Biomass

WHAT IS BIOMASS?

Biomass is any organic matter (anything that was once alive) that can be used as an energy source. Wood, crops, and yard and animal waste are examples of biomass. People have used biomass longer than any other energy source. For thousands of years, people have burned wood to heat their homes and cook their food.

Biomass gets its energy from the sun. Plants absorb sunlight in a process called **photosynthesis**. With sunlight, air, water, and nutrients from the soil, plants make sugars called carbohydrates. Foods that are rich in carbohydrates (like spaghetti) are good sources of energy for the human body. Biomass is called a **renewable** energy source because we can grow more in a short period of time.

USING BIOMASS ENERGY

A wood log does not give off energy unless you do something to it. Usually, wood is burned to make heat. Burning is not the only way to use biomass energy, though. There are four ways to release the energy stored in biomass: burning, bacterial decay, fermentation, and conversion to gas/liquid fuel.

Burning

Until the mid-1800s, wood was the biggest energy provider in the United States and the rest of the world. Wood heated homes and fueled factories. Today, wood provides only a little of our country's energy needs.

Wood is not the only biomass that can be burned. Wood shavings, fruit pits, manure, and corn cobs can all be burned for energy.

Garbage is another source of biomass. Garbage can be burned to generate steam and electricity. Power plants that burn garbage and other waste for energy are called **waste-to-energy** plants. These plants are a lot like coal-fired plants. The difference is the fuel. Garbage doesn't contain as much heat energy as coal. It takes about 2,000 pounds of garbage to equal the heat energy in 500 pounds of coal.

Sometimes, fast-growing crops like sugar cane are grown especially for their energy value. Scientists are also researching ways to grow aquatic plants like seaweed to use for their energy value.

Bacterial Decay

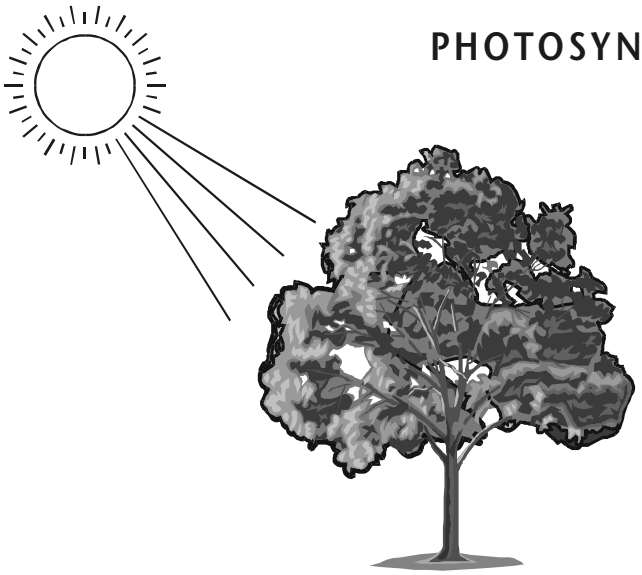
Bacteria feed on dead plants and animals. As the plants and animals decay, they produce a colorless, odorless gas called **methane**. Methane gas is rich in energy. Methane is the main ingredient in natural gas, the gas we use in our furnaces and stoves. Methane is a good energy source. We can burn it to produce heat or to generate electricity.

In some landfills, wells are drilled into the piles of garbage to capture methane produced from the decaying waste. The methane can be purified and used as an energy source, just like natural gas.

Fermentation

We can add yeast (another bacteria) to biomass to produce an alcohol called **ethanol**.

For centuries, people have fermented crops to make alcoholic drinks like beer and wine. Wine is fermented from grapes. Wheat, corn, and many other crops can be used to make ethanol.

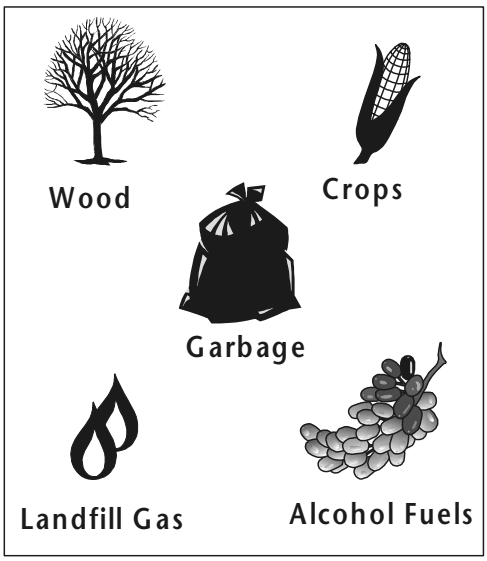


In the process of photosynthesis, plants convert radiant energy from the sun into chemical energy in the form of glucose - or sugar.

water + carbon dioxide + sunlight → glucose + oxygen

$6\,H_2O + 6\,CO_2 +$ radiant energy $\rightarrow C_6H_{12}O_6 + 6\,O_2$

Types of Biomass



Ethanol is sometimes made from corn to produce a motor fuel. Automobile pioneer Henry Ford wanted to use ethanol to power his cars instead of gasoline.

Ethanol is more expensive to use than gasoline. Usually, it is mixed with gasoline to produce a fuel called **gasohol**, which is 90 percent gasoline and 10 percent ethanol. For cars to run on ethanol, their engines would have to be changed. But cars can run on gasohol without changes. Adding ethanol to gasoline results in a cleaner burning fuel.

Conversion

Conversion means changing a material into something else. Today, we can convert biomass into gas and liquid fuels. We do this by adding heat or chemicals to the biomass.

The gas and liquid fuels can then be burned to produce heat or electricity, or it can be used as a fuel for automobiles. In India, cow manure is converted to methane gas to provide heat and light.

USE OF BIOMASS

Until the mid-1800s, wood gave Americans 90 percent of the energy we used. Today, biomass gives us only about three percent of the energy we use. It has been replaced by coal, natural gas, petroleum, and other energy sources.

Today, most of the biomass energy we use comes from wood. It accounts for 79 percent of biomass energy. The rest comes from crops, garbage, landfill gas, and alcohol fuels.

Industry is the biggest user of biomass energy. Industry uses 77 percent of biomass energy to make products.

Homes are the second biggest users of biomass energy. About one in five American homes burn wood for heat. Three percent use wood as their main heating fuel.

Power companies also use biomass to produce electricity. Biomass produces a very small amount of the electricity we use in the U.S.

In the future, trees and other plants will be grown to fuel power plants. Farmers will also have huge farms of energy crops to produce ethanol, an alcohol fuel, for transportation.

BIOMASS AND THE ENVIRONMENT

Biomass can pollute the air when it is burned, though not as much as fossil fuels. Burning biomass fuels does not produce pollutants like sulfur, that can cause acid rain.

Growing plants for biomass fuel may reduce greenhouse gases, since plants use carbon dioxide and produce oxygen as they grow. Carbon dioxide is considered an important greenhouse gas.

U.S. CONSUMPTION OF BIOMASS