THE BIOENERGY FRENZY

Dr. K. K. Klein and Dr. Danny G. Le Roy
The University of Lethbridge

Ethanol production has increased dramatically since the turn of the century. In 2000 total world production of ethanol for fuel was less than 18 billion litres and by 2006, production had almost tripled to over 52 billion litres by the end of 2006. The International Energy Agency (2004) projected that ethanol production in the world may rise to 65 billion litres by 2010 (and account for about 4% of motor gasoline use) and to 120 billion litres by 2020 (and account for about 6% of motor gasoline use), but those estimates might turn out to be too low.

The United States is now the largest producer of ethanol in the world, having overtaken Brazil in 2005. Far behind the United States and Brazil, but in third place in world production, is China, where production approached 4 billion litres, followed by India with about 1.9 billion litres. In Eastern Europe, producers in the Russian Federation and Ukraine supply most of the output. Production in many western European countries, notably France, Germany and Spain, has been increasing rapidly. Canada produced 578 million litres of ethanol in 2006 (but has expanded production in 2007).

There has been an increasing international emphasis on production of biofuels. This is in response to (1) concern for the environmental effects of burning fossil fuels; (2) desire for a more secure source of energy since much available hydrocarbon fuel comes from areas of the world that are unstable and worries about the limit of their production; and (3) beliefs that a biofuel industry would aid primary agricultural producers and rural areas that are seen as being perpetually in financially strapped conditions.

The profitability of biofuel production is largely determined by the price of competing outputs, principally petroleum products, and the cost of its feedstock, mostly cereal grains and oilseeds. The prices of petroleum and agricultural crops are notoriously variable. This, combined with the uncertainties involved in agricultural crop production presents several risks for biofuel producers.

Relatively high oil prices over the past couple years has provided a good opportunity for biofuel producers to sell their products in a high-priced market. At the same time, relatively low grain and oilseed prices have allowed biofuel producers to capture much larger financial margins than were possible as recently as 2003. Eidman (2005) reported that many ethanol plants in the United States achieved return on equity of 25-40 % in the last two years, "with rumours of plants achieving over 60 %." The high rates of return on invested capital, and the expectation that demand for ethanol will continue to grow, has attracted a lot of private capital in the United States and other countries. Although ownership of ethanol plants in the United States, Canada and Europe has been mostly fragmented with a large number of farmer co-operatives, recent investments by private equity funds, venture capitalists, money-centre banks and international corporations has led to consolidation of ownership and severe competition for smaller, farmer-owned and controlled syndicates (Eidman, 2005).

One of the major objectives of most biofuel policies is to provide opportunities for primary agricultural producers to get a higher price for the products they produce. An ethanol plant that uses cereal grains (or eventually plant residues) provides an additional market for these products. Grain and oilseed prices rose dramatically in the past year. Market analysts at the Chicago Board of Trade, Iowa State University and the University of Minnesota, among others, have attributed the rapid escalation of grain and oilseed prices to the extra demand for corn to produce ethanol. The increased prices of feed stocks for biofuels may limit future expansion of the industry in several countries.

Virtually all countries that are involved in the production of biofuels have programs that support biofuel research, much of it aimed at developing more efficient processes for converting plant-based starches to alcohol. A wide variety of new processes are under investigation, including gasification and Fischer-Tropsch synthesis. Although these new processes do not appear competitive at present, it is likely that continued research will result in significant breakthroughs in cost efficiency.

This production-oriented research has been instrumental in bringing down the average costs of producing biofuels. The largest ethanol cost component is the plant feedstock (although part of this cost can be offset by selling by-products such as distiller's dried grains for animal feed). Research into higher yields of feedstock grains can achieve important reductions in the average cost of producing ethanol. In Brazil, substantial improvements in efficiency of sugar cane production and conversion processes lowered production costs of ethanol substantially over the last decade, to a level of about 15 US cents/litre (IEA, 2004).

The greatest potential cost reductions lie in the development of technologies that convert cellulosic feedstock to ethanol, and eventually to hydrogen and other liquid fuels like synthetic diesel. Ethanol derived from cellulosic materials requires greater processing than that required for converting starch or sugar based feedstocks to ethanol. The cost of cellulosic feedstock, including grasses, harvest residues and trees generally is much lower than that of cereals. However, the additional costs of handling, storage and transportation of the bulky materials can significantly increase average costs of production (Miranowski, 2007). As a result of

on-going research, the IEA estimates the cost of producing a litre of ethanol made from cellulose (poplar trees) to decline by about half within ten years and the cost of producing a litre of ethanol from corn in the United States to decline by about 14% in the same timeframe (IEA, 2004).

Although the cost of oil has increased substantially recently, it generally remains true that the cost of producing biofuels still is substantially higher than the cost of petroleum fuels. However, a lot of evidence exists that production costs of biofuels (particularly ethanol) are much lower in the developing countries that lie in tropical and sub-tropical areas with low land and labour costs. Crops such as sugarcane, tapioca, sorghum, and cassava have been used as feedstocks for ethanol production. Palm oil, soybeans, peanuts, cocoanut, and jatropha have been used to produce bio-diesel. In Brazil, the costs of producing ethanol from sugarcane are now similar to (or less than) the cost of petroleum fuels. In other tropical and sub-tropical countries, especially in Thailand and the Philippines, major new initiatives have been implemented to boost production of biofuels (F. O. Lichts, 2005).

The production cost advantage of ethanol in lower income countries provides an obvious opportunity for increased international trade in this product. However, like many other agricultural-related commodities, restrictions to trade in biofuels exist in most high-income countries. The United States imposes a tariff against ethanol from Brazil of about 14 US cents/litre. This is partially offset by imports that occur through the Caribbean Initiative, which allows up to 7% of the previous year's ethanol use to enter without duty. Mostly, this is hydrated ethanol from Brazil that is converted to anhydrous ethanol and denatured in the Caribbean before being shipped to the United States (Eidman, 2005). Relatively small quantities of ethanol have been imported into the United States, though imports have been increasing.

It is likely that the demand for biofuels will continue to increase throughout the world. There has been an increased awareness of environmental issues in recent years and this seems likely to continue. Additionally, demand is likely to grow due to new regulations being established in the European Union, the United States, and other countries on automobile emissions.

References

Eidman, Vernon R. 2005. *Agriculture's role in energy production: Current levels and future prospects.* Presented at Conference on Energy From Agriculture: New Technologies, Innovative Programs & Success Stories. Farm Foundation, St. Louis, Missouri.

F. O. Licht. 2005. Biofuels and the international development agenda. *F. O. Licht World ethanol and biofuels report.* Volume 3, No. 21, 5 pp.

International Energy Agency (IEA) (2004) *Biofuels for transport: An international perspective.* International Energy Agency, OECD, Paris. http://www.iea.org/textbase/nppdf/free/2004/biofuels2004.pdf

Miranowski, John A. 2007. *Feasibility of large scale biofuels: Assessing the one billion ton study.* Presented at Conference on Modeling Ag-Forest Offsets and Biofuels in U.S. and Canadian Regional and National Mitigation. Shepherdstown, West Virginia. March.