

Bethel College Mennonite Church Creation Care Committee
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Biofuels - Generation II

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The October 30, 2010 Economist has a long three page article on the new approach to biofuels. The Economist has no bylines, so it is difficult to assess the expertise of the authors, but several years of experience with the science and technology reporting in the Economist leads me to have a fair bit of confidence in objectivity and expertise.

The authors summarize the problems with ethanol as a substitute for petroleum: 1) It absorbs water, 2) it is corrosive, 3) it contains less energy per volume than petrol, 4) when distillation energy comes from coal it is not very environmentally friendly, 5) it is only economically viable with government subsidy, and 6) in the U.S. it is made out of corn which competes with an important food source. On the last 2 points, the author notes that if it is made from sugar, as in Brazil, it is cheaper than gasoline and is not made out of an important food stock. They also note that the reason we do not import this cheap fuel is because our government has imposed tariffs to protect the American ethanol industry. (I take the message - ethanol as a biofuel is a dead end.) As to cellulosic ethanol the authors simply note that, "cellulosic biofuel has so far failed on an epic scale..." In any case, cellulosic ethanol is still ethanol.

The new push in biofuels is based on the creation of designer "bugs" that make hydrocarbons that can substitute directly for existing fuels. The authors call such fuels "drop-in fuels". The drop-in fuels would not have the first three short comings of ethanol listed above. The proposal in the short run is to make them out of Brazilian sugar, which is not subject to the ethanol tariff, and in the long run to make them out of cellulose. It is expected that in the short run this will make them cheap enough to be economically viable without government subsidy, and will avoid competition with an important food stock. An additional advantage of this approach is that the biofuels could substitute directly for diesel as well as aviation fuel, which ethanol can not do.

So much for the theory part of the article. The practical part details the progress of a number of startups that are aiming to get into the new biofuel business. Two startups are far enough along that they are listed on the stock market.

Codexis produces designer bugs and specialized enzymes, it is partnering with Shell, which will provide much of the financing, and Cosan, Brazil's third largest sugar producer. The partnership plans to build a plant that produces 2.5 million barrels a year, and ultimately 12.5 million barrels. Codexis will produce straight-chain alkanes which are the basic ingredients of diesel.

Amyris has developed a designer yeast that produces terpenes. It is partnering with Total, the French oil company, and Santelisa, Brazil's second largest sugar producer. This partnership is busy refitting some of its ethanol plants to produce the new fuel.

In addition to these two companies there are a half dozen other nascent ventures mentioned, including several that plan to make butanol, one that is partnering with Exxon Mobil, and one that plans to use one-celled algae. There is much more of interest in the article including many factual details.

So, what is the bottom line? It is important to note that none of this suggests that we will be energy sufficient any time soon. All of these things are hopes more than realities. Still, there are three things which suggest that we should be watching these efforts over the next two or three years. First, the new emphasis on drop-in fuels seems to be moving in a more promising direction than the use of alcohol. Second, the fact that the largest oil companies are all getting into the business suggests that the science looks promising. Third, the range of technologies being tried makes it more likely that one or another will turn out to be feasible. Of course, it is always useful to remember the string of bright hopes that have quietly passed into history or taken their place as bit players - fuel cells, hydrogen fuel, hybrids, plug-in hybrids, grain ethanol, cellulosic ethanol.

Might not electric cars make any synthetic fuel itself only a bit player? There are a couple of things to note here. As Jim Goering noted in Stewardship Note 37 1) If the electricity that drives the electric car is made from coal, the electric car turns out to be more environmentally damaging than a good hybrid car. Jim also noted that electrics need longer distance batteries as well as batteries that can be charged faster. The most encouraging prospect I know is a Chinese company that claims to have produced experimental electric cars that go 150-200 miles per charge and can be half-charged in 10 minutes [goggle BYD E6 for information]. Even if electric cars were to become the common family transportation, drop in fuels would still be important because they substitute for diesel fuel and aviation fuel.

If drop in fuels were to become as cheap or cheaper than petrol (gasoline and diesel), there would still be environmental questions. It takes energy to produce such fuels. If this energy comes from coal there will be questions about the environmental impact. (It is useful to note that Brazil gets its energy for ethanol production from the fiber left from pressing the sugar cane.) There might also be a problem with land fertility. Ultimately, producers of drop in fuels hope to use cellulose as the feed stock for their fuel. If this proves feasible, there would have to be very large acreages dedicated to the production of cellulose - food crop refuse, switch grass, miscanthus grass. This land would be robbed of any returning humus and minerals. In the long run this seems to me to be a problem.