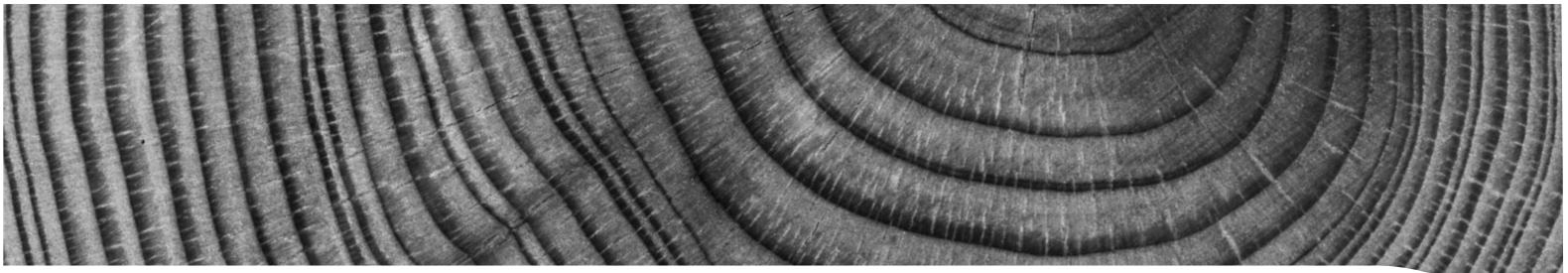


Handout 1 Electricity Production: Comparing Wood and Fossil Fuel Feedstocks

Woody biomass is a substantial renewable resource that can be used as a fuel to produce energy. This wood can come from a wide variety of sources, including land clearing for development, silvicultural activities (managing forests for timber production), urban tree and landscaping debris, and waste wood (bark, sawdust, wood chips, and wood scrap) (U.S. DOE, 2006a).

Energy can be produced from woody biomass in various ways. Wood-fueled power plants are capable of producing significant amounts of electricity and can be cleaner, renewable alternatives to many current power facilities that currently use fossil fuels (Northeast Sustainable Energy Association, 2001). In addition, woody biomass can be used to produce heat and power at facilities, such as hospitals and schools. Biomass has been the largest nonhydro renewable energy source for electricity in the United States since 2000 and offers some promising incentives for continued development and research of its use (Energy Information Administration, 2006). As technology improves, biomass is becoming a more attractive alternative to fossil fuels because it produces fewer emissions, contributes to local economies, mitigates global climate change, and can increase national security.

Cost

Cost is an important factor to consider when comparing fuel sources. Table 1 shows a comparison of the price of fuels measured in British thermal units (Btu). Depending on the type and proximity of the source and local supply and demand conditions, wood prices can be competitive with most fossil fuels.

The cost of using wood to generate energy can vary significantly depending on the technology used, the size of the facility, the wood transportation distance, and the cost of wood (Power Scorecard, 2007). For instance, if a wood-fueled facility is situated near the source of wood, fuel transportation costs will be lower, making the final fuel cost lower. Currently, the most inexpensive method of using woody biomass is co-firing, which involves burning two or more types of fuel together, such as coal and wood. Modifying an existing coal power plant to use wood is much less expensive than building a new, exclusively wood-fueled facility. The addition of wood and reduction of coal reduces overall air emissions and cuts down on emission control costs (Power Scorecard, 2007).

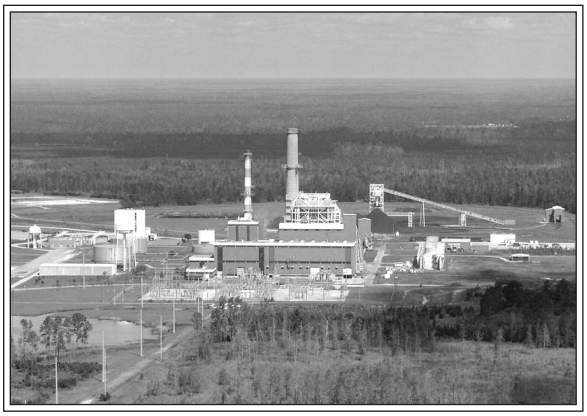
While coal has historically been significantly cheaper than wood, the price of coal has nearly tripled since November 2007 (Energy Information Administration, 2008). The full cost of coal is not included in the figures in Table 1. Because coal produces numerous toxic air emissions such as carbon dioxide, sulfur dioxide, nitrogen oxides, and carbon monoxide, which contribute to climate change, acid rain, water pollution, and health risks, its use comes with significant environmental and social costs that are not reflected in the price alone (U.S. EPA, 2007b). Communities may want to consider such indirect costs when deciding how to meet future energy needs (Figure 1).

Table 1: *Approximate Price of Residential Heating Fuels in 2008* (Energy Information Administration 2008a).

Fuel Type	Dollars per million Btu
Oil (residential)	$22.42
Wood*	$9.09
Natural Gas	$12.40
Coal	$8.03

*The price of wood for fuel can vary depending on several factors, including the type of tree species. Energy Information Administration 2008a.

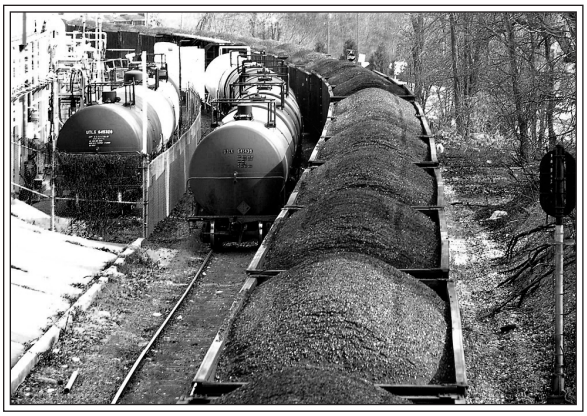
Figure 1: *Fossil fuels, such as coal, may have non-economic costs associated with them.* Photo by Larry Korhnak, University of Florida.



Environmental Impacts

Coal accounts for more than 57 percent of electrical generation in the United States. It is a popular fuel because of its abundance and low cost. However, the type of coal that has been used traditionally is also responsible for 93 percent of sulfur dioxide, 80 percent of nitrogen oxide, and 73 percent of carbon dioxide emissions that come from the electricity industry. Proper emission controls and new technologies can reduce the environmental impacts of using coal; yet, even with these improvements, emissions from burning coal can contribute to acid rain, urban smog, health problems, water pollution, and global climate change. Coal plants can also contaminate air and water with mercury, a toxin linked to a variety of neurological disorders. The environment is also impacted by the mining, processing, and transporting of coal (Figure 2). Surface mining heavily disturbs the land and contaminates the soils with heavy metals, threatening nearby water quality (U.S. DOE, 2006b). In some cases, coal is obtained through mountaintop removal using explosives. This practice may detract from the safety, aesthetics, and quality of life for local communities (U.S. EPA, 2007a).

Figure 2: *The mining, processing, and transporting of coal can negatively impact the environment.* Photo by Larry Korhnak, University of Florida.



Natural gas creates fewer environmental impacts than coal, producing about half the amount of carbon dioxide, less particulate matter and nitrogen oxides, and negligible amounts of sulfur dioxide or mercury emissions. However, natural gas produces methane, a greenhouse gas that is twenty times more effective than carbon dioxide at trapping heat in the atmosphere, thereby contributing to climate change. Other environmental impacts associated with the drilling and natural gas explorations are erosion, landslides, and flooding (U.S. DOE, 2006b).

Biomass emissions can vary depending on the type of wood and technology that is used. If wood is the primary source for energy generation, very little sulfur dioxide is emitted. Nitrogen oxide and carbon monoxide are produced; however, emission levels of these vary greatly depending on the combustion facilities. The combustion of wood releases carbon dioxide into the atmosphere, but through the cycle of growing trees, using the wood, and replanting more trees, the carbon dioxide is recycled from the atmosphere. As long as trees are replanted 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 adding more carbon dioxide to the atmosphere. Using wood as a fuel source can also help reduce release of methane by diverting waste wood from landfills.

Possible negative effects of managing forests for energy production are the change in wildlife habitat from periodic harvests and the decreased soil quality requiring the use of fertilizers (U.S. DOE, 2006b).

These effects can be addressed with proper forest management. For example, in order to ensure sustainable forest management, some communities have hired professional foresters to monitor the operations that provide wood for a wood-fueled facility. In many cases, the use of wood for energy can provide the economic basis for maintaining land in forests. If landowners cannot afford to maintain forestlands, they are frequently sold for housing developments and the many benefits of forestlands are lost forever.

Jobs

The current lack of employment opportunities in the rural United States is putting a burden on local economies, infrastructure, and the tax base. Using wood for energy can provide important economic benefits, such as local job creation, strengthening of forestry markets, and reduction of the national trade deficit (when the value of what we import is greater than the value of what we export) (Energy Information Administration, 2007b). Through construction, operation, maintenance, and support for bioenergy facilities, rural communities have the opportunity for more domestic jobs and increased local economic activity.

A study by the Renewable Energy Policy Project shows that co-firing biomass in existing coal facilities tends to offer more employment than coal-only operations. Furthermore, coal mining jobs are decreasing as the industry becomes more automated (U.S. DOE, 2005).

According to the National Renewable Energy Laboratory, by 2020, more than 30,000 megawatts of biomass power could be used nationwide. Approximately 60 percent of the fuel would come from energy crops and 40 percent would be supplied from woody biomass. This increase in biomass facilities could support more than 150,000 U.S. jobs that could contribute to the revitalization of rural economies (Singh and Fehrs, 2001).

National Security

Fossil fuel energy sources are nonrenewable and may not ensure a secure energy future for the United States. More than half of our daily needs of oil and petroleum products are imported each day. Increasing demand and dependency on foreign energy sources could affect the nation's economy by contributing substantially to the trade deficit. Furthermore, national security could be affected because most of the oil imported to the United States comes from politically unstable regions.

Facilities that use renewable sources of energy (e.g., biomass power plants) are typically small and geographically dispersed. They promote energy independence and provide an infrastructure that is not easily disrupted. Biomass resources can be derived from any location that can support agricultural or silvicultural production. Thus, biomass resources and facilities can be located almost anywhere in the country, broadening our resource availability and increasing energy security (National Renewable Energy Laboratory, 2000).

Summary and Conclusion

Both wood and fossil fuels offer certain advantages as fuels for energy production. While some fossil fuels under certain circumstances may be less expensive and utilize traditional and familiar practices, wood tends to be a more environmentally sound option. In addition, using wood can help foster national security, introduce new markets for forestry, and create local jobs. Because there is not enough wood to provide all of our energy needs, we need to look at a variety of sources and continued use of fossil fuels in the near future. While wood may not be a feasible or sensible option for every community, it may help support efforts to promote more sustainable and locally generated sources of energy. In deciding how to meet growing energy demands, each community will need to carefully evaluate the advantages and disadvantages of a variety of energy options.

This handout was adapted from the following source and used with permission.

Monroe, M. C., L. W. McDonell, and A. Oxarart. 2007. Wood to energy outreach program: Biomass ambassador guide. Gainesville, FL: Florida Cooperative Extension Service, Circa 1526, University of Florida.

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