## The Unseen Connection:

# Building Materials and Climate Change

### INCOMPLETE DATA SKEWS THE IMPACT OF ENVIRONMENTALLY FOCUSED BUILDING STANDARDS

You might expect "green" building standards to reduce greenhouse gas emissions or favor removing carbon from the air. But don't count on it.

No green building standard today adequately addresses the carbon stored in wood products or the value in substituting wood for fossil-fuel intensive materials.

*By Bruce Lippke, Ph.D.*

Before you buy breakfast cereal, you have a pretty good idea of what you're getting. The label on the Wheaties box gives you information about carbohydrates, saturated fats, calories, sodium and so on. You may not always choose the healthiest cereal, but that's up to you.

"Green" building standards should come with the kind of label breakfast foods do.

Environmentalists exploiting fears over global warming have thrust building standards aimed at "environmentally friendly" design and construction into the limelight. So, you might expect those standards to reduce greenhouse gas emissions. You might expect them to favor removing carbon – an element frequently linked to global warming – from the air.

But don't count on it. Instead, the few green building standards that exist today provide incomplete data and often reflect more about a sponsor organization's agenda than a true scientifically based environmental footprint. As a result, states and municipalities that adopt these standards get a skewed perspective of construction's impact and may inadvertently contribute to global warming.

That's where life-cycle inventories and assessment (LCI/LCA) comes in, or should.

### Seeing the bigger picture

LCI essentially measures all inputs and outputs for every stage of processing a building material from origin through construction, producing a comprehensive set of data. LCA aggregates the data into key environmental risk indices like global warming potential and water pollution.

By comparing building assemblies using different products and manufacturing processes, LCA makes clear the trade-offs between one building material and another. It measures the environmental effects of each material from forest management or extraction to product manufacturing, transportation, building use and final disposal or recycling.

Lacking sufficient information, some green building standards promote the use of non-renewable resources over renewable resources even when they consume much more fossil-fuel energy. An LCA shows that using steel and concrete results in more greenhouse gas emissions, more energy consumption, and greater water quality degradation than using wood.

### Measuring wood's performance

Recent work by the Consortium for Research on Renewable Industrial Materials (CORRIM) compared steel, concrete and wood in residential home construction. In Minneapolis, a wood frame house was compared to a steel frame house. In Atlanta, wood was compared to concrete. The study found that using steel in the above-grade wall generates 33 percent more greenhouse gas emissions than wood, and concrete 80 percent more.

In fact, wood outperformed steel in terms of greenhouse gases, energy use, air and water

emissions. The wood wall outperformed concrete in all measures except water pollution, which showed no difference.

A closer look at greenhouse gases reveals wood's unique advantages in addressing global climate change. Trees remove carbon from the air (first positive impact) and store it in long-lived wood products (second positive impact). Futhermore, wood is used to generate clean energy in biomass or cogeneration facilities (third positive impact). Already, the majority of energy used in wood processing is generated from wood residuals like bark.

Using wood products reduces the need to burn fossil fuels for concrete and steel products, which reduces the amount of carbon released into the atmosphere (fourth positive impact). Forests can also be regenerated, so while much of the carbon from a harvested forest remains sequestered in wood products, growing new trees takes more carbon out of the air (fifth positive impact).

In contrast, using steel or concrete depletes a non-replaceable resource and emits greenhouse gases.

Yet, there is an apparent anti-wood bias in some green building standards.

### Shortsighted analysis, long-term detriment

No green building standard today employs LCA, nor do they adequately address the carbon stored in wood products or the value in substituting wood for fossil-fuel intensive materials. Adopting LCA, now up for consideration, would require a dramatic overhaul of current rating systems.

Sustainable forest management leverages a renewable resource and reduces greenhouse gas emissions. CORRIM's research further shows that forest management can be adapted to maximize carbon sequestration. For example, intensive forest management that can grow more wood on shorter rotations rather than longer intervals between harvesting can sequester more total carbon over time. Frequently trapping carbon in wood products can capitalize on young trees' rapid growth to sequester carbon and more quickly create opportunities to replace the use of fossil fuel-intensive building materials like concrete or steel.

Ignoring the carbon stored in wood products and the impact of non-wood substitution can result in misleading building guidelines, flawed policies and unintended environmental consequences.

The core problem with green building standards today is insufficient or skewed data. They miss the mark on greenhouse gas emissions. LCA can address this problem.

It's like the cereal box label: you need to know what you're getting before you choose. When energy consumption labels were put on refrigerators, units with low efficiency were driven out of the market quickly. LCA offers the chance to make an informed decision when designing building components and selecting building designs.

*The complete CORRIM study is available online at: www.CORRIM.com*

## Understanding the Value of Wood

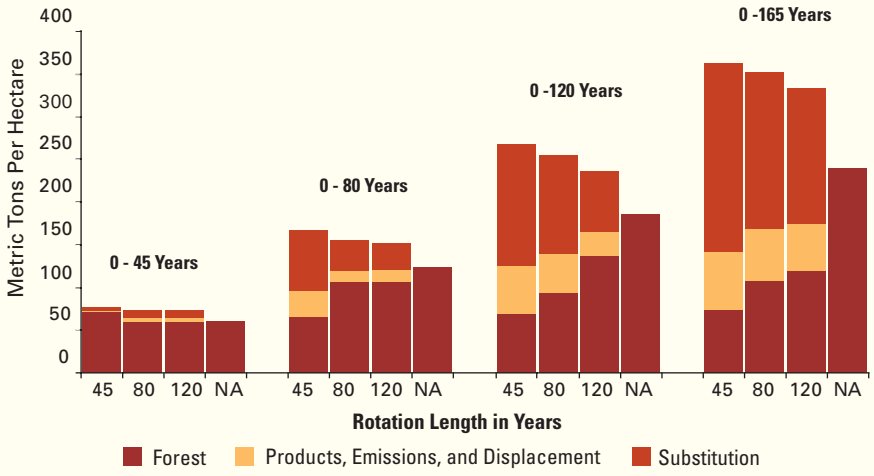
Environmental performance indices for above-grade wall designs.

| Minneapolis house | Wood frame | Steel frame | Difference | Steel vs. wood (% change) |
|---|---|---|---|---|
| Embodied energy (GJ) | 250 | 296 | 46 | 18% |
| Global warming potential ($CO_2$ kg) | 13,009 | 17,262 | 4,253 | 33% |
| Air emission index (index scale) | 3,820 | 4,222 | 402 | 11% |
| Water emission index (index scale) | 3 | 29 | 26 | 867% |
| Solid waste (total kg) | 3,496 | 3,181 | -315 | -9% |

| Atlanta house | Wood frame | Concrete frame | Difference | Concrete vs. wood (% change) |
|---|---|---|---|---|
| Embodied energy ( GJ) | 168 | 231 | 63 | 38% |
| Global warming potential ($CO_2$ kg) | 8,345 | 14,982 | 6,637 | 80% |
| Air emission index (index scale) | 2,313 | 3,373 | 1,060 | 46% |
| Water emission index (index scale) | 2 | 2 | 0 | 0% |
| Solid waste (total kg) | 2,325 | 6,152 | 3,827 | 164% |

## Shorter Rotations, More Carbon Sequestered

Average annual carbon in forest, product, and concrete substitution pools for different rotations and specified intervals.




Shorter harvest intervals can increase the total amount of carbon sequestered by increasing the carbon stored in wood product pools and displacing carbon emissions by substituting wood products for other building materials sooner.

Source: CORRIM, 2004