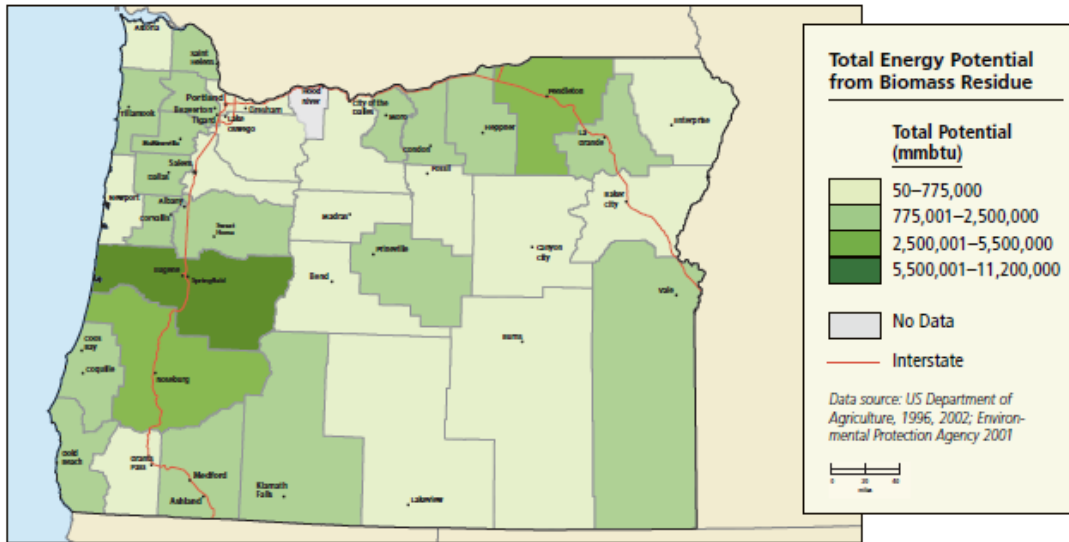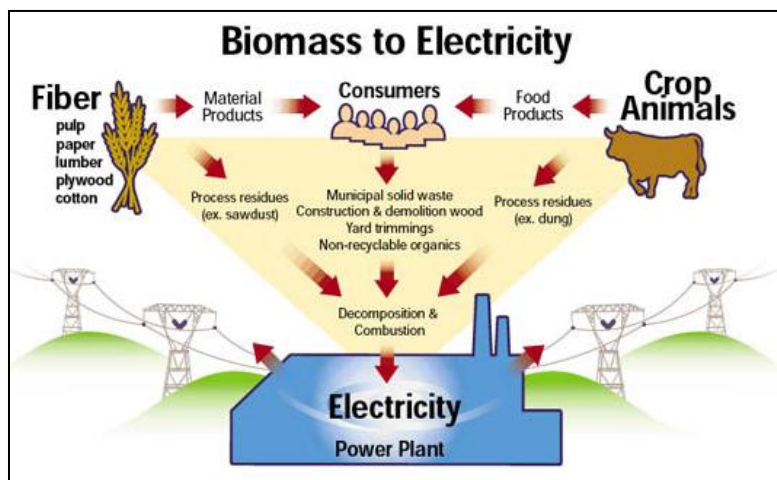# Biomass

Biomass Resource Potential in Oregon

[Published in Renewable Energy Atlas of the West, 2006]

"Biomass" refers to organic material that is either grown with the specific purpose of producing energy, or is left over from the production or consumption of food or fiber. While there are some dedicated biomass energy crops in Oregon (e.g., the hybrid poplar farm in Boardman), most biomass resources are secondary products, such as logging slash (from forest restoration treatments or commercial logging) or animal manure. Examples of biomass resources available in the Northwest include woody biomass (forest products, logging slash, and mill residue), spent pulping liquor (byproduct of wood pulp making process), agricultural field residue, animal manure, food processing residue, landfill gas, municipal solid waste from biogenic sources, and wastewater treatment plant digester gas.

[California Energy Commission]

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]

Biomass energy applications include biofuel, biopower, and bioproducts (Table 1). The U.S. Department of Energy has been encouraging a biorefinery concept for processing woody biomass (also called lignocellulosic biomass). A biorefinery produces a range of products including power, fuels and chemicals, similar to a petroleum refinery or petrochemical facility. For more information on emerging biorefinery technologies, see the National Renewable Energy Laboratory's "The Biomass Economy" published in 2002.

The most common source of biomass energy is wood. In 2009, biomass constituted 38 percent of the total non-hydropower renewable energy generation in the U.S. (about 1.4 percent of total generation). The top five states for biomass energy generation are: California, Florida, Maine, Virginia and Georgia (NREL 2009 Renewable Energy Data Book).

The most common method of converting biomass to electricity is through direct-fired combustion; a similar process to that used for coal or nuclear fuels. After the biomass has been pre-processed to remove impurities, it is burned in a boiler to generate steam, which turns a turbine and generates electricity. Excess heat is a byproduct of the generating process, and the most efficient facilities (able to utilize up to 85 percent of the energy potential in the fuel, compared to less-efficient operations that reach only 20 percent utilization) are those that are able to capture and utilize this "waste" heat in space heating, kiln drying and other uses (termed combined heat and power, or CHP). Biomass boilers are typically 20 – 50 MW in size, compared to coal plants, which are 100 – 1,500 MW in size. There are approximately 45

biomass facilities in Oregon, primarily in the wood products industry.

Another way to generate biopower is 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). Biogas is typically 50 – 75 percent methane. There are currently 9 wastewater treatment plants (WWTP) that produce energy from biogas and 19 others that have anaerobic digestion, but do not produce energy with the biogas. Seven landfills in Oregon capture biogas for energy generation. A number of projects are also being developed in the agricultural sector.
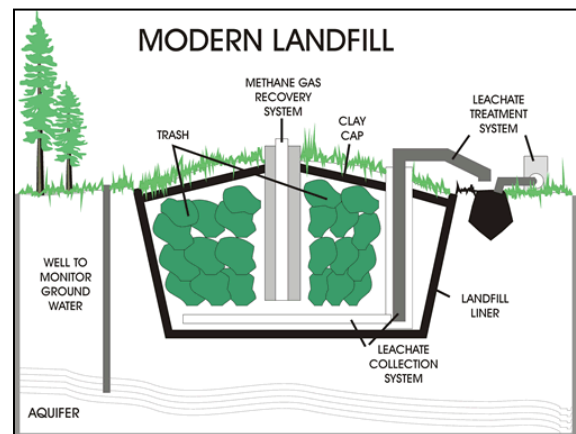
[Figure from National Energy Education Project]