FACT SHEET: Alternative Fuels

In recent years, many technologies have been put forth for creating liquid fuels as alternatives to our reliance on oil and gas for transportation and heating. All of these alternatives have significant environmental and economic impacts, making them undesirable to society at large and to the communities where the production plants would sit.

Three of the most prominent "alternative fuel" technologies are cellulosic ethanol, thermal depolymerization (TDP) and Fischer-Tropsch (F-T) gasification / liquefaction.

Cellulosic Ethanol

Cellulosic ethanol is the technology needed to make ethanol from a wide array of organic materials. Unlike conventional ethanol production, it wouldn't be used on corn or grains. However, it can be used on corn husks, leaves and stalks (known as "stover"), trees and other crop and agricultural wastes. The same technology can be used for more dangerous types of wastes, such as municipal solid waste (household and commercial trash), sewage sludge, scrap tires, construction and demolition wood wastes and other waste streams known to be highly contaminated with toxic chemicals of various sorts.

Promoters of cellulosic ethanol typically talk about it as if the main interest is in using switchgrass, an allegedly "sustainable" fast-growing crop native to North America prairies. What they don't talk about is industry's plans to genetically modify switchgrass at least three different ways. One way would make it grow denser and straighter, meaning that switchgrass will be more demanding on water and soil than usual. Another modification would make it herbicide tolerant – meaning that increased amounts of toxic herbicides would be sprayed to establish the crop. Since switchgrass is a native grass, these biotech varieties would cross-breed with (contaminate) native grasses, causing untold ecological problems.

The biotechnology industry is also excited about cellulosic ethanol because it requires genetically-modified enzymes to crack the cell walls (made of cellulose) with an efficiency that would make it more economically viable. Nature designed cellulose to be difficult to break down and no natural enzymes have yet been found that can do what industry needs. Should these biotech enzymes escape into the environment (more a matter of *when* than *if*), they could bring their own as-yet-unknown complications.

The U.S. annually consumes 142 billion gallons of gasoline and is now producing a record 6.6 billion gallons of ethanol. The Energy Policy Act of 2005 sets a national goal of only 0.25 billion gallons of cellulosic ethanol production by 2013, yet the USDA has expressed doubts that the technology will be commercially economical by then. Most cellulosic ethanol research is in genetic engineering, to overcome the hurdles that the technology faces. Work is also being done to engineer plants with lower lignin levels, because lignin helps to prevent cellulose from being broken down.


Iogen Plant in Ottawa

Cellulosic ethanol is advertised as being more energy efficient than conventional corn-based ethanol. However, experience to date has shown the opposite. The Iogen facility in Canada – the world's first pilot-scale cellulosic ethanol plant to commercially produce fuel – has major operational problems, producing only about 1/6th of their capacity and using more energy than they produce.

Cellulosic ethanol also suffers from the lack of land and other resources needed to grow enough crops to fulfill the vision. Advocates push for using Conservation Reserve Program (CRP) lands in order to increase the available land for growing feedstocks. However, this land is already sought for increased corn and soy production for conventional ethanol and biodiesel. The government pays rent to farmers to keep the highly erodible CRP lands *out* of production. This land over the years has returned to the wild and is acting as a giant carbon sink soaking up 15-30% of America's CO_2. It has also provided a great deal of wildlife habitat. Putting this land into intensive production (destroying an effective carbon sink) to make ethanol will be worse for global warming than leaving the land alone and doing without this "alternative fuel."

Several companies have been seeking to build "trash-to-ethanol" plants throughout the nation. Since the technology is experimental and unproven, investors have avoided funding the industry (they all want to be the "first to finance the *second* proposal," according to one industry leader). The Energy Policy Act of 2005 includes government-subsidized loans that will enable the first plants to be financed. The nation's leading proposal (now scrapped) was a plan for a facility in Middletown, New York that would take trash as well as sewage sludge. The plant would have had its own gasification-style incinerator to burn its lignin-heavy solid waste products. The air permit showed that they expected the plant to have emissions of many of the same pollutants you'd expect to see from a trash incinerator.

Some companies have even proposed to turn waste coal and scrap tires into ethanol through a different process… one that involves "plasma arc" incinerator technology.

Thermal Depolymerization (TDP)

This technology has been widely promoted as "anything-to-oil" by a company called Changing World Technologies. They have a pilot test facility in Philadelphia where they have processed a variety of contaminated waste streams, including food wastes, sludges, offal, rubber, animal manures, black liquor (paper mill waste), plastics, coal, PCBs, dioxins, and asphalt. They also have a full-scale facility in Carthage, Missouri where they turn turkey guts into "oil" – and not without serious odor violations. Many questions remain unanswered about where all of the toxic contaminants end up when their machines magically turn "anything" into "oil."

Fischer-Tropsch (F-T) Gas-to-Liquids

This technology is named after two German scientists who developed it as a means to turn coal into oil. This was used to fuel the Nazi war machine. It turns gases into liquid fuels (often after a solid fuel like coal is gasified). This same "coal-to-oil" technology was later used in South Africa, when the Apartheid regime had a similar problem importing oil, but had large domestic coal supplies.

While the technology could be used to turn natural gas into liquid fuel, or to turn any solid fuel into liquids, it's primarily sought for coal-to-liquids use. This technology faces many major problems, including massive water requirements, mercury and other toxic air emissions, huge volumes of solid and liquid waste byproducts, and greenhouse gas pollution. A "small" experimental coal-to-liquids plant planned for eastern Pennsylvania would annually consume 1,468,000 tons of waste coal, about 2.5 billion gallons of water, 123 million cubic feet of natural gas, 134,000 tons of limestone, 11,400 gallons of methanol, 5,000 gallons of sulfuric acid and 3,200 gallons of ammonia… turning it all into 60-70 million gallons of coal-based liquid fuels, 2,282,000 tons of carbon dioxide emissions, 1.6 billion gallons of wastewater, 250,000 tons of mercury-laden toxic slag, 62,500 tons of "fine solids" (waste), 3,400 tons of iron sludge, 4,000 tons of wastewater treatment sludge, and various other waste products and air emissions. The many commercial-scale coal-to-oil plants being planned would be six times larger than this on average. Billed as "Ultra Clean Fuels," the Pennsylvania company has a website at www.UltraCleanFuels.com. The opposition site is www.UltraDirtyFuels.com

Fischer-Tropsch can be used for a wide variety of wastes. The Pennsylvania project would test process a wide range of municipal and industrial wastes as well as "biomass" (a wide category of often contaminated waste streams).

It has often been promoted as the means to reduce reliance on foreign oil, by increasing the use of coal and waste coals in the U.S. If they succeed at building 6-7 full-scale refineries, they would produce 20% of the diesel used in the U.S. (an amount that would more easily be avoided through conservation and efficiency tactics, such as hybrid trucks and increased use of rail for shipping). If all U.S. oil imports were replaced with coal-based liquid fuels, coal mining in the U.S. would nearly double.

Coal-to-oil refineries are really bad for global warming, with CO_2 emissions 80% higher than conventional petroleum refineries. Even if they could capture and store their CO_2 emissions, they'd still emit about the same as oil refineries.

What's wrong with these magic machines?

In addition to being supposed "solutions" to our reliance on foreign oil and gas, these technologies are often promoted as alternatives to landfills and incinerators for a variety of waste streams. However, these fancy technologies can't solve problems that need to be addressed "up-stream."

These alternative liquid fuels schemes produce solid and liquid wastes, air emissions (including when the produced fuel is burned) and require significant water use.

There's no magic technology that can make toxic metals (or radioactive contaminants) disappear. It's rare that any technology actually makes halogens (chlorine, bromine, fluorine...) into fairly benign chemicals (like salts); most make these chemicals more dangerous (like converting them into dioxins or releasing them as acid gases).

Promoters of these technologies avoid describing the fate of the chemicals that enter their processes, giving the impression that they can handle contaminated wastes and have toxic chemicals disappear. Solid waste byproducts of these processes will contain concentrated levels of toxics from the original feedstock plus new contaminants formed in the process. These toxins can leach out over time. The high cost of using these technologies causes companies to try to pass off their wastes as saleable products rather than paying for their disposal in a landfill.

As a solution for municipal solid wastes, any technology that destroys materials necessitates the re-creation of those materials from virgin feedstocks, making the net energy flow highly undesirable. Like trash incinerators, these technologies would be more accurately described as waste-*of*-energy instead of waste-*to*-energy facilities.

These facilities are fairly flexible in the types of fuels/wastes they process, so there are economic incentives to use of the dirtiest possible feedstocks –like trash, tires and sewage sludge – since facilities can get paid to take such wastes, whereas they often have to pay to obtain cleaner fuels – like trees, forestry residues or organically-grown crops. Even these "ideal" fuels have serious impacts, especially since the machines need to be fed constantly – risking decades of abuse of nearby forests or croplands. No facility is going to pay more to obtain organically-grown crops, when they can use genetically-modified, herbicide drenched crops grown with imported natural gas-based fertilizers. Even facilities that start with such a "clean" feedstock will be tempted over time to accept dirtier waste streams that they can get paid for.

These technologies fail to solve waste problems (which can only be solved upstream, not through end-of-pipe technologies) and also fail to provide clean alternatives to oil for transportation needs. They compete with clean energy and zero waste strategies. By posing as "green" solutions to waste problems, these technologies justify continued waste generation. In transportation, they compete with the move toward electric vehicles, which can be "fueled" more cheaply – even when buying wind power.

Clean energy (conservation, efficiency, wind and solar) and zero waste tactics (source reduction, reuse, recycling and composting; see www.grrn.org/zerowaste/ for details) produce more jobs and solve energy and waste problems without polluting communities and wasting resources.

Mike Ewall **215-743-4884** **catalyst@actionpa.org** **www.energyjustice.net/fuels/** Nov 2007