Handout 2 Woody Biomass Basics

In 2006, 7 percent of the energy consumed in the United States came from renewable resources. Roughly half of that amount, 3 percent total, was producing using some form of biomass (U.S. EIA, 2008). Biomass is organic plant or animal material that is available on a renewable basis (U.S. EIA, 2008). Biomass energy resources include food crops, grassy and woody plants, agricultural and forestry residues, municipal and industrial solid wastes, and landfill gas (NREL, 2008). These resources are renewable because, although individual trees and plants are consumed, additional trees and plants can be cultivated and grown relatively quickly, and municipal and industrial solid wastes are continually produced.

Plants grow by harnessing the sun's energy through photosynthesis. During photosynthesis, plants use the sunlight, carbon dioxide, and water to produce oxygen and glucose. The glucose (or sugar) is a form of chemical energy that is stored in the cells of plants or trees (U.S. EIA, 2008). This energy is released when the plants are eaten, decomposed, or burned. Whether burned or converted through a chemical process, biomass fuels release energy that can be used to produce heat, power, electricity, and transportation fuels.

Woody Biomass

Woody biomass is plant material from trees and shrubs that can include roots, bark, leaves, branches, limbs, trunks, and vines. Woody biomass can come from many sources, including forestry operation residues, wood product residues, urban waste wood, trees grown specifically for energy, fuelwood, and forest thinnings that reduce damage from fires and pests.

Forest Operation Residues Residues are branches, tree tops, stumps, and other woody debris left behind after trees are harvested for timber. Removing and selling these residues for energy production can provide landowners with additional income and improve forest health by reducing susceptibility to wildfire, insects, and disease.

Figure 1: *Forest operation residues.* Photo courtesy of Diomy Zamora, University of Minnesota.

Wood Products Residues Sawdust, scraps, and other wood waste from industries that make products from wood, such as cabinet and furniture companies, can also be used to produce energy. Many wood product facilities use their own wood waste to produce heat, steam, or electricity for their operation. This reduces costs and utilizes a waste product. In some cases, industries can even sell surplus energy to local power companies.

Urban Waste Wood and Yard Waste Each time utility workers clear trees from power lines or homeowners trim their hedges, woody biomass is piled up and removed. This biomass is often mulched, taken to a landfill, or burned without emission controls. Waste wood resulting from storms and land clearing also produce woody debris, but these sources are not consistent or sustainable over the long term. Woody biomass from urban waste wood and yard waste can also be used to produce energy. People generally have to pay to dispose of urban waste wood; however, if

a local wood energy market existed, this wood might represent a reasonable source of inexpensive energy.

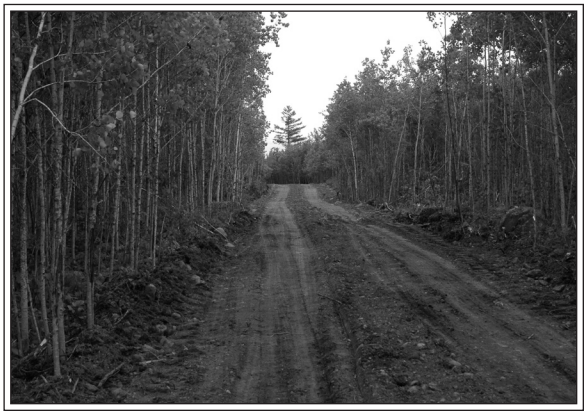
Figure 2: *Woody biomass from urban waste wood and yard waste can be used to produce energy.* Photo courtesy of Randy Cyr, Greentree Technologies.

Energy Plantations Just as trees can be grown for lumber, they can be produced in forestry plantations for energy. Just as we grow fields of wheat for food, we can grow fields of trees to produce energy. Some species of trees or woody crops, known as short-rotation woody crops, grow quickly and also resprout after they are trimmed. Examples of short-rotation woody crops are hybrid poplar and willow. These crops produce a lot of biomass in a short time and can be harvested repeatedly before they have to be replanted. Though this form of energy wood tends to be more expensive than some wood waste, it could be a reasonable option in some places, especially on degraded lands that cannot support healthy, natural forests or be used for growing food crops.

Forest Restoration and Health Improving forest health and restoring certain ecosystems to the naturally occurring forest type typically involves removing unwanted trees and other vegetation to reduce crowding and promote healthy tree growth. Small diameter trees may need to be removed in a process called thinning, to reduce the risk of wildfire and insect pest or disease outbreaks. If the removed biomass can be sold for energy, it might help landowners pay for removal efforts.

Fuelwood In addition to residues, waste, and dedicated energy crops, pulp wood and commercial grade timber can be used as an energy or bioproducts feedstock. When used this way, the fiber is called "fuelwood." In 2005, approximately 35 million dry tons of fuelwood was used in the residential and commercial sectors where it was harvested and burned for space and process heat (U.S.DOE and USDA 2005). Harvesting fuelwood may become more feasible in areas where the forest products industry is not buying or paying competitive market prices for pulp and commercial grade wood due to mill closures, market shifts, or other reasons.

Figure 3: *Short rotation woody crop grow very quickly. For example, the hybrid poplar trees pictured above are only six years old.* Photo courtesy of Diomy Zamora, University of Minnesota.



Summary and Conclusion

Woody biomass can provide a locally available, renewable source of energy that can be combined with other energy options to help meet growing energy needs. A combination of energy conservation, using multiple renewable energy sources, and managing population growth, is the most likely recipe for success when it comes to meeting energy needs in an environmentally, socially, and economically sustainable way.

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