 requires composite wood and agrifiber products to have no added urea-formaldehyde resins.

Innovation & Design - Life Cycle Assessment: LEED does not provide specific recognition for using LCA as an element of the material design and selection process. However, there are Innovation and Design credits available in LEED that make it possible to apply for credit where LCA is used and when deemed appropriate by USGBC.

### Use of Wood in Green Globes (GG)

Green Globes E1.1 Integration of Systems and Materials with Low Environmental Impact during Their Building Cycle: Credit (up to 40 points) is given for selection of materials that reflect the results of a "best run" life cycle assessment for the following: Foundation and floor assembly and materials, column and beam or post and beam combinations, and walls, roof assemblies, other envelope assembly material (cladding, windows, etc.).

GG evaluates energy used in manufacturing of materials through the concept of embodied energy. So, for example, the substitution of solid-sawn wood joists with engineered I-joists shows very little difference between the environmental performance indices, as the increased use of resins and energy offsets the greater material efficiency of the I-joists.

Green Globes E.2 Minimal Consumption of Resources: E2.1 allows up to 4 points for specifying used building materials and components. Refer to *FPL–GTR–150* (see LEED Credit MR 3.1) for a list of salvaged lumber providers.

E2.3 provides up to 4 points for specifying materials from renewable resources and/or locally manufactured materials that have been selected based on LCA. Wood products can take advantage of this credit, as they are manufactured from a renewable resource. This credit also recognizes the carbon sequestering potential of wood used in building construction. Unlike LEED, the second part of this credit recognizes the use of locally manufactured materials, only when it can be demonstrated through LCA that they offer an environmental benefit. This is implemented because otherwise it is quite possible to find a locally manufactured material that has poorer environmental performance than a material which is transported by rail over a further distance.

Per E2.5, up to 4 points are awarded for wood products that are harvested from a credible forest certification scheme. Credits are awarded for use of lumber and wood panel products originating from certified and sustainable forests, i.e. SFI, (Sustainable Forestry Initiative), FSC (Forest Stewardship Council), AFTS (American Tree Farm System) or the CSA International (Canadian Standards Association). Users are cautioned to avoid tropical hardwoods that have not been certified as coming from sustainable resources.

Green Globes E.6 - Reduction, Reuse and Recycling of Demolition Waste: Up to 5 points are awarded for diverting wood waste from landfills. As noted earlier, there are hundreds of companies engaged in reclaiming lumber for use in construction.

### Use of Wood in National Association of Homebuilders
*Model Green Home Building Guidelines*

As noted, the National Association of Homebuilders (NAHB) Guidelines were developed by the NAHB Research Center. A standards development process employing all the essential elements of nationally recognized consensus was followed, providing ample participation, time, and opportunity for public comments on the draft guidelines. The guidelines are available to local homebuilder associations (HBA) interested in further developing a local program.

With respect to the use of wood products in the *NAHB Guidelines*, aside from the use of certified wood and renewable resources, there are some unique credit areas.

For example, because jobsite waste of scrap lumber and wood structural panels is undesirable, establishing building dimensions that correspond to product sizes is recognized. Notably, building widths that are divisible by 4 feet, and building lengths that are divisible by 2 feet, are ideal for panel products.

Another example of optimizing the use and minimizing the waste of lumber is to pay careful attention to wall opening locations. According to the *NAHB Guidelines*, windows and doors sized or positioned to take advantage of 24" on-center framing are ideal.

In addition to a comprehensive Checklist, the *User's Guide* promises to be an outstanding resource for architects, engineers, and homebuilders interested in "greening" their designs.

## Conclusions

Green building rating systems are evolving. Not all green building rating systems recognize the significant environmental attributes of wood as a primary building material. However, science-based life cycle assessment readily demonstrates for typical single-family construction that wood products have less of an environmental footprint than competing materials. The North American forest products industry strongly supports the integration of science-based green building criteria into mainstream practice.▪

*Since 1993, Ken Bland, P.E. has been the Senior Director of Codes and Standards for the American Forest & Paper Association in Washington, D.C. He has 5 years experience in building code administration and enforcement. He is a member of the Society of Fire Protection Engineers, the International Code Council's Industry Advisory Committee, and serves on a number of National Fire Protection Association technical committees.*

## SFI vs. FSC

One highly visible debate in the green building movement is over certified wood. LEED's MR7 offers a credit for wood certified only under the Forest Stewardship Council (FSC). Green Globes E 2.5 gives credits for wood certified under any credible forest certification scheme, including FSC, the Sustainable Forestry Initiative® (SFI) program, the American Tree Farm System and Canadian Standards Association (CSA).

Recently, a number of independent studies have indicated that the SFI® program and FSC have virtually identical effects on on-the-ground forestry practices. Further, there have been several dual assessments – where the same North American forest is certified to both the SFI Standard as well as the FSC standard – which also show very little difference between the two programs.

Based on these studies, there is no scientific basis on which any green building program should give preference to one program over another. Any green building program, if its goal is to lessen a building's negative impact on the environment, should give credit to materials certified under any of the credible, science-based certification schemes, rather than giving preference to just one program.▪