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## **American Crystal Sugar Company: Making Ethanol from Sugar Beets?**

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American Crystal Sugar is the nation's largest processor of sugar beets. American Crystal Sugar is a cooperative owned by sugar beet growers in the Red River Valley of North Dakota and Minnesota. Jim Horvath, CEO of American Crystal Sugar, is contemplating how to explain the issues associated with using sugar beets as a feedstock for ethanol production. The dramatic increase ethanol production, first in Brazil and now in the U.S., is an important structural shift in world agriculture and energy markets. Since most existing ethanol production processes rely on the fermentation of starches and sugars found in raw cane sugar (Brazil) or corn (U.S.), Jim wonders if sugar beets are a viable source of ethanol feedstock.

The case is designed for undergraduate-level courses in agribusiness management, marketing, or courses with a public policy component. The objective of the case is to have students analyze policy factors regarding the possibility of using sugar beets as an ethanol feedstock.

The case was used by students at Dickinson State University, North Dakota State University, and Kansas State University in 2007. Interviews were done with Jim Horvath and Dave Malmskog, Director of Business Development at American Crystal Sugar, as part of the research process for writing the case. We revised the case based upon their comments, as well as the comments from the students. The specific questions are described below. These can be done in the form of a homework assignment or an in-class discussion.

## Assignment or Discussion Questions

### 1. What are the cost factors that affect the profitability of using sugar beets for ethanol production?

The case discussion begins with a focus on the costs of producing ethanol. These costs are influenced by factors both internal and external to the ethanol-producing firm. First, ask the class what the inputs for ethanol production are and how these affect the profitability of producing ethanol from sugar beets. The instructor can point out that there are three principal sets of costs: beet acquisition, processing costs, and capital investment. Next, discuss available substitute products (petroleum, corn-based ethanol) are available and how their costs compare with costs for ethanol made from sugar beets.

Students should raise the following issues:

- ✓ Genetically modified varieties of sugar beets do exist, but do little to reduce net processing costs. Though fewer and less costly chemical applications may be made, technology fees offset the reduced costs.
- ✓ Net processing costs for using sugar beets to produce ethanol are more than twice that of using corn, given current corn and sugar beet prices and ethanol production technology.
- ✓ Investment costs for a sugar-based ethanol plant depend on whether or not existing sugar beet processing facilities are used. Building on to existing processing facilities is less costly than building new facilities.
- ✓ The relative cost of producing ethanol from sugar beets, as compared to corn, changes as corn prices increase. Increasing corn prices are related to an increase in the number of proposed and currently operating ethanol production facilities which rely on corn. Historical corn prices are available at [tradingcharts.com](http://tradingcharts.com).

- ✓ Whether or not ethanol produced from sugar beets could be profitable depends on oil prices remaining high relative to historical prices. For example, as of May 2007, at \$100 per barrel of oil the corn-based ethanol break-even corn price is \$7.93 (University of Illinois Department of Agricultural and Consumer Economics, 2007). Higher prices must prevail to achieve the sugar beet-based ethanol break-even price. The actual break-even price will depend on the efficiency of the technology ACSC would use, the price of sugar beets, and the price of oil.
- ✓ Since natural gas prices also affect the profitability of ethanol production, it may be interesting to consider whether the northern states have access to relatively cheaper natural gas for industrial use. Natural gas prices are available at the state level from the U.S. Department of Energy at [http://www.eia.doe.gov/pub/oil\\_gas/natural\\_gas/data\\_publications/natural\\_gas\\_annual/current/pdf/table\\_023.pdf](http://www.eia.doe.gov/pub/oil_gas/natural_gas/data_publications/natural_gas_annual/current/pdf/table_023.pdf).

## **2. How would existing and future sugar policy affect the profitability of using sugar beets for ethanol production?**

After discussing costs of ethanol production the instructor can turn the discussion to policies affecting the market price of refined sugar, an alternative use of sugar beets. The students and instructor could discuss the following:

- ✓ The 2002 Farm Bill contains three policy tools used to administer the current sugar policy. These are a non-recourse loan program, marketing allotments, and tariff-rate quotas. Each is described below in the context of sugar policy. When used together, these three policy tools are designed to support a targeted market price of sugar at no cost to the government but at considerable cost to taxpayers.

The nonrecourse loan program allows the USDA to make loans available to sugar processors, not beet producers, at a set rate (the loan rate), currently \$0.18 per pound for sugar beets. The nonrecourse feature of the loan means that the government must accept the sugar used as collateral for the loan as payment in lieu of cash if the market price drops below the loan rate. Forfeiting the sugar to the government removes the sugar from the market, effectively reducing supply and supporting the established market price.

Marketing allotments also help support the targeted market price. The government sets a flexible maximum quantity of sugar, generated from current and stored production, which can be marketed within the year. These allotments are divided between sugar cane and beet production, and then among processors based on production in prior years. The maximum quantity of sugar is adjusted so that the market price remains near the loan rate.

Tariff-rate quotas are a third policy tool used to support domestic sugar price. At lower quantities of imported sugar a relatively low tariff is charged. Quantities in excess of that amount are charged a higher rate. The tariff-rate quotas are adjusted annually to regulate the amount of sugar imported, and thus the market price, through announcements of quantities charged the high and low rates.

The class could discuss how increased imports of sugar from Mexico will affect the ability to administer this program, through these three tools, at no cost to the government.

- ✓ Changes in the EU Common Agricultural Policy, or other foreign agricultural policies, may affect market price. For example, if the CAP is changed such that the

EU becomes a net sugar importer, the world price will increase, making the use of sugar beets for ethanol even less attractive.

- ✓ Other trade agreements, such as CAFTA-DR, will also affect domestic sugar production. CAFTA-DR is a free trade agreement between the U.S. and Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and the Dominican Republic. A portion of the agreement addresses sugar trade. The agreement increases the quantity of sugar imported under the low tariff rate every year for 15 years, ultimately allowing entry of sugar from these countries equal to less than 2% of current domestic sugar consumption (USTR, 2005). Discuss the effect of this additional sugar on U.S. sugar prices and what adjustments may have to be made to sugar policy to maintain the current market price.
- ✓ Current policy sets a price floor for sugar. One result of this floor is to reduce price and income risk from sugar sales to sugar beet producers. In contrast, the price of ethanol varies with the price of gasoline. If a processor chooses to sell ethanol it will be subject to income and price risk associated with fluctuations in the market price for ethanol. What resources should sugar processors develop to manage risks associated with these price variations?

**3. What market forces external to ACSC should Jim consider that will affect the profitability of ethanol production? Do these offset the cost factors on profitability?**

This is an interesting question because the production costs discussion clearly demonstrates that producing ethanol from sugar beets is not necessarily profitable for ACSC. Discussion of the second question, however, makes clear that the current import control/marketing allotment program will not maintain prices above the loan rate as

international sugar trade policies change. Hence, the government may not be able to maintain the sugar program at zero taxpayer cost.

- ✓ Information provided in the case guides the student's application of Porter's Five Forces framework when considering the likely ability of ACSC to produce ethanol profitably over the long term.

1. Supplier power is affected by several factors, such as the number of companies. The Renewable Fuel Association publishes information about the capacity of each in operation plant (<http://www.ethanolrfa.org/industry/locations/>). Current facilities produce between 30 and 100 million gallons annually. Facilities under construction or expansion will typically range between 50 and 110 million gallons. This suggests that the production occurs in an unconcentrated environment, leading to competitive pricing behavior by suppliers.

Other factors affecting supply include marketing arrangements, duration of marketing contracts, and growth in number of facilities.

2. The price and value of substitute products also affects ethanol profitability. ACSC will be exposed to these same factors. Imported ethanol is a possible substitute, but its viability is reduced by virtue of transport costs and import tariffs. Other technologies are substitutes for ethanol, cars propelled by hybrid, electric, natural gas, or fuel cell powered engines.
3. Buyer power is also affected by several factors. Production of ethanol is encouraged through policies requiring ethanol blending with gasoline. It is

also a substitute for MTBE, and increasing demand for alternative fuels.

All of these tend to reduce buyer market power.

4. Entry of other producers reduces the margins available from ethanol production. The Renewable Fuel Association publishes information about two types of entrants: the location of newly planned facilities, or facilities that are being expanded. As corn prices increase, the rate of investment in construction of facilities using corn as the feedstock will likely decrease. Students should consider how this will affect the use of sugar beets as a feedstock.
5. The overall market conditions for ethanol production appear to be competitive (FTC, 2005). This suggests that little rivalry will take place in setting prices.

- ✓ The decreases in domestic production that may accompany sugar trade liberalization suggest that ACSC's producer surplus will decline. ACSC may be able to maintain producer surplus by taking advantage of current federal-sponsored ethanol production research and development grants available through various agencies. Producing ethanol from sugar beets can increase sugar producer surplus, relative to the surplus available from liberalized trade, by maintaining domestic sugar supplies. Increased consumer surplus, through increased ethanol supply, will also be created and help to offset the reduced taxpayer surplus associated with funding these research efforts.
- ✓ Other policy changes, such as the use of direct payments as part of sugar policy, which comply with NAFTA and WTO regulations, may also increase consumer and producer surplus.



- ✓ After discussing these two domestic policy options, students should realize that, although producing ethanol from sugar beets is unprofitable, changes in domestic and trade policies will require changes to domestic sugar policy in order to generate surplus for domestic sugar producers. Producing ethanol from sugar beets is a possible way to support sugar prices and maintain current domestic production.
- ✓ An informative reference about the potential impact of sugar trade liberalization with Mexico is Abler, Beghin, Blanford, and Elobeid, 2006. A citation is included in the text. These authors conclude that allowing duty-free imports of sugar into the United States will allow the Mexican beverage industry to expand, using high fructose corn syrup as an ingredient. The displaced sugar will likely seek a market in the United States. The scenarios examined by these authors can be used to quantify the impact of increased imports on sugar beet production, prices, and returns. It is easy to compare the scenarios in Table 2 with historical production and prices. This comparison will help students understand how changes in trade policy through quantifying its effect.

The precise offsetting effects of producing ethanol from sugar beets could be discovered by exploring the following questions as a class.

- ✓ How will demand for domestic sugar production change ten years from now?  
Could changes in domestic sugar or trade policies affect demand?
- ✓ How will the diversion of sugar beet supply for ethanol production affect the price of domestic sugar? Will processors continue to use sugar beets to produce ethanol causes if this causes the price of sugar beets to rise?

**4. What action would the membership recommend to him with respect to using sugar beets for ethanol production?**

Encourage students to write a concise action for ACSC to perform and to justify their decision based on the above discussion. The instructor can lead the class through the pros and cons of each alternative.

Tong and Reuer (2007) indicate the real options framework is increasingly used to understand the impact of uncertainty on the structure and evaluation of resource investments. For example, a decision by a seed manufacturer to invest in the development of a new set of traits for seed involves resource commitments to future, but uncertain, payoffs. Uncertainties associated with successful concept development, product development, and government approval, affect the expected payoffs from investment.

Students could be encouraged to consider what gives ACSC members option invest in ethanol production technology at a later date its expected benefits , as well as the potential costs of not making the investment. The returns to the option for ACSC to invest in ethanol production equipment are uncertain. The value of the ethanol production investment option is based on uncertain costs and uncertain prices, as well as the competitive environment, and, since Mr. Horvath's decision depends on the opinion of the members, the management and organizational structure of ACSC. The following questions could be used to generate interesting discussion.

- ✓ If ACSC enters the ethanol production market, its producer surplus payoff will be affected by stiff competition from increasing number of corn-based plants in operation or under construction, increasing capital expenses, and the potential for losses from ethanol revenues not covering costs. How does the competitive

environment, as discussed in the five forces framework, affect ACSC's investment decision?

- ✓ What steps should ACSC consider? The instructor should discuss the process of investing in the technology to learn more about its feasibility, and a formal business plan prior to actually building a plant. The technology part should not be overlooked. A necessary first step is to get the technology feasibility better understood. ACSC could not withstand a price-cost squeeze with its ProGold investment. It was unlikely to be able to withstand a similar situation with this technology.
- ✓ If ACSC does not enter the ethanol production market, its payoff will be affected by still having to deal with problem of imports, the need to lobby to change domestic policy, and the probability that all sugar processors will lobby similarly. Does this threat reduce the threshold for investment activity?
- ✓ ACSC may want to consider a timing option in making the investment decision. What information about feasibility and profitability should ACSC watch for?
- ✓ Do the principles of member-ownership, member-control, and member-benefits cause a cooperative to have insufficient management and organizational support to exercise an option to invest in ethanol production?

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