

## **Environmentally Friendly Homes By Adam Downing, Virginia Cooperative Extension**

If the three little pigs were environmentally conscious and building houses today, what materials would they choose to build with? What constitutes an environmentally friendly home that will stand the test of time? Some would say it is a home designed to use natural systems such as sun in the winter and shade in the summer or perhaps even geothermal energy, to limit reliance on electricity and fossil fuels. Indeed, these and other factors such as energy-efficient appliances are part of a design that limits a home's impact on the environment. But, builders of truly environmentally friendly homes need also consider what the structure is made of. What's holding it all together?

Home building materials used today fall into roughly three categories: wood, concrete, and steel. Each of these has certain benefits, drawbacks, and environmental costs. Consideration must be given to what it takes to produce a load of 2x4's, concrete, or steel framing and deliver it to a building site. Where do these raw materials come from? What is their availability? What does it take to extract and process them to make usable building materials?

Wood, concrete, and steel are end products, processed from various natural resources. Wood, of course, comes from trees. Concrete is a mixture of sand, gravel, and cement (made of burned lime and clay). Like concrete, steel also comes primarily from below the earth with the mining of iron ore that is alloyed with other materials to achieve certain properties. While each of these materials is extracted and processed differently, the environmental friendliness of each can be measured by keeping track of the total energy inputs for the product, from cradle to grave.



***Homes built with wood, a renewable natural resource, are  
40% more energy- efficient to produce than steel homes  
Photo by: Adam Downing, VCE.***

The amount of energy required is a quantifiable tool to measure environmental impact.

One study was conducted in a part of the world where a typical house has a steel frame, corrugated iron roof, a concrete floor, brick veneer wall cladding, and aluminum window frames. The fraction of this house in steel is only 6% by weight but consumes up to 31% of the total energy! A house such as this requires approximately 525 units of energy measured in billions of joules (GJ). A typical concrete house ranks second, totaling almost 400 GJ. The concrete in this type of house accounts for approximately 26% of the total energy consumed.

The energy used to produce the wood used in a typical wood house totals less than 20% of the total energy required for the materials in that house. Overall, a wood house requires just over 300GJ to produce. This is greater than 10% savings in total energy in production when compared to a concrete house and savings of almost 40% when compared to a steel house! This means that wood is the most environmentally friendly building material considering how much energy it takes to obtain and process various materials.

Not only does wood require the least amount of energy to process, but it also comes from a natural resource that is renewable. As mentioned earlier, all three products originate from natural resources. Natural resources fall into one of two broad categories, renewable and non-renewable. Renewable resources, as the name suggests, are renewable. That is, within a reasonable time frame (a generation or two), the resources we harvest can be replenished. The best example of a renewable natural resource is a forest. On the other hand, non-renewable natural resources cannot be replenished within a reasonable time frame. Materials such as iron and concrete are examples of products that come from primarily non-renewable resources. When sand and gravel are mined from an area, they will only be replenished by natural systems over thousands and millions of years. The same is true for iron ore, the primary ingredient in steel.

Trees, as natural resources, grow very fast. Trees can be harvested for use in our homes and offices and more trees will grow during our lifetimes. With a little bit of management, we can even encourage faster and better growth. Depending on the type of trees, a new stand ready for harvest can grow from the ground up in as little as 15 years to as great as 100+ years. Even at this upper end, wood is a very renewable resource!

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Wood, concrete, and steel are all acceptable building materials in terms of strength and durability. But, they are not created equal in terms of the impact to the environment. If the environmentally conscious three little pigs were building houses today, what material do you think they WOOD choose?

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The data regarding different building material was taken from the following source: Glover, J., D. White, and T. Langrish. 2002. Wood versus Concrete and Steel in House Construction: A Life Cycle Assessment. *Journal of Forestry*. 100(8):34-41.