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BIOMASS ENERGY

BACKGROUND BRIEF

WHAT IS BIOMASS?

Biomass energy, or "bioenergy" – the energy from plants and plant-derived materials – has been used since people began burning wood to cook food and keep warm. Wood is still the largest biomass energy resource today, but other sources of biomass are also used including food crops, grassy and woody plants, residues from agriculture or forestry, oil-rich algae and the organic component of municipal and industrial wastes. Even the fumes from landfills (which are methane, the main component in natural gas) are used as a biomass energy source.

While Oregon has some dedicated biomass energy crops, most biomass resources are secondary products, such as lumber mill residue, logging slash (from forest restoration treatments or commercial logging) or animal manure. Examples of biomass resources in the Northwest include woody biomass, spent pulping liquor (byproduct of pulp and the paper making process), agricultural field residue, animal manure, food processing residue, landfill gas and municipal solid waste and wastewater treatment plant digester gas. Between 2012 and 2014, biomass, landfill gas, and municipal waste supplied 0.57 percent of the electricity consumed in the state.

Biomass energy applications include biofuel,¹ biopower and bioproducts (see Table 1). The U.S. Department of Energy has encouraged a biorefinery concept for processing woody biomass at a new facility near Lakeview, Oregon. A biorefinery produces a range of products, including power, fuels and chemicals, similar to a petroleum refinery or petrochemical facility.

BIOMASS FOR ELECTRICITY GENERATION

The most common source of biomass-based electricity is wood. In 2014, biomass from wood and waste constituted 11 percent of total renewable electricity generation in the United States. The top five states for biopower electricity generation are California, Florida, Virginia, Georgia and Maine.²

The most common method of converting biomass to electricity is through direct-fired combustion – a similar process to that used for coal or natural gas. After the biomass is pre-processed to remove impurities, it is burned in a boiler to generate steam, which turns a turbine and generates electricity.

The efficiency of converting biomass to electricity is extremely variable due to the technology and feedstocks used to generate the initial heat. The efficiency of biomass plants can range from 22 to

¹ For more information on Biofuels see Oregon Department of Energy's *Renewable Fuels* brief, 2016.

² National Renewable Energy Laboratory 2014 *Renewable Energy Data Book*



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34 percent when generating electricity only. When operated as a combined heat and power plant, total efficiencies of up to 85 percent are achieved.³ Combined heat and power is a technology in which excess heat or steam from the generating process is used in secondary processes such as heating or drying.

Biomass power plants are typically less than 50 megawatts (MW) in size, compared to coal plants, which are typically 200 to 1,500 MW in size. Oregon has 17 woody biomass power facilities,⁴ primarily in the wood-products industry. An additional 21 facilities in Oregon use woody biomass to provide space heat; these include schools and hospitals.

Biopower can also be generated by capturing the output of decomposing biomass (animal manure, human waste or organic forms of municipal solid waste) in digesters or contained landfills.

“Biogas” or “digester gas” is the resultant product, consisting primarily of methane, carbon dioxide and water vapor. Once the biogas has been cleaned to remove water and impurities, it can be used to generate electricity, usually onsite or in a nearby dedicated plant. The higher the methane content, the higher the energy potential. Natural gas used by consumers is almost 100 percent methane, whereas biogas is typically 50-75 percent methane. In Oregon, there are 11 wastewater treatment plants that produce energy from biogas, nine anaerobic digestion facilities located on farms, and one merchant biogas plant. Six landfills in Oregon capture biogas for electricity generation. Oregon also has eight liquid biofuel production facilities and 10 wood pellet manufacturing facilities.

Table 1. Biomass energy applications

Energy Application	Definition
Biofuel	Converting biomass into liquid fuels for transportation
Biopower	Burning biomass directly, or converting it into gaseous or liquid fuels that burn more efficiently, to generate electricity
Bioproduct	Converting biomass into chemicals for making plastics and other products that typically are made from petroleum

Information supplied by National Renewable Energy Laboratory

STAFF CONTACTS

Beth Reiley
Legislative Policy and Research Office
(503) 986-1755
beth.reiley@oregonlegislature.gov

Beth Patrino
Legislative Policy and Research Office
(503) 986-1751
beth.patrino@oregonlegislature.gov

³ IEA, *Biomass for Power Generation and CHP*, 2007

⁴ Some woody biomass facilities are not currently operating.



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