Embodied Energy of WOOD Products

BACKGROUND

Currently, about one-third of energy usage in the developed world goes towards heating, cooling, lighting and the operation of appliances in non-industrial buildings; so it is reasonable that the central goal of sustainable design is to minimize the energy required to heat, cool and illuminate buildings.

But what about the amount of embodied energy in the building and the impact this has on the environment? The issue of energy consumption is so central that other sustainability issues, such as embodied energy, are almost overlooked.

Simply put, every material used in construction has embodied energy. This is the sum of the energy required to extract, harvest, process, manufacture, transport, construct and maintain the materials/products used in building applications. This "embodied" energy, though less significant in quantity than the amount of energy consumed by ongoing building operations, nevertheless impacts upon the environment and should play an important role in environmental assessment.

ISSUE

The primary emphasis in sustainable building programs is always on reduction of operating energy. While this is certainly important, it is essential not to lose sight of impacts from other key factors.

Understanding how the embodied energy of materials, products and systems impact on the environment will lead to a more balanced approach to sustainable design, particularly as building designs become more energy-efficient and the relative impact of embodied energy becomes more important in meeting sustainability objectives.

WHAT YOU NEED TO KNOW

Wood's cellular structure acts as a natural insulator by trapping air within its cell walls. The low conductivity and good insulating properties of wood make it the material of choice when building to meet sustainable design goals. Steel conducts heat 400 times faster than wood. High conductivity causes thermal bridging (heat transfer between indoor and outdoor environments) leading to increased energy use for heating and cooling. Because steel and concrete must overcome lower R-values due to thermal bridging, they require additional insulation to match the insulating properties of wood.

Wood is also low in embodied energy and the use of wood products creates less water and air pollution. In 2004, the Canadian Wood Council launched a Sustainable Building Series. In the first publication, *Energy and the Environment in Residential Construction*, the operating and embodied energy assessment results, based on life cycle assessment, were summarized into six key measures:

Figure 1: Air Pollution

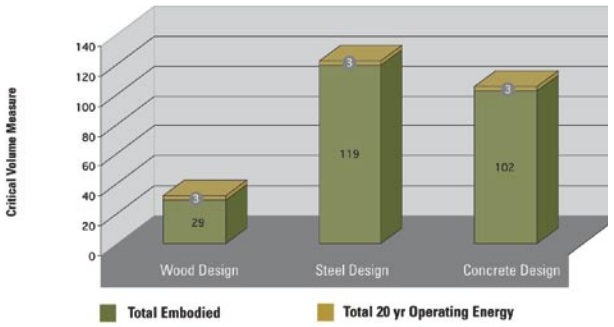

Figure 2: Water Pollution

primary energy, greenhouse gas emissions, air pollution, water pollution, solid waste production and resource use.

In each measurement, the wood structure performed better than the steel and concrete designs.

When the total embodied impact of each design was calculated, the analysis revealed some telling statistics. The steel and concrete designs embody 26% and 57% more energy relative to the wood design, emit 34% and 81% more greenhouse gases, release 24% and 47% more pollutants into the air, discharge 400% and 350% more water pollution, produce 8% and 23% more solid waste, and use 11% and 81% more resources (from a weighted resource use perspective).

FOR MORE INFORMATION

Visit the Canadian Wood Council's web site at www.cwc.ca to obtain a copy of *Energy and the Environment in Residential Construction*.