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ETHANOL PRODUCTION FROM US SUGAR:

A BAD IDEA ON ECONOMIC AND PRACTICAL GROUNDS

Faced with the prospect of opening the US market to more imported sugar via various FTAs and the full implementation of NAFTA in 2008, and given the growing demand for fuel ethanol in the United States, some domestic sugar producers have suggested diverting excess sugar supplies to ethanol production to support sugar prices when needed. There is, however, one missing ingredient for an economically viable US sugar-based ethanol industry, and that is competitive world-priced sugar.

Even though the technology to convert sugar to ethanol may be more straightforward than converting corn to ethanol, and Brazil and a couple of other countries have viable industries converting sugarcane to fuel ethanol, the high price of sugar in the US makes it very costly to use for the production of ethanol. Moreover, there are practical issues related to whose sugar gets diverted, and to intermittency of use of sugar to produce fuel ethanol, as discussed below.

Poor economics

The economic hurdle is evidenced in a USDA study published in July 2006 – *The Economic Feasibility of Ethanol Production from Sugar in the United States.* The study estimated costs of production for ethanol using molasses, sugar beets, sugarcane, raw sugar and refined sugar by multiplying the quantity of each input required to produce one gallon of ethanol by the input's 2003-2005 average market price and adding operating costs. The latter were based on average ethanol dry mill operating costs from 2003-2005 with adjustments for the differences in processing corn and sugar into ethanol.

The study's estimates for raw and refined sugar are shown in the table below, excluding certain other costs associated with ethanol production, such as transportation and capital expenses.

	Raw sugar	Refined sugar
Feedstock required (tons/gallon)	0.0074	0.0071
Feedstock price ($/ton)	422	509
Feedstock cost ($/gallon)	3.12	3.61
Ethanol operating costs ($/gal)	0.36	0.36
Total cost ($/gal)	3.48	3.97

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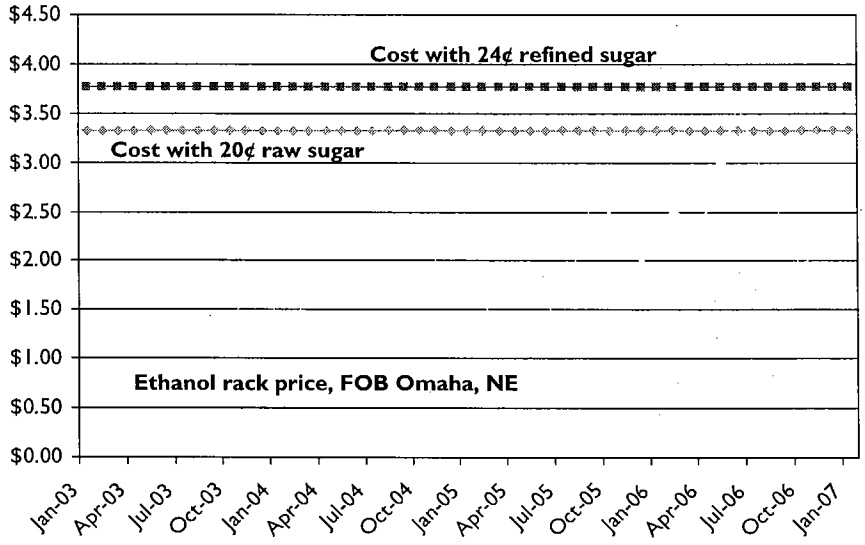
The study concluded that the cost to produce ethanol from sugar is a prohibitive $3.48 to 3.97 per gallon, far above the cost to produce ethanol from corn, which USDA put at between $1.03 and $1.05 per gallon with corn at $2.16 per bushel. (In early 2007, corn is over $4.00 per bushel, implying costs of about $1.50 per gallon.)

However, the price of ethanol is based on the price of gasoline and not the feedstock or operating costs. Given the high market value of sugar in the United States and the average rack price of ethanol, which has ranged from as low as $1.12 per gallon to more than $3.50 in the summer of 2006 (FOB Omaha), it is clear that ethanol production from sugar in the United States would seldom, if ever, be profitable. (Note: Nebraska ethanol prices are typically in the middle of the range of prices around the country.)

Ethanol production from sugar could only be profitable assuming a very high price of ethanol and without factoring in capital or transportation costs. As seen in the following figure, even depressed sugar prices in the US at loan forfeiture levels would make for an expensive and unprofitable feedstock. Assuming prices of 20 cents per pound ($400/ton) for raw sugar and 24 cents per pound ($480/ton) for refined sugar, the out-of-pocket ethanol production costs with raw and refined sugar would still be well over $3 per gallon ($3.32 with raw and $3.77 with refined).

As the figure illustrates, there was only one month in the last four years when the cost of producing ethanol from raw sugar could have been covered. It would likely require an additional subsidy of at least a dollar per gallon, on top of the current $0.51 tax exemption, to allow ethanol production from sugar to cover operating costs in the United States.

Cost to produce one gallon of ethanol with raw and refined sugar compared with the price of ethanol, 2003-2007



Sources: USDA, the Nebraska Ethanol Board and the Nebraska Energy Office

Some might note that production costs using molasses or the actual crop as the feedstock are lower according to the USDA study: $1.27 per gallon for molasses, $2.40 for sugarcane, and $2.35 for sugar beets. However, using those raw materials does not deal with any surplus raw or refined sugar that emerges. Molasses is just a byproduct of sugar production, and where it pays to make ethanol from it, companies are already doing so. In the case of beets or cane, if a company makes the capital investment to produce ethanol from the crop, growers are just going to grow more of the crop to meet that need. One still has to maximize throughput in the sugar factory to spread out the fixed costs over as much volume as possible.

The practical obstacles

There are two practical issues: whose sugar will get diverted to ethanol, and how intermittent will this be? The usual suggestion is that the foreign sugar will get diverted, i.e. sugar from the 40 or so quota holders and all the sugar mills in Mexico. This would apparently require the Commodity Credit Corporation to buy the foreign sugar, in competition with US refiners, arrange for importation, and resell it at a discounted price of 5 or 10 cents per pound to whomever was going to convert it to ethanol. It is not even clear that CCC has authority to do that.

And when does one know there is surplus sugar? In the autumn of 2006, some said there was excess supply, but then the Mexican crop turned out poorly and there was no surplus. If sugar had been diverted to ethanol last fall, we would now be facing shortages.

The alternative is to divert domestic sugar. In the case of beet processors who sell finished refined sugar to customers, this would mean giving up historic customer relationships. That is not typically something that businesses are keen to do. In the case of cane sugar mills, it becomes a problem if the company is vertically integrated into refining, which is the case for the Florida industry, and may be for much of Louisiana as well if mills invest in Cargill's planned sugar refinery. If the market surplus were in the form of refined sugar from Mexico, the US refiners would be unable to replace the diverted domestic raw sugar with imports, raising the same customer relationship issue as for beet processors.

Intermittency is a problem because of capital costs. Who is going to build an ethanol facility that only operates some of the time? Although capital costs for ethanol production vary widely for different feedstocks and different locations, it is clear that there will be capital costs associated with producing ethanol from sugar and that these costs will only increase the overall cost of production.

Some assert that surplus sugar could just be sent to a corn dry mill, but this is not as easy as it sounds. When USDA had its last million ton stockpile of forfeited sugar, they were actually able to sell only 8,611 tons for ethanol production in FY2001 and 2,407 tons in FY2002, despite their willingness to take a loss on the sugar to get rid of it. Many dry mills are grower-owned and the whole idea is to use the growers' corn, and even distilleries owned by non-growers have raw material purchasing and hedging programs that typically lock in corn supplies months in advance. Moreover, the handling and processing systems (not to mention the yeasts) differ for corn and sugar.

Using estimates developed by a leading sugar ethanol manufacturer in India (shown in the table on the following page), the USDA study estimated the annual capital costs for producing ethanol from corn and sugar feedstocks. These are shown in the following tables. They are probably underestimated because the boom in plant construction in the United States has driven up costs significantly over the past year, according to press reports.

Estimated capital investment costs for alternative sugar feedstocks

	Plant size (million gallons per year – MGY)	
	20 MGY	40 MGY
Feedstock	($ per gallon of capacity)	($ per gallon of capacity)
Corn	1.50	1.30
Sugarcane	2.10-2.20	1.63-1.68
Sugar beets	2.10-2.20	1.63-1.68
Cane/beet juice	1.35-1.45	1.05-1.10
Cane/beet molasses	1.30-1.40	1.03-1.05

Source: PRAJ Industries via *The Economic Feasibility of Ethanol Production from Sugar in the United States*, USDA

Annual capital expense estimates were based on a 20-year payback period with an interest rate of 7 percent. As seen in the following table, this would add an additional 10-20 cents per gallon to the sugar ethanol production cost, depending on the size of the plant. (A 40 million gallon per year plant would use about 300,000 tons of raw sugar.)

Annual capital investment expense for alternative feedstocks

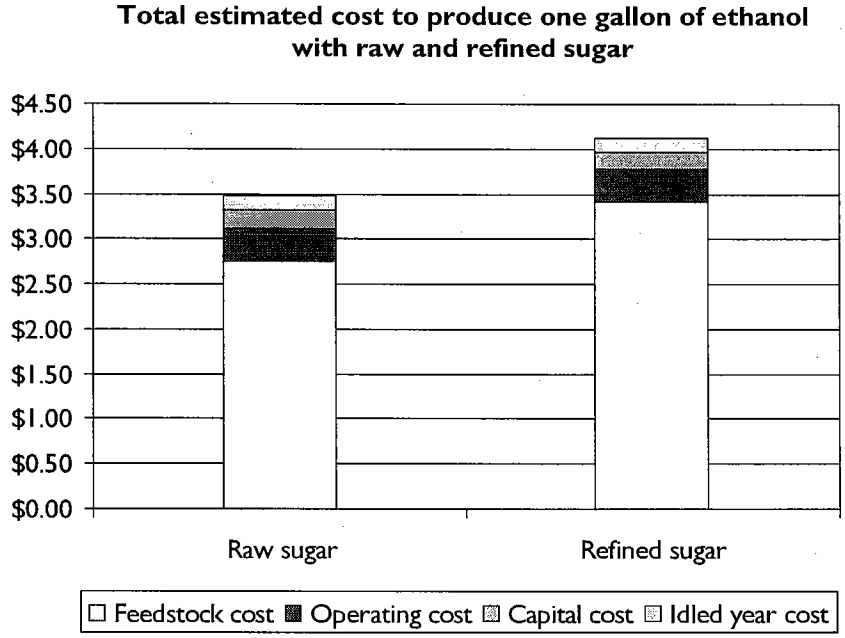
	Plant size (million gallons per year – MGY)	
	20 MGY	40 MGY
Feedstock	(cents per gallon of capacity)	(cents per gallon of capacity)
Corn	14	12
Sugarcane	20	16
Sugar beets	20	16
Cane/beet juice	13	10
Cane/beet molasses	13	10

Source: *The Economic Feasibility of Ethanol Production from Sugar in the United States*, USDA

Moreover, producing ethanol from sugar only in times of surplus would make the capital cost for sporadic operation significant. Even assuming a total capital investment cost of only $1.00 per gallon for sugar in a 40 million gallon capacity plant and an estimated 10 cent per gallon annual cost, there would be significant cost implications for intermittent operations.

If the plant were operated as regularly as every other year, the capital costs that each gallon of sales would have to cover would be at least 20 cents per gallon – not to mention the additional costs associated with managing the plant even in a down year, such as labor, maintenance, etc.

As the figure below illustrates, factoring in the feedstock cost (using depressed sugar prices), normal operating cost, capital expenses, and an additional 15 cents for operating a plant in the off year, the total cost to produce just one gallon of ethanol from raw sugar would be $3.50 and the cost to produce a gallon of ethanol from refined sugar would be $4.12.



The USDA study was released in July 2006 and at that time ethanol prices had reached a record high. Thus, it was concluded that ethanol production from sugar could be profitable at those prices. Under our scenario – factoring in capital costs – one would break even at best. Nevertheless, ethanol prices have dropped and, due to the continued expansion of US ethanol production capacity, it is unlikely that prices will often be at the level reached in the summer of 2006.

Therefore, it is safe to say that producing ethanol only in times when there are excess supplies of raw or refined sugar would prove to be a very costly venture. Moreover, any subsidy that is linked specifically to the sugar program would be considered amber box in the WTO context.

This is not to say that the US sugar sector will never have an ethanol connection. Molasses is already a viable feedstock. And if and when cellulosic technologies are commercialized, both beet factories and cane mills have a large supply of raw material already collected – beet pulp and bagasse – that can serve as a feedstock. In fact, Florida International University and Florida Crystals Corporation recently announced a joint research effort on pretreatment processes for bagasse conversion to sugars for fermentation, supported by a $1 million grant from the Florida Department of Environmental Protection. This is the direction in which the domestic sugar industry should head, rather than trying to get the federal government (and taxpayers) to finance an ethanol plant, with massive subsidies, that may or may not have any raw material to process, depending on whether there is surplus sugar.