



Biomass

Biomass is any organic material not derived from fossil fuels that can be converted to a fuel useful for generating electricity. Minnesota currently has 343 MW of biomass electric generation capacity. The Union of Concerned Scientists estimates that with existing technology, biomass could provide 6,690 MW of capacity to Minnesota, or well over half of the state's current needs.¹

How is biomass used to produce electric power? When biomass is burned, it produces heat (as in any simple fireplace or furnace). In most power plants this heat is captured by boiling water to generate steam, which turns turbines and drives generators that convert the energy into electricity. New technologies now being evaluated include several types of biomass gasifiers in which biomass is heated to convert it into a gas. This gas is used directly in a gas turbine, which drives a generator (a *simple gas turbine* system). In some cases, the waste heat from the gas turbine may be used to drive a secondary steam turbine, thus converting more of the fuel energy into electricity (a *combined-cycle* system).²

What does "co-firing" mean? "Co-firing" refers to the blending of biomass with coal in the furnace of a conventional coal-fired steam-cycle electric power plant. This is currently one of the simplest ways of utilizing biomass to displace fossil fuels, requiring no new investment or specialized technology. Between 5% and 15% biomass (by heat content) may be used in such facilities at an additional cost estimated at less than 0.5 cents/kWh (compared with coal-firing alone). Co-firing is known to reduce carbon dioxide emissions, sulphur dioxide (SO_x) emissions, and potentially some emissions of nitrogen oxides (NO_x) as well. Many electric utilities around the United States have experimented successfully with co-firing, using wood chips, urban waste wood and forestry residues.

What are energy crops? Energy crops, also called "bioenergy crops", are fast-growing crops that are grown for the specific purpose of producing energy (electricity or liquid fuels) from all or part of the resulting plant. The plants that have been selected by the U.S. Department of Energy for further development as energy crops are mostly perennials such as switchgrass, willow and poplar. They were selected for their advantageous environmental qualities such as erosion control, soil organic matter build-up and reduced fertilizer and pesticide requirements. There are many other perennial plant species which could be used for energy crops. In addition, some parts of traditional agricultural crops such as the stems or stalks of alfalfa, corn or sorghum may be used for energy production.

¹ Pawlisch, Melissa, Carl Nelson, Lola Schoenrich. 2003. *Designing A Clean Energy Future: A Resource Manual*. P.37. Retrieved on February 7th, 2005, from www.cleanenergyresourceteams.org.

² All questions and answers listed come from the Bioenergy Information Network's Frequently Asked Questions link. Retrieved on February 8th, 2005, from <http://bioenergy.ornl.gov/faqs/tech>.

So, how much of our energy supply comes from biomass today? Worldwide, biomass is the fourth largest energy resource after coal, oil, and natural gas - estimated at about 14% of global primary energy (and much higher in many developing countries). In the U.S., biomass today provides about 3-4% of primary energy (depending on the method of calculation). Biomass is used for *heating* (such as wood stoves in homes and for process heat in bioprocessing industries), *cooking* (especially in many parts of the developing world), *transportation* (fuels such as ethanol) and, increasingly, for *electric power production*. Installed capacity of biomass power generation worldwide is about 35,000 MW, with about 7,000 MW in the United States derived from forest-product-industry and agricultural residues (plus an additional 2,500 MW of municipal solid waste-fired capacity, which is often not counted as part of biomass power, and 500 MW of landfill gas-fired and other capacity). Much of this 7,000 MW capacity is presently found in the pulp and paper industry, in combined heat and power (cogeneration) systems.

What can I do? What should I be growing? If you are interested in experimenting with one or more of the most likely candidate bioenergy species in your area, you can start by gaining some working knowledge of growth characteristics and management responses under local conditions - this will be useful if a later opportunity for commercial production and sale of biomass occurs in your area. The primary bioenergy crops at this time are native perennial grasses, such as switchgrass, and trees, such as hybrid poplar and willow (the optimum varieties depend on region). You should not expect an economic return from such efforts at this stage unless a market for your biomass has been identified in advance.

Where can I sell biomass? The two main bioenergy markets are (1) electric power/ heat plants and (2) chemical processing plants that convert biomass to liquid fuels, ethanol and biodiesel. In general, biomass facilities draw feedstock from about a 50 miles radius to keep transportation costs at a reasonable level.

Can I plant poplars or other energy crops now, and what do I do with them? Depending upon where you live, there may be interest in your local area for some of the different energy crops for co-firing or fiber production. You would have to check with local electricity utility companies or fiber processors (paper and board manufacturers) to see if there is market for these intensively managed crops before establishing them. Remember that tree crops may take from 4 to 10 years before they are large enough to harvest, although perennial grass crops like switchgrass may be harvested from the second year onwards. Establishing the crop also requires commitment and effort to control weeds until the plants can shade-out weeds on their own. You cannot just plant-and-walk-away, expecting to come back years later to harvest the crop! In the U.S., many electricity utilities considering co-firing with bioenergy crops have established guidelines to help growers meet their needs.

Links:

Bioenergy Information Network: <http://bioenergy.ornl.gov/faqs/#tech>

Minnesota Department of Agriculture: <http://www.mda.state.mn.us/crp/biomass.htm>.

Minnesotans for an Energy-Efficient Economy Biomass Energy Information:
<http://www.me3.org/issues/biomass/>.

Clean Energy Resource Teams: <http://www.cleanenergyresourceteams.org/biomassenergy.html>.

American Bioenergy Association: <http://www.biomass.org/>.

National Renewable Energy Laboratory: http://www.nrel.gov/clean_energy/bioenergy.html.

U.S. Department of Energy: <http://www.eere.energy.gov/biomass/>.