Comparing Wood For Energy

by Terry Conners

Energy can be produced from woody biomass in various ways, and wood-fueled power plants can be a renewable alternative to many current power facilities that are using fossil (or nuclear) fuels. Woody biomass can also be used to produce heat and power at facilities such as hospitals and schools. After hydroelectric power, biomass has been the largest non-hydro renewable energy source for electricity in the United States, and as technology improves, biomass will likely become an even more attractive alternative to fossil fuels. There are issues with collecting sufficient supplies and collection in many areas, but woody biomass ultimately might become a source of local revenue for both landowners and small power companies.

Supplies of Fossil Fuels and Wood for Fuel

Kentucky is blessed with an abundance of coal, but 58% of our daily needs for oil and refined petroleum products were imported in 2007. Energy independence has been a popular topic in this election year, and it surprised me to learn that almost 50% of U.S. crude oil and petroleum products imports came from the Western Hemisphere (18% from Canada alone) during 2006 (see Figure 1). We imported only 16% of our crude oil and petroleum products from the Persian Gulf, but as we've recently learned, even slight disruptions in global supplies can affect availability and prices in the U.S.

Facilities that use renewable sources of energy can promote energy independence and provide a supply of energy that isn't subject to international situations. Biomass can be collected from any location that supports agricultural or silvicultural production, so biomass power facilities can be located almost anywhere in the country. Kentucky is potentially a good location for a biomass power plant because of its acreage of timberland.

Most wood "residue" from manufacturing operations already has a buyer (for horse bedding, for example), and there isn't enough unused waste wood from used pallets and so forth to generate a significant part of our energy needs. More wood would have to be collected from forest operations to make energy generation from wood practical. Equally important, any power generating station that wants to use wood will require a guaranteed supply for a sustained period of time.

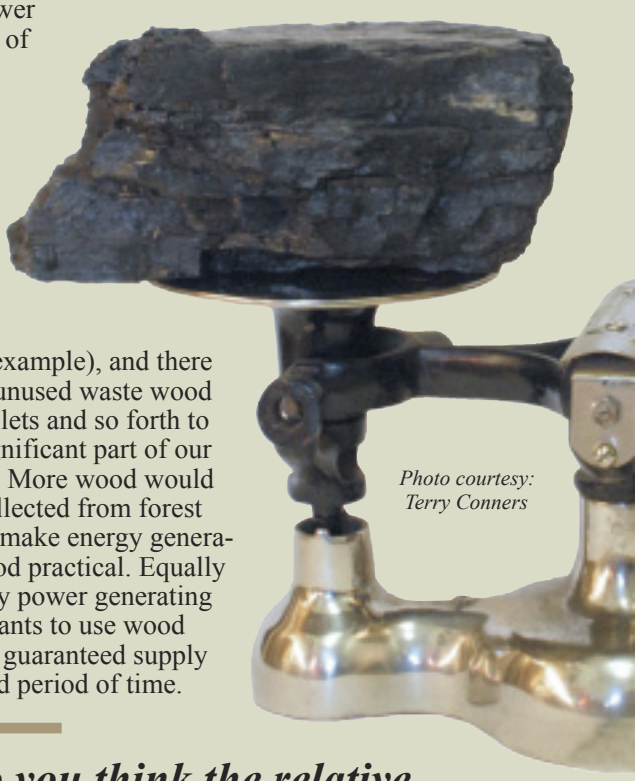


Photo courtesy: Terry Conners

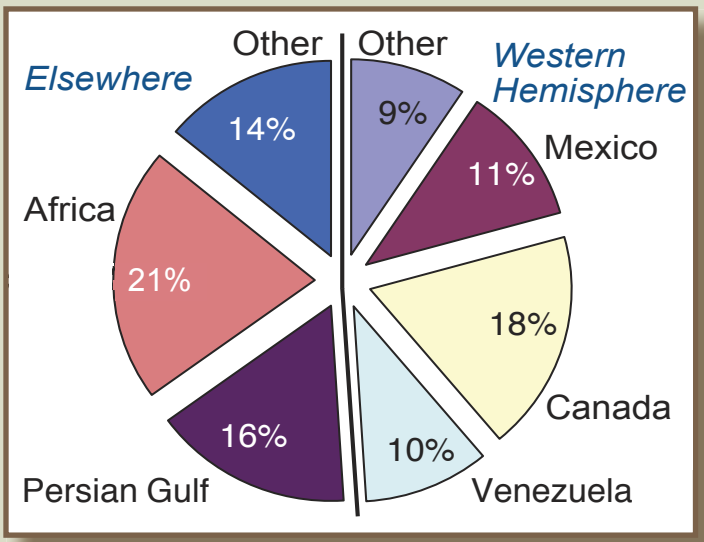


Figure 1: Import source of U.S. crude oil and petroleum products during 2006. *Data from EIA's Energy in Brief: How dependent are we on foreign oil? Accessed 11/08*

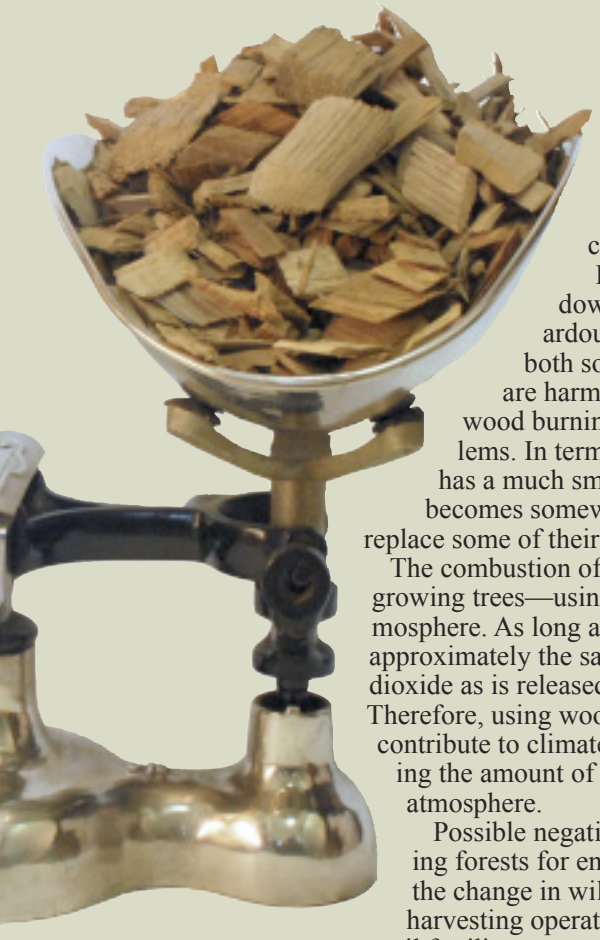
What do you think the relative importance of wood energy and coal should be in Kentucky?

This would be difficult to provide in a state such as Kentucky with few large landowners, so potential power stations using biomass would likely have to contract with a mix of landowners, municipalities, tree service companies, etc. to assure a large enough supply.

Gas and Particle Emissions from Burning Wood and Fossil Fuels

The kind of emissions from wood-fueled power generation will vary, depending on whether softwoods (like pine) or hardwoods (like oaks or maples) are used. As anyone who has ever touched a bleeding wound on a pine tree knows, pines contain a sticky resin. Pine resin resembles maple syrup, in that it contains a solvent and some soluble compounds that harden in air as the liquid evaporates; instead of water and maple sugar, though, wood resin is made up of turpentine and rosin – when the tur-

and Fossil Fuels Production



pentine evaporates from the bleeding wound, the rosin is left behind to act as a stopper for the sap. Turpentine is a volatile organic compound (VOC), and if it is released into the air because of poor combustion controls, it can combine with other compounds in the air to form ozone. Evaporation of turpentine from forests is spread out, and ozone formation is usually not a significant problem; turpentine released from a power plant is a point source, however, so local ozone concentrations can be higher if emissions are uncontrolled.

Hardwoods don't contain turpentine, but they do contain chemicals that break down when the wood is dried. Some of the resulting chemicals are classified as hazardous air pollutants (HAPs) by the EPA (for example, formaldehyde). Additionally, both softwood and hardwood burning will result in the creation of small particles that are harmful to our health. Gas and particulate emissions like these HAPs aren't unique to wood burning, and pollution control equipment is available to handle these potential problems. In terms of the amount of greenhouse gases produced by different fuels, however, wood has a much smaller impact than other fuels (see Figure 2), and pollution control equipment becomes somewhat less expensive. This is one of the reasons why some power plants choose to replace some of their coal fuel with wood ("co-firing").

The combustion of wood releases carbon dioxide into the atmosphere, but through the cycle of growing trees—using the wood—replanting more trees, the carbon dioxide is recycled from the atmosphere. As long as trees are replaced at the same rate they are harvested and used, they take in approximately the same amount of carbon dioxide as is released during combustion. Therefore, using wood for energy does not contribute to climate change by increasing the amount of carbon dioxide to the atmosphere.

Possible negative effects of managing forests for energy production are the change in wildlife habitat from harvesting operations and decreases in soil fertility over a prolonged period of time (most of the mineral nutrients are left behind when tree stems are harvested). These effects can be addressed with proper forest management.

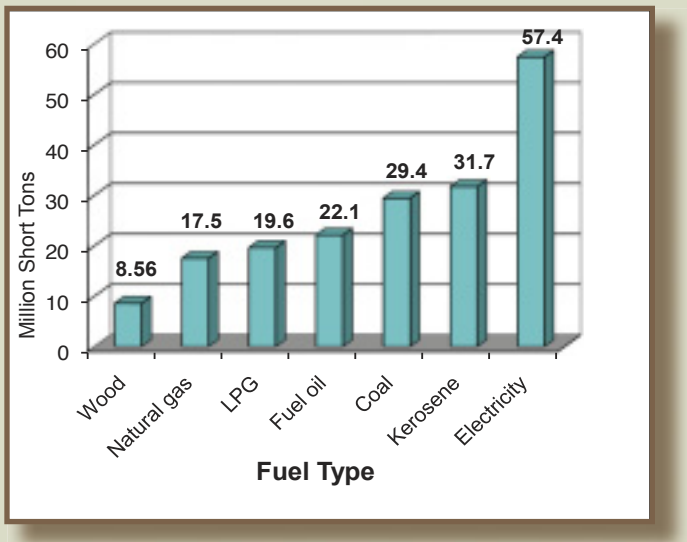


Figure 2: Carbon equivalents of greenhouse gases per quad of heat delivered. (A quad is equal to 1,015 BTUs.) *Redrawn from data contained in: Air Emissions from Residential Heating: The Wood Heating Option Put into Environmental Perspective. J.E. Houck, P. E. Tiegs, R.C. McCrillis, C. Keithley and J. Crouch. In The Proceedings of a U.S. EPA and Air Waste Management Association Conference: Emission Inventory: Living in a Global Environment, v. 1, pp. 373–384, 1998.*

Summary

Both wood and fossil fuels offer certain advantages as fuels for energy production. Fossil fuels can be used with familiar technology, but woody biomass appears to be a more environmentally sound option. While wood may not be a feasible or sensible energy option for every community, it can support efforts to promote more sustainable and locally-generated sources of energy.

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About the Author:

Terry Conners, Ph.D. *is an associate extension professor at the University of Kentucky Department of Forestry and has experience working with the pulp, paper, and wood industries as well as youth education. Current interests include assisting the Kentucky forest industry, youth education, and assisting homeowners with wood identification and wood related problems.*

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