Fuel: from the harvest to the engine

Imagine gas prices dropping to what they were a few years ago, before recent fiascos found prices at times soaring upwards of three dollars per gallon. The outlook is good that fuel prices could fall back where they used to be, though without any help from fossil fuels. This result could come from biofuels, fuel grown through crops or made from vegetable waste. Biofuels are renewable, which would solve the problem of depleting oil stores; they are more environmentally friendly than fossil fuels; and they would enable the United States to eliminate its reliance on fuel imports from other countries. With these natural advantages, fuel could become the next major crop in the country.

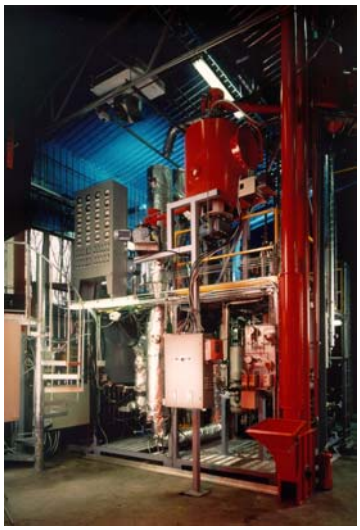
Why Biofuels?

Corn could be power of the future

Using vegetables is by far not a new concept as a fuel source. The first recorded usage was in the early 1900s, when a German engineer used peanut oil to power an engine at the Paris World Exposition. However, the real research into biofuels began in the 1970s, due to an energy crisis in the United States when the Arabs refused to export oil to our nation. Great interest has arisen to make the United States energy self-sufficient, without its heavy reliance on imported fuel, to avoid another such crisis. To stretch out the limited oil supplies in the 70s, engineers for the first time mixed ethanol from corn into the gasoline. Today, the need for an alternate energy source is based more on the fact that the world's oil supplies are becoming rapidly depleted; the US alone consumes 60 billion gallons of petroleum diesel and 120 billion gallons of gasoline each year (Biofuels). Prices soar as supplies dwindle – with scientists saying that the supply could peak by the 2020s (Wu). The decreasing supply of fossil fuels has sped up research of all renewable fuel sources, biofuels being a large one among them.

What are Biofuels?

Plant matter, solid waste, and vegetables may provide the fuel for the future in the form of biofuels. There are two essential forms of biofuels being developed today, ethanol and biodiesel. Ethanol is formed from the distillation of vegetable products, such as corn in the U.S. or sugarcane in Brazil. To turn ethanol into liquid fuel, the cellulose in vegetables first needs to be broken down into smaller molecules; this can become a problem because the main function of cellulose in plants is stability, so the bonds between each molecule are difficult to break. Strong enzymes called cellulases break down the cellulose into small sugar molecules, and finding the most efficient cellulase will greatly reduce costs of producing ethanol fuel by cutting down time and energy input greatly. Already, new enzymes have reduced the cost per gallon of ethanol produced from an initial $5.40 to only $0.20 per gallon (Moreira). Once cellulose is broken into simple sugars, bacteria are then used to ferment, or break down those molecules further into an alcohol. There has been quite a lot of research into the type of bacteria to use for fermentation, to find the cheapest and quickest, all to bring renewable ethanol down to a price competitive with that of regular petroleum fuels. The alcohol produced is then distilled, filtering out the usable fuel, and leaving behind many useful by-products. Depending on what product was used for the distilling, the by-products can be used for a mash for livestock feed, fertilizer, dyes, or a multitude of other uses.



Ethanol distillation instrument

The other type of biofuel is biodiesel, which is made from vegetable oils and plant waste (such as cornhusks or peels), rather than from the rest of the crop. Fossil fuels are made up of hydrocarbons of various lengths and structures; vegetable oils are made from fatty acids, which are essentially those same hydrocarbons with oxygen added as well. The oils are passed through a catalytic reactor, a machine that reduces the fatty acids to simple hydrocarbon molecules. The resulting molecules can then be used the same way as fossil fuels in engines because of their similar structure; therefore, biodiesel is the same as petroleum fuel, only biodiesel is renewable. Different vegetable oils are used for production of biodiesel

based on location: soybean oil in the United States, rapeseed oil in the United Kingdom, and sunflower oil in France, depending on prominent crops for the area (De Winne).

Biofuels are not only a great renewable fuel source; they also are very beneficial to farmers. Firstly, they provide a new market for the farmers who grow crops to be turned into fuel. Not only that, farmers can use biofuels easily on their farms, distilling the grain they grow into ethanol for fuel to be used on the farm. Once the ethanol is distilled, the by-product can still be used to feed livestock. Farming that produces all the energy that it consumes is called sustainable mixed farming, and can often be more productive than large, industrial farming. The industrial farms consume a large amount of fossil fuels, which can in turn cost more than sustainable farming while producing only a slight increase in crops. A small concern has arisen with the world's starvation rate that land should be used to grow food, not fuel. Many new technologies, however, have arisen to produce fuel from the inedible parts of plants or from plant wastes, such as cornhusks or wood chips, so that food supplies would not be compromised.

There are few setbacks in the advancing biofuel technology. One is the large expense in building refineries required to turn the plant matter into a usable liquid fuel. Making all U.S. used gasoline into a mixture of 10 percent ethanol – 90 percent gasoline would require at least 200 small-scale ethanol plants around the United States (Vinas, "Building"). Moreover, transporting the large amounts of the plant material adds considerably to costs. Some scientists also claim that producing biofuels consumes more energy than it saves, but others say that the information used for those computations was outdated; recent calculations show that the production of ethanol produces 67 percent more fuel than it consumes (Moreira). Some environmental concerns pose problems as well, including the possibility of pesticides and fertilizers entering the environment from water runoff in the fields, but these are minimal when compared to the environmental advantages of biofuels.

Biofuel refinery in the Midwest

Advantages of Biofuels

There are many advantages to the uses of biofuels, both for consumers and for the environment. The cost of biofuels over other alternate forms of energy is greatly reduced, because they can be distributed and used without requiring new systems. Governments would not have to build new pumps or distribution centers, and biofuels can be used in existing car engines, dramatically reducing the initial costs of using the alternate fuel. Biofuels do not have to be imported from other, oil-mining countries – therefore, many countries can become energy self-sufficient. As more forms of biofuels are competitively priced, consumers will also have the choice of what biofuel they want to use. Another benefit of some types of biofuels is that they can be mixed with ordinary gasoline – in other words, it makes biofuels more attractive to consumers by keeping the usable fuel within their car warranties' limits. Biofuels are also easier on the engines of cars, so that corrosion of parts is reduced and cars are kept running in good condition longer, yet another advantage to consumers.

Consumers could have their choice of biofuels

The other great advantage of biofuels is that they are much cleaner for the environment. Greenhouses gasses that are emitted when fossil fuels are burned, such as carbon dioxide, deplete the ozone layer in our atmosphere: 12,000 pounds of carbon dioxide alone are emitted by the average car each year. (Biofuels). In contrast, biofuels emit fifty percent less carbon dioxide than regular diesel fuel, helping to save the ozone layer and reduce global warming (Frost and Sullivan). Biofuels also emit fewer pollutants and no sulfur, therefore ridding the atmosphere of acid rain, which erodes rock and is harmful to plants and animals. Seventy to eighty percent of the biofuels are biodegradable into small molecules, making it friendlier than petroleum that can be very harmful to the environment, especially when spilled. Another environmental advantage is that biofuels can be made from recycled materials, such as the used vegetable frying oil from fast food restaurants.

Use of Biofuels

The use of biofuels is not by far a technology of the far future; there are quite a few examples of its use in the world today, and many plans are in the works for the use of them in the near future. One example in India is the case of the Talukas, which are groupings of eighty to one hundred villages that are completely self-sufficient, making all of the energy they consume themselves in the form of biofuels using the distilling process. In addition to their own fuel, each produces surplus crops that could be made into 30 million litres - over 60 million gallons - of fuel (Biofuels). In Canada, already government vehicles use ethanol for their fuel, and most countries around the world have some percentage of biofuels additives in their fuel supplies. By the end of this year, France – whose fuel supplies already contain one percent ethanol – will produce over 100 million litres of biofuels from surplus wine supplies with the approval of the European Union. The percentage of ethanol in France's fuel supplies will increase dramatically from one percent to over five percent over the next few years (Smith). The European Union will also require countries to add certain percentages of biofuels into that country's fuel supplies in the near future. Some types of gaseous biofuels are already piped to districts to be used in heating systems. Recently, President Bush signed the Energy Policy Act, which will add 7.5 billion gallons of biofuels (almost six percent of the nation's transportation fuel) into the United States' fuel supplies by 2012 (Moreira). This will greatly reduce the U.S.'s dependence on imported fuel as well as creating new markets and jobs for American workers. There are few working biofuel plants in the United States right now, but many are in the works by various companies, mostly in the Midwest. The major oil companies feel in no way threatened by the emerging biofuel technology; in fact, the leaders in petroleum are already clients of various biofuel companies around the world.

Ethanol fuel pump

A shift from petroleum fuel to biofuels would not be sudden and abrupt, but rather it would be gradual, governments increasing the percentage of biofuels included in fuel mixes over time. When technology advances to where producing and selling biofuels is cost competitive with petroleum fuels the market for biofuels will increase dramatically and they will be found in a prominent position in the world's fuel supplies. The use of biofuels solves many problems environmental, political, and economical, plus they are renewable so that the world does not have to worry about biofuel supplies running out as it has with fossil fuels.

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