Biofuels

Background

Unlike other renewable energy sources, biomass can be converted directly into liquid fuels, called "biofuels," to help meet transportation fuel needs. Biomass is organic (living or once-living) matter such as trees, grass, corn stalks, or even manure from humans or livestock. All living organisms get their energy from the sun, either directly or indirectly. They use the sun's energy to convert water and carbon dioxide into carbohydrates (sugars) and oxygen (and they also release water in the process). Because new plants can be grown, biomass is a renewable resource.

Most of the biomass used for energy production is products from wood—logs, bark, sawdust, etc. Wood products are used to generate electricity or heat ovens in wood-processing plants. This process alleviates disposal costs, saves landfill space, and cuts utility bills. Wood is also burned to heat homes in the form of logs or compressed wood pellets.

The two most common types of biofuels in use today are ethanol and biodiesel. Ethanol is an alcohol, the same as in beer and wine (although ethanol used as a fuel is modified to make it undrinkable). It is most commonly made by fermenting any biomass high in carbohydrates through a process similar to beer brewing. Today, ethanol is made from starches and sugars, but scientists are developing technology to allow it to be made from cellulose and hemicellulose, the fibrous material that makes up the bulk of most plant matter.

Ethanol is mostly used as blending agent with gasoline to increase octane and cut down carbon monoxide and other smog-causing emissions.

Biodiesel is a diesel fuel substitute that can be made from a variety of oils, fats, and greases. It is made by reacting vegetable oil or animal fat with an alcohol (usually methanol or ethanol) and a catalyst (usually sodium hydroxide or potassium hydroxide). The resulting product is thinner than the original oil or fat and thus works better in a diesel engine. Hundreds of governments, national parks, school districts and utility companies in the United States use biodiesel blends to run their fleets.

Biodiesel is of interest to farmers for a number of reasons:

- It can provide an additional market for vegetable oils and animal fats.
- It can allow farmers to grow the fuel they need for farm machinery.

Commonly-used crops for the production of biodiesel include soybean, rapeseed/canola, used (waste) vegetable oils, and tallow (animal fat).

Oklahoma State University, in cooperation with the Noble Foundation in Ardmore, is working on an alternative using switchgrass to make biofuels. Switchgrass is a native prairie grass that grows all over Oklahoma. Unlike corn and other crops, the current varieties of switchgrass grow without tillage and planting. Switchgrass is perennial and requires less water and fertilizer than crops such as corn. Switchgrass can produce between 300 and 700 gallons of ethanol per acre. In addition, more net energy is gained from switchgrass than from corn. Ethanol from corn yields 34 percent more energy than it takes to grow and process the corn into biofuel. Ethanol from switchgrass nets over five times more than that amount.

Vocabulary

anaerobic—without oxygen
decomposers—organisms that break dead organisms into their component parts
enzymes—proteins that speed chemical reactions; biological catalysts
fermentation—turning sugar into alcohol or lactic acid during anaerobic respiration
fossil fuel—nonrenewable energy sources from ancient life, e.g., oil, coal, natural gas

greenhouse gas—gases such as carbon dioxide and methane that trap warmth in the atmosphere and raise the earth's temperature over time
perennial—living over a period of many years
photosynthetic—an organism that derives its energy from the sun
renewable resource—energy resourcesthat are replaceable or not used up, such as trees, water power, solar energy
tillage—plowing the ground to make it ready for planting