

February 1989

FUEL ETHANOL

Imports From Caribbean Basin Initiative Countries



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United States
General Accounting Office
Washington, D.C. 20548

National Security and
International Affairs Division

B-234382

February 21, 1989

The Honorable Dan Rostenkowski
Chairman, Committee on Ways and Means
House of Representatives

The Honorable Lloyd Bentsen
Chairman, Committee on Finance
United States Senate

As required by the Omnibus Trade and Competitiveness Act of 1988, we examined fuel ethanol imports from Central America and the Caribbean and their impact on the U.S. fuel ethanol industry. Such imports qualify for duty-free treatment if local feedstock from the region accounts for at least 75 percent of the value of the product when it enters the United States.

We examined whether this requirement contributes to the economic development of the countries and whether Caribbean companies can meet the requirement and still economically produce fuel ethanol for export to the United States. We assessed possible modifications to the requirement that would insure meaningful production and employment in the region, discourage Caribbean companies' use of imported alcohol feedstocks for making ethanol, and not result in harm to the U.S. ethanol industry.

We concluded that the current requirement is not economically feasible for Caribbean producers. We analyzed three options for modifying the requirement.

The major contributors to this report are listed in appendix I.

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Executive Summary

Purpose

The 1983 Caribbean Basin Economic Recovery Act permits eligible products from designated countries and U.S. insular possessions in Central America and the Caribbean (referred to as CBI countries) to be imported into the United States duty-free. Duty-free treatment was granted to all eligible products if at least 35 percent of their value was added in the CBI countries. Legislation was enacted in 1986 providing that ethanol qualified for duty-free entry only if raw materials (feedstock) from the region accounted for at least 30 percent of the value of the ethanol when it entered the United States in 1987, 60 percent in 1988, and 75 percent in 1989.

Trade legislation enacted in 1988 required GAO to study whether the 75-percent local feedstock requirement will contribute to the economic development of the CBI countries through maximum utilization of the natural resources of those countries. The Act specified that the study should assess whether the local feedstock requirement is economically feasible for ethanol producers and if not, to recommend modifications to the requirement that (1) will insure meaningful production and employment in the region, (2) discourage the processing of feedstock obtained outside the region, and (3) not result in harm to ethanol producers in the United States. The Act also required GAO to assess the effects of CBI ethanol imports on U.S. producers.

Background

Ethanol is the alcohol in beverages such as beer, wine, and whiskey. It can be used as a fuel by blending with gasoline and in a number of industrial applications. Ethanol can be made from renewable resources, such as corn, wheat, grapes, and sugarcane, through a process of fermentation. It can also be made synthetically from crude oil. All ethanol discussed in this report is made from renewable resources to be used as fuel when mixed with gasoline.

To be suitable for blending with gasoline, ethanol must be virtually anhydrous (the water content cannot be greater than 0.5 percent). We refer to this as fuel or dry ethanol. Ethanol can be distilled up to about 95 percent alcohol. Above that level it must be dehydrated to remove water.

Subsequent to the 1983 CBI legislation, several companies built dehydration facilities in CBI countries to produce ethanol for export to the United States. Rather than make the product by a process of full fermentation of local feedstock, such as sugarcane, the companies imported and dehydrated low-cost, European wine alcohol. This activity has been

described as a pass-through operation. Companies have added local feedstock (for example, 10 percent of total feedstock) to meet the 35-percent, value-added requirement and the 1987 30-percent local feedstock requirement. Local processing costs accounted for the remaining CBI value-added requirement.

The U.S. ethanol industry objected to pass-through operations because it believed the heavily subsidized European wine alcohol gave the Caribbean ethanol producers an unfair cost advantage in U.S. markets. To discourage pass-through operations, Congress legislated the local feedstock requirements.

Results in Brief

Given current sugar and gasoline prices, it is not economically feasible for CBI ethanol producers to meet the 75-percent local feedstock requirement. At current prices, CBI companies can be competitive with no more than a 10 to 30-percent local feedstock requirement. Therefore, the 75-percent requirement will not permit CBI producers to be competitive and contribute to the economic development of CBI countries. To date, ethanol imports from CBI countries have been small and have not had much impact on the U.S. market. However, eliminating any requirement would give CBI ethanol producers an advantage in the U.S. market if the CBI companies can readily obtain subsidized European wine alcohol supplies at low prices.

The policy objectives of the 1988 legislation—i.e., that the local feedstock requirement will (1) increase meaningful production and employment in the region, (2) discourage pass-through operations, and (3) not harm U.S. ethanol producers, are thus in conflict and involve tradeoffs. GAO's report contains information to assess the tradeoffs and discusses options for modifying the 75-percent local feedstock requirement.

Principal Findings

The CBI Industry

Since 1984 four companies have built dehydration plants in the CBI region that have operated and exported ethanol to the United States. GAO estimates their current effective, combined production capacity at about 88 million gallons a year. Two other plants are under construction, but may never be completed. If they are finished and certain

improvements are made to all plants, maximum ethanol production capacity of these six plants might reach 212 million gallons a year.

One company in Costa Rica and two in Jamaica have also invested in sugarcane and two in full fermentation facilities. The latter facilities can currently supply only a limited amount of the total feedstock required to operate the dehydration facilities. New investment in sugar and full fermentation facilities is unlikely without greater assurance of a long-run rate of return and a more favorable price structure than currently exists.

Because of competing demands for CBI sugarcane and wet ethanol, there is a limit on the amount of local feedstock currently available in the CBI region. This could affect CBI producers' ability to meet a local feedstock requirement. CBI producers have had difficulty in obtaining adequate supplies of local feedstock.

The governments of Jamaica and Costa Rica see fuel ethanol as a way to diversify sugar uses. This is seen as important, especially in light of declining U.S. sugar quotas. Ethanol is seen as a way of maintaining existing employment in the sugar industries of these countries. The U.S. Virgin Islands sees it as a way of reducing dependence on the tourist industry.

Although dehydration of imported wine alcohol provides significantly less employment and local production than full fermentation of local feedstock, it does provide CBI countries with economic benefits.

Impact on the U.S. Industry

Between 1979 and 1985, U.S. ethanol sales grew rapidly. Since then, however, they have stagnated. Annual sales are currently about 850 million gallons. Past imports from CBI countries peaked at 3 percent of the U.S. market in 1987.

The future impact of CBI ethanol imports will depend importantly on U.S. restrictions, CBI production capacity, availability of low-cost European alcohol feedstock, and growth of the U.S. market. The strength of the market depends on the continued availability of government subsidies, future corn and oil prices, and expanded use of ethanol to enhance gasoline octane ratings and reduce pollution.

Range of Alternatives Available to the Congress

Setting or modifying a local feedstock requirement tailored to today's market conditions is difficult because its impact can vary significantly as sugar, corn, and/or oil prices change. Prices for these commodities have varied substantially in the past. In addition, individual company cost structures differ. An added difficulty in modifying the 75-percent local feedstock requirement as contemplated by the 1988 trade legislation is that the several policy objectives of that legislation are in conflict. Thus, GAO is making no recommendations but presents three options to show the range of possible alternatives available depending on the priorities of the Congress.

In the first option, in addition to the 35-percent, value-added requirement, Congress could set a local feedstock requirement in the range of 10 to 25 percent. Currently, most companies could probably meet a 10-percent requirement and some might meet a higher one. Under the assumption that oil prices will increase in future years, Congress could initially require that companies meet a 10-percent requirement, with increases to 20 or 30 percent in future years. If the price structure improves, the companies might be able to meet a higher requirement; however, if the cost or price structure becomes less favorable in the future, it could make companies uncompetitive.

Option two would eliminate any local feedstock requirement while maintaining the 35-percent, value-added requirement of the original CBI law. One reason for considering this option is that the local feedstock requirement for ethanol changed the rules for a CBI product after investments had already been made. CBI government officials believe this change has adversely affected investor interest in the CBI program more generally. Option two would enable all currently exempt plants to operate as long as they can meet the original 35-percent, value-added standard. Plants have used some local feedstock to meet this requirement and some plan to maximize the use of local feedstock as long as their ethanol is still competitive. However, option two would not encourage companies to maximize the use of local feedstock.

Option three stems from the 1988 Trade Act provision. The Act provided a limited exemption from the local feedstock requirements for 1988 and 1989 for a number of CBI dehydration facilities already completed or under construction. Each can import into the United States up to 20 million gallons of ethanol duty-free without meeting the 75-percent local feedstock requirement. Option three would provide permanent

exemptions from any local feedstock requirement, up to a 20 million gallon a year cap, for each of the currently exempt plants. A local feedstock requirement, say 30 percent or higher, could be established for exports above the cap or for all production of any new plants. This option would enable the exempted plants to operate as long as they meet the 35-percent, value-added requirement. It would also provide an incentive to use additional local feedstock to increase exports above the cap. It would cap CBI exports based on low-cost, imported feedstock at a maximum of 120 million gallons a year and assure U.S. industry that exports over that amount would include at least 30-percent local feedstock.

Agency Comments

To meet the statutory reporting deadline, GAO decided not to seek agency comments on its report.

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Abbreviations

CBERA	Caribbean Basin Economic Recovery Act
CBI	Caribbean Basin Initiative
EC	European Community
ETBE	ethyl tertiary butyl ether
GAO	General Accounting Office
MGY	million gallons a year
MTBE	methyl tertiary butyl ether

Background

The Omnibus Trade and Competitiveness Act of 1988 required that GAO and the International Trade Commission each review fuel ethanol imports from Central America and the Caribbean and their impact on the U.S. ethanol industry.

Ethanol is an alcohol. It is a component of alcoholic beverages, such as beer, wine, and whiskey. It can be used as a fuel and in a number of industrial applications. Ethanol can be made from renewable resources, such as corn, wheat, grapes, and sugarcane through a process of fermentation. It can also be made synthetically from crude oil. All ethanol discussed in this report is made from renewable resources to be used as fuel when mixed with gasoline.

To be suitable for blending with gasoline, ethanol must be virtually anhydrous (i.e., the water content cannot exceed 0.5 percent). We refer to this as fuel or dry ethanol. Ethanol can be distilled up to about 95 percent alcohol. Above that level it must be dehydrated to remove water. Ethanol that has not been dehydrated is referred to as hydrous or wet ethanol.

To decrease U.S. dependence on imported oil, federal and state tax incentives have been provided since 1978 that made gasoline-ethanol blends, known as gasohol, competitive with gasoline. The 1978 Energy Tax Act instituted a federal gasoline tax reduction of 4 cents a gallon for 10-percent ethanol blends.¹ We refer to this as the federal gasoline tax exemption. The 1980 Crude Oil Windfall Profit Tax Act instituted a blender's tax credit of 40 cents a gallon as an alternative to the excise tax exemption. These incentives have been increased and currently are 6 cents a gallon for gasohol and 60 cents a gallon for ethanol, respectively. The federal tax exemption and the blender's credit are scheduled to expire September 30, 1993 and December 31, 1992, respectively. At existing gasoline prices, ethanol is not competitive without the federal subsidy.

Early on, Congress decided against subsidizing ethanol imported from another nation. In 1980 it instituted tariffs on imports of foreign ethanol to offset the federal subsidy which ethanol enjoys. The tariff began lower but has been equal to the federal subsidy for domestic ethanol since 1982.

¹This is equivalent to 40 cents for each gallon of ethanol.

Caribbean Ethanol Granted Duty-Free Status Under 1983 Act

The Caribbean Basin Economic Recovery Act (CBERA), commonly referred to as the Caribbean Basin Initiative (CBI), was enacted in August 1983 to permit duty-free imports of eligible products from designated countries² and U.S. insular possessions in Central America and the Caribbean. This duty-free treatment was the centerpiece of the CBI proposed by the administration in 1982 to promote economic and political stability by attracting foreign and domestic investment, thereby diversifying the economies and expanding exports, particularly of non-traditional products. The CBI duty-free treatment became effective in January 1984.

Duty-free treatment was granted to articles imported from a CBI country if at least 35 percent of their value was added in the CBI countries. This includes materials and direct processing costs. The Act provided duty-free treatment for 12 years for most CBI products entering the United States. A number of specific products were not granted duty-free treatment because of their import sensitivity. Fuel ethanol was not one of these.

Subsequent to the 1983 CBI legislation, several companies built dehydration facilities in CBI countries to produce ethanol for export to the United States. Rather than make the product by a process of full fermentation of local feedstock, such as sugarcane, the companies imported and dehydrated low-cost, European wine alcohol. This activity has been described as a pass-through operation.

The U.S. ethanol industry objected to pass-through operations because it believed the heavily subsidized European wine alcohol gave the Caribbean ethanol producers an unfair cost advantage in U.S. markets.

1986 Tax Reform Act Amendments

To discourage pass-through operations and encourage meaningful economic development in the Caribbean, Section 423 of the Tax Reform Act of 1986 amended the 1983 CBI legislation by restricting duty-free imports of ethanol from CBI countries. Under the amendment, the ethanol can qualify if it has been dehydrated there from CBI wet ethanol that equals at least 75 percent of the value (delivered price) of the final product. There was a phase-in period during 1987 and 1988 when the percentage requirements were 30 and 60 percent, respectively.

²The following countries are currently included under the Act: Antigua and Barbuda, Aruba, the Bahamas, Barbados, Belize, Costa Rica, Dominica, the Dominican Republic, El Salvador, Grenada, Guatemala, Haiti, Honduras, Jamaica, Montserrat, Netherlands Antilles, St. Kitts, St. Lucia, St. Vincent and the Grenadines, Trinidad and Tobago, and the Virgin Islands (British).

The Tax Reform Act amendment provided temporary exceptions for some plants already built or for which equipment had been purchased, was located in the United States, and ready for delivery to a CBI country.

1988 Trade Act

The 1988 Omnibus Trade Act made some amendments to the 1986 Tax Reform Act. The net effect was that each of six dehydration plants already built or under construction are allowed to qualify for duty-free treatment of fuel ethanol imports into the United States for up to 20 million gallons per year in 1988 and again in 1989.

Information provided to us by company officials show the dehydration facilities included under these exemptions are Tropicana and Petrojam in Jamaica, Punta Morales in Costa Rica, Allied Ethanol on Grand Bahama Island, and VIAG Fuels, Inc. and the CFC plant owned by BioCom in the U.S. Virgin Islands. The Punta Morales facility is owned by LAICA, a non-profit institution which is made up of all the Costa Rican sugar mill owners and independent sugarcane growers. Petrojam is a subsidiary of the Petroleum Corporation of Jamaica, the state petroleum corporation. The other four companies all have U.S. investors and three of them have no CBI partners.

A LAICA representative told us that its full fermentation facilities, Catsa and Taboga, also qualify for exemptions under the 1988 Trade Act.³ Because each plant has a dehydration column, in principle these plants could also be used to dehydrate imported wet alcohol. However, company officials told us it would not be economical to do so because of the added cost to transport the alcohol inland to the plants.

U.S. Ethanol Industry

U.S. ethanol production grew from 20 million gallons in 1979 to an estimated 835 million gallons in 1988. Ethanol blended gasoline accounts for about 7 percent of all gasoline sales.¹

Most ethanol produced in the United States is made from grain, primarily corn. The fuel ethanol industry evolved out of the corn processing industry, as ethanol facilities complement corn sweetener operations; some processing facilities can handle either corn sweetener or ethanol production. Revenues from the sale of production by-products and

³These two plants have an aggregate design capacity of 37 million gallons a year (MGY). However, their effective capacity is estimated at only 13 MGY.

¹Source: Information Resources, Inc., Washington, D.C.

coproducts, such as distillers dried grains, wet grain feeds, and corn oil, are considered essential to profitable operations.

Total U.S. fuel ethanol production capacity is estimated at 1.36 billion gallons a year, almost 74 percent of which is concentrated in the Midwest. One large Midwestern producer accounts for over 66 percent of the operational capacity. Three smaller Midwestern producers account for almost 20 percent of operational capacity. In the fourth quarter of 1987, there were 61 operating ethanol companies. Another 60 companies had been shut down for less than one year and 17 companies had not operated for more than one year.⁴

Some 327 million gallons a year of capacity in plants, each of which can produce 500,000 gallons a year or more has been shut down, including 121 million gallons of capacity which has been shut down for 2 years or more because of long-term inability to operate profitably. Consequently, current operating capacity is about one billion gallons.⁴ Operating capacity is more than production because all plants do not operate at full capacity.

In 1987, 28 states provided excise tax exemptions, sales tax exemptions, or producer tax credits for ethanol, ranging in value from 10 cents to \$1.40 per gallon of ethanol. Certain states impose restrictions on the applicability of ethanol incentives, such as "in-state" or "home-grown" clauses that are intended to encourage local production. There is a strong correlation between the availability and generosity of state subsidies and fuel ethanol production and market penetration.

Ethanol competes with gasoline and gasoline blending agents. The prices of gasoline and gasoline blending agents are closely tied to the price of crude oil. When oil prices dropped in 1986, so did the price of ethanol. Fuel ethanol prices, which averaged about \$1.60 a gallon in January 1986, fell to 73 cents a gallon by December, about a 54 percent decline. During the March to September 1988 period, average monthly ethanol prices varied from 99 cents to \$1.11 a gallon.

Caribbean Ethanol Production

The Caribbean has two kinds of fuel ethanol production: (1) full fermentation and (2) dehydration. The former includes a fermentation, distillation, and dehydration facility. The ethanol is produced from either sugarcane juice or molasses. The primary factor affecting the cost of full fermentation ethanol is the cost of the feedstock.

Currently, Costa Rica, El Salvador, and Guatemala have full fermentation facilities. Their combined design capacity is about 41 million gallons a year (MGY). El Salvador shipped less than 2.5 million gallons to the United States in 1985 and again in 1986, and none since. Guatemala shipped less than one million gallons in 1986 and in 1987, and none in 1988. Costa Rica shipped about 4.6 million gallons of full fermentation ethanol to the United States in 1985 and only 2 million gallons in 1986.

The CBI dehydration plants produce dry ethanol from wet ethanol through an azeotropic distillation process.⁵ Wet ethanol containing less than 95 percent alcohol must be rectified or distilled before dehydration or run through the dehydration system twice in order to reach the anhydrous level.

Tropicana and Petrojam in Jamaica; LAICA in Costa Rica; and U.S. Resources, now owned by VIAG, in the U.S. Virgin Islands have constructed dehydration facilities. Additional plants are under construction by BioCom in the U.S. Virgin Islands and by Allied Ethanol on Grand Bahama Island.

At the present time, only the two companies in Jamaica and the one in Costa Rica have produced dehydration ethanol for export to the United States. Duty-free imports from Jamaica totaled about 10 million gallons in 1985, 23 million gallons in 1986, 24 million gallons in 1987, and about 6 million gallons in the first half of 1988. Duty-free imports from Costa Rica totaled about 5 million gallons in 1987. Another facility, which is in St. Croix, exported fuel ethanol to the United States when it was owned by U.S. Resources. VIAG, which acquired the plant, is expected to begin exporting to the United States shortly.

The design capacity of the dehydration plants is as follows: Tropicana, 28 MGY; Petrojam, two dehydration facilities with a combined capacity of 52 MGY; Punta Morales, 22 MGY; and VIAG, 18 MGY. Total design capacity for the four companies that have operated, then, is 120 MGY. The unfinished facilities, BioCom and Allied Ethanol, have design capacities of 50 and 42 MGY, respectively. This brings total potential capacity to 212 MGY. However, the BioCom and Allied Ethanol facilities may never

⁵At 190+ proof, ethanol will have formed a bond with water and other impurities that cannot be broken using traditional distillation methods. Azeotropic distillation uses benzene to break this bond and remove the water and impurities to produce ethanol suitable for blending with gasoline.

be completed because of needed additional financing and investor uncertainty about the local feedstock requirements over the long run and whether they can be met.

The effective total capacity of the Caribbean dehydration facilities is considerably less than design capacity. The plants were initially designed to process 190-proof hydrous ethanol. The European wine alcohol which CBI producers primarily have been using is usually less than 190 proof and contains a number of impurities. Unless rectification towers, which process alcohol up to 190 proof, are added, the effective capacity of the plants is reduced and a plant may not even operate.

Tropicana added a rectification tower to its dehydration facility, and LAICA is constructing a rectification column at Punta Morales which should be completed by spring 1989. None of the other plants have rectification towers. Based on information provided to us, we estimated the effective capacity of the operating plants as follows⁶: Tropicana, 23 MGY; Punta Morales, 28 MGY; Petrojam, 25 MGY; and VIAG, 12 MGY. Combined effective capacity is 88 MGY.

Neither BioCom nor Allied Ethanol have rectification columns attached to the dehydration facilities they are building. If completed, their combined effective capacity is estimated at 46 MGY.

Objectives, Scope, and Methodology

As required by the Omnibus Trade Act, we made this study to determine whether CBI feedstock requirements of the Tax Reform Act are consistent with and will contribute to the achievement of the stated policy of Congress to encourage the economic development of the CBI countries through maximum use of their natural resources.

The Trade Act requires that we assess whether the local feedstock requirements of the Tax Reform Act are economically feasible for ethanol producers. If not, we were required to recommend modifications to the requirements that will (1) insure meaningful production and employment in the region, (2) discourage pass-through operations, and (3) not result in harm to ethanol producers in the United States. These objectives can conflict and thus involve policy trade offs.

⁶Information provided on both design and effective capacities from different sources was not always in full agreement.

The Act also requires that GAO assess the effects of CBI ethanol imports on U.S. producers. We focused on the impact on U.S. producers of CBI ethanol imports from the dehydration facilities.

In this report, the term “CBI countries” is used to mean those countries and insular possessions of the United States designated under the CBERA.

In making our review, we met with representatives of the U.S. Departments of State, Commerce, and Agriculture; the U.S. Agency for International Development; the Overseas Private Investment Corporation; the International Trade Commission; and the Office of the U.S. Trade Representative to get a perspective on CBI ethanol and U.S. government policy. We met with a representative of the Department of Energy to get a government perspective on the U.S. ethanol industry. We met with Congressional Research Service analysts to get an overview of ethanol in the United States and its relation to sugar both in the United States and in the CBI region. We also spoke with the U.S. Customs Service to get information on requirements for CBI ethanol imports.

We met with private sector groups with interests in the issue, including ethanol industry associations, to get their perspective on the impact of CBI ethanol on the United States and their view on the future of ethanol in the United States and with Caribbean associations to get their perspectives on the benefits to the Caribbean of ethanol. We talked to plant engineers to better understand the process and capacity of the CBI ethanol plants and with consultants for both the U.S. and Caribbean ethanol and sugar industries. We also met with an official of the Organization of American States.

We visited U.S. ethanol facilities in Illinois and met with officials of three U.S. ethanol producers to learn about their businesses and get their perspective on CBI ethanol. We visited all of the Caribbean plants exempted by the 1988 Trade Act and met with company officials. We also met with CBI ethanol marketers and alcohol brokers to learn about CBI ethanol marketing in the United States and the acquiring of feedstock for the CBI plants. During our overseas visits, we met with officials of host-nation governments, U.S. embassies, and appropriate private sector organizations to gather information and views on CBI ethanol and its benefits to the CBI countries and their sugar industries.

We reviewed legislation and U.S. government reports as well as studies on U.S. and Caribbean ethanol industries, sugar, and gasoline. We attended International Trade Commission hearings held pursuant to its

study on October 27, 1988, and reviewed briefs submitted by witnesses. We reviewed documents pertaining to the European wine alcohol situation from U.S. agricultural attaches in appropriate countries and from the European Community. We analyzed responses submitted by U.S. and Caribbean industry ethanol producers to a questionnaire distributed by the International Trade Commission. We also analyzed responses to a GAO questionnaire distributed to CBI ethanol producers.

This review was made between September 1988 and January 1989 in accordance with generally accepted government auditing standards. To meet the statutory reporting deadline, we decided not to seek agency comments on our report, but did discuss our work with appropriate agency representatives.

What Local Feedstock Requirements Are Economically Feasible?

CBI companies that have operated to date have generally had to mix some CBI feedstock with non-CBI feedstock in order to meet the 35-percent, value-added requirement of the CBERA and/or the 1987 30-percent local feedstock requirement of the Tax Reform Act. Companies which were required by the Tax Reform Act to meet a 60-percent local feedstock requirement in 1988 did not export ethanol to the United States.

To assess the economic feasibility of the Tax Reform Act requirement, we estimated what it would cost CBI companies to produce ethanol and deliver it to the United States based on a mixture of CBI wet ethanol (enough to meet the 75-percent local feedstock requirement) and European wine alcohol. We compared this result to the competitive ethanol price in the United States. We focused on European wine alcohol for the non-CBI feedstock, because that is what CBI companies have largely used and because these stocks are the source of concern to U.S. ethanol producers.

We also analyzed CBI costs under alternative local feedstock requirements and various CBI feedstock costs.

In making our estimates, we reviewed confidential data provided to us by CBI companies that have operated during the past few years on their costs of production, including the cost to acquire both European wine alcohol and CBI wet ethanol. From companies which had not yet produced or which have plants still under construction, we collected information on their estimated costs of production. We also reviewed estimates made by other industry analysts who have experience with CBI ethanol production.

Recent Production Costs

We found that production costs vary considerably from one company to another and over time. European feedstock costs can vary substantially, depending in part on the quality and alcoholic content of the wet ethanol, transportation costs involved in collecting and delivering it to the Caribbean, and the ability of CBI companies to negotiate favorable prices. Operating costs can also vary considerably, depending on the efficiency of a plant, the quality of the feedstock which is used, and whether it operates close to production capacity or not.

Table 2.1 provides a range of what we believe are representative recent costs to CBI producers to make fuel ethanol and ship it to a port on the U.S. east coast. The range of costs for European wet ethanol is representative of costs to CBI companies over the past 2 years. Operating costs

include other raw material costs (such as chemicals and denaturant), energy, direct labor, depreciation and amortization, rent, maintenance and other factory costs, as well as accrued overhead cost but excluding profit.

Operating costs vary across companies. However, data for CBI companies that we reviewed indicate that much of the variation reflects differences in capacity utilization. Because there are only a few companies and the information provided included proprietary data, we do not report a range for operating costs. Rather, we use an estimated cost of 30 cents a gallon for processing and shipping costs to the U.S. east coast. This figure is consistent with estimates reported by several industry analysts.

Table 2.1: Costs to Produce Fuel Ethanol in the Caribbean and Ship It to the U.S. East Coast

	Per Gallon Cost Using	
	100% CBI Wet Ethanol	100% European Wet Ethanol
Feedstock cost (net of by-product value)	\$1.20 - 1.40	\$0.55 - 0.70
Operating and Shipping cost	0.30	0.30
Total cost	\$1.50 - 1.70	\$0.85 - 1.00

As table 2.1 shows, the major cost component is the feedstock, and CBI wet ethanol feedstock costs are about double those of the European feedstock. Thus, CBI production costs will increase substantially as the proportion of CBI feedstock increases.

Some observers have suggested that CBI companies have been able to obtain European wet ethanol at lower prices than those shown in table 2.1. Information we reviewed showed that some purchases were made at lower prices but that most prices paid by firms during the past 2 years, after adjusting for alcoholic content and considering transportation costs, are consistent with the costs reported in table 2.1.

CBI wet ethanol costs could vary significantly in future years from the figures shown in table 2.1, since the feedstock for CBI wet ethanol used in producing fuel ethanol is sugarcane based (e.g., sugarcane juice, blackstrap molasses, etc.) and sugar prices have fluctuated widely over time.

Caribbean sugar producers receive different prices depending on the purchaser. The price relevant to producing ethanol for fuel use is the

world or “free” market price. These average annual prices, free-on-board Caribbean ports, fluctuated from a high of 29 cents a pound in 1980 to a low of 4 cents a pound in 1985. The average price for the first half of 1988 was about 9 cents a pound. One gallon of ethanol requires enough sugarcane to make about 14 to 16 pounds of sugar. Since the cost to process wet ethanol from sugar is relatively small, the cost of CBI wet ethanol is roughly proportional to sugar costs.

Simulated Production Costs Under Alternative Feedstock Requirements and Costs

Table 2.2 provides the results of simulated CBI ethanol costs under alternative local feedstock requirements, ranging from 10 percent to 75 percent. In making the estimates, we used the range of recent costs presented in table 2.1. In addition, we simulated how alternative world sugar prices (5 to 15 cents a pound) could affect CBI feedstock costs and, in turn, overall production costs.

As table 2.2 shows, with a 75-percent local feedstock requirement and based on the recent cost structure, it would cost about \$1.30 to \$1.41 a gallon to make the ethanol and ship it to the United States. The average annual price of ethanol in the United States during 1987 and 1988 was in the \$1.06 to \$1.08 a gallon range. At that price range, the 75-percent local feedstock requirement results in costs well above the price at which the ethanol can be sold.

Under the current cost structure and a 30-percent feedstock requirement, it would cost CBI companies about \$1.03 to \$1.17 a gallon to produce and ship fuel ethanol to the U.S. east coast. Thus, based upon the above prices some companies would be competitive and others would not be. If sugar prices increase to 15 cents a pound (corresponding to \$1.80 - \$2.10 a gallon CBI wet ethanol cost), the situation worsens for the CBI firms. If sugar prices decline to about 5 cents a pound (60 to 70 cents a gallon wet ethanol cost), CBI companies could compete using only CBI feedstock. However, a recent World Bank study projected that world sugar prices are likely to increase by a few cents a pound over the next several years.

With a CBI feedstock requirement ranging between 10 and 25 percent and under the current cost structure, it would cost from 91 cents to \$1.14 a gallon to make the ethanol and ship it to the United States. If sugar increases to 15 cents a pound, company costs would range from 93 cents to \$1.18 a gallon. If sugar prices drop to 5 cents a pound, all the companies that fall within the representative cost structure could compete.

Chapter 2
What Local Feedstock Requirements Are
Economically Feasible?

Table 2.2: Simulated CBI Ethanol Production Costs Under Alternative Feedstock Requirements^a

Required percent CBI feedstock ^c	Cost of CBI Wet Ethanol ^b		
	\$.60 - .70 ^d	\$1.20 - 1.40 (current cost)	\$1.80-2.10
10	\$0.86 - 1.00	\$0.91 - 1.06	\$0.93 - 1.07
15	0.86 - 1.00	0.94 - 1.08	0.96 - 1.11
20	0.87 - 1.00	0.97 - 1.11	1.00 - 1.15
25	0.87 - 1.00	1.00 - 1.14	1.04 - 1.18
30	0.88 - 1.00	1.03 - 1.17	1.08 - 1.22
60	(e) - 1.00	1.21 - 1.33	1.31 - 1.44
75	(e) - (e)	1.30 - 1.41	1.42 - 1.55

^aIncludes shipping to the east coast and U.S. Customs charges. We assume CBI feedstock is mixed with European feedstock priced at 55 to 70 cents a gallon (190 proof) and the processing and shipping costs are 30 cents a gallon.

^bThe current world free market sugar price is about 9 to 10 cents a pound. Assuming a proportional relation between this sugar price and CBI wet ethanol cost, the lower cost wet ethanol should be available when the sugar price is about 5 cents a pound, and the higher cost wet ethanol should be available when the sugar price is about 15 cents a pound.

^cConsistent with the Tax Reform Act, the simulation assumes the feedstock requirement is computed as the value of the local feedstock relative to value of the ethanol when it is imported into the United States. The value requirement was converted into an implied volume requirement assuming an ethanol value of \$1.10 a gallon.

^dWhen CBI and European wet ethanol both sell for 70 cents a gallon, production costs do not vary.

^eThe cost of CBI wet ethanol is too low to meet this specific requirement, but CBI companies can compete economically with as much as 100% local feedstock.

Relationship Between Value-Added and Local Feedstock Requirements

The relationship between the 35-percent, value-added requirement of CBERA and the local feedstock requirement of the Tax Reform Act depends on local processing costs. As discussed above, the latter varies from company to company and depends importantly on capacity utilization.

If local processing and overhead costs equal 25 cents a gallon¹, the value added to the fuel ethanol delivered to the United States for \$1.10 a gallon will be 23 percent. If the company purchases local wet ethanol at \$1.30 a gallon, one-tenth of a gallon will provide the additional value added needed to achieve 35-percent value added. Under the current cost structure, then, the 35-percent, value-added requirement is comparable to about a 10-percent by quantity local feedstock requirement or a 12-percent by value local feedstock requirement.

¹This cost is different from the 30-cent cost presented in table 2.1 because it excludes shipping and U.S. Customs costs which are not considered as part of local value added.

Given the same local processing and operating costs and delivered selling price, a 75-percent local feedstock requirement would result in more than 95-percent CBI value added.

Volume Versus Value for a Local Feedstock Requirement

Under current law, the local feedstock requirement is determined by the value of local wet ethanol plus local operating costs relative to the value of the product when it enters the United States. Some have suggested that the requirement be based on volume rather than value. For example, rather than requiring that the local wet ethanol have a value of 30 percent relative to the value of the final product, the law could require that 30 percent of the ethanol by quantity entering the United States have resulted from local wet ethanol.

Under a value standard, companies must assess the price for which they can sell their product when it enters the United States in order to determine how much local wet ethanol to mix in their product. Under a volume standard, this complication would be eliminated. Under a value standard, companies might try to use transfer pricing to boost the value of the local inputs. For example, a subsidiary of the company that produces feedstock could charge a high price for local feedstock to another subsidiary of the same company that uses the feedstock to make fuel ethanol. In this way, the company would use less local feedstock than it otherwise would.

Apart from the above considerations, it is important to point out that at the same percentage level, whatever the requirement, a volume standard is more difficult to meet. This will be the case as long as the cost of CBI ethanol exceeds the sales price at which fuel ethanol enters the United States.

Insure Meaningful Production and Employment in the Caribbean and Discourage Pass-Through Operations

In order to determine an alternative local feedstock requirement, the 1988 Omnibus Trade Act required that we consider one that would discourage pass-through operations and insure meaningful production and employment in the region.

Discourage Pass-Through Operations

Pass-through operations refer to the activity whereby European wine alcohol is imported into the Caribbean Basin, dehydrated, and subsequently exported to the United States where the fuel grade ethanol receives duty-free treatment.

Under CBERA, to qualify for duty-free treatment, an article must be the growth, product, or manufacture of a beneficiary country. The U.S. Customs Service interprets this to mean that if an article is produced by processing a different article, the new article must have been substantially transformed in the beneficiary country.

In the view of the domestic industry, the process of dehydrating European wine alcohol in the Caribbean does not result in a new or different article of commerce from beverage grade ethanol, as the only significant difference in the composition of the two is their water content. In addition, the industry has said that the azeotropic method of distillation which is used to remove most of the remaining water content is not a substantial manufacturing process. In domestic industry's view, then, the activity essentially amounts to transshipping or passing the ethanol through the Caribbean in order to circumvent the U.S. tariff on imported fuel grade ethanol.

The U.S. Customs Service examined this issue and concluded that the azeotropic distillation facilities met the substantial transformation requirement of the CBERA. In late 1985, Customs said that the azeotropic distillation of 190-proof ethanol to 199+ proof ethanol involves complex equipment, sensitive instruments, and trained personnel and that the technical nature of the equipment and the skills needed by the personnel to operate it are enough to take the operation out of the simple combining, packaging, or mere dilution category. Customs also said that the dehydration facilities involve ample capital investment and that the amount of local employment in the operation does not affect the substantial processing ruling.

Congress disagreed with the Customs Service's ruling. It decided that the CBI plants that relied primarily on non-CBI feedstock did not provide

the type of economic development opportunities that justified preferential tariff treatment. To encourage meaningful economic investment in CBI countries and greater use of local sugar supplies, the 1986 Tax Reform Act required that the fuel ethanol had to be dehydrated from CBI wet ethanol that equals at least 75 percent of the value of the final product. In fairness to companies that had made significant economic investment based on existing Customs rulings, it provided exemptions for some facilities during 1987 and 1988 up to a cap of 20 million gallons for each facility for each year. For production above the cap or from other facilities, the Act provided for a phase-in period during 1987 and 1988 with percentage requirements of 30 and 60 percent, respectively.

Our analysis indicates that, in principle, Congress could discourage pass-through operations by setting a local feedstock requirement which requires CBI companies to use as much CBI feedstock as economically feasible. However, in practice it is difficult to set such a requirement because sugar and gasoline prices are subject to considerable variation over time. The risk involved in setting a specific requirement is that, at any given time, it may be either so low as to promote pass-through operations or so high as to make CBI companies uncompetitive.

Encourage Meaningful Production and Employment

There is a substantial difference between the amount of local production and employment which is generated by a facility which primarily dehydrates foreign-produced wet ethanol and one which uses Caribbean sugar-based feedstock and full fermentation facilities to produce the wet ethanol that is then dehydrated.

According to one estimate, a 20-MGY dehydration facility should have a work force of up to 20 to 25 employees. On the other hand, a 20-MGY full fermentation plant annexed to a sugar mill would use enough sugarcane to employ 980 full-time and seasonal workers in addition to the employees who operate the distillation plant. However, given the current cost structure in the Caribbean, companies are not viable if they use only local sugar-based feedstock produced in full fermentation facilities.

Three CBI Companies Have Invested in Sugar- Based Feedstock and/or Full Fermentation Facilities

Three of the six CBI ethanol producers have invested in sugarcane fields and/or full fermentation facilities—LAICA in Costa Rica and Tropicana and Petrojam in Jamaica. These facilities are seen as a way for the host countries to decrease their dependence on the sugar market by diversifying their use of sugarcane. CBI countries have been seriously affected by substantial reductions in their allocations under the U.S. sugar quota system which, in aggregate, declined 83 percent between 1981 and 1986.

LAICA initially built two full fermentation facilities attached to sugar mills and exported full fermentation ethanol to the United States in 1985 and 1986 when the price structure was more favorable. LAICA decided to build a dehydration facility in order to continue to export ethanol to the United States when the price structure was not cost-effective for full fermentation ethanol alone. By using ethanol as a way to stabilize its sugar industry, LAICA is able to maintain employment in the sugar industry.

In late 1985, both Petrojam and Tropicana took over government-owned sugar mills which were to be closed. Each company has brought at least 6,000 acres back into production. Company officials say they have created an outlet for private cane farmers who would have lost their market if the mills had been closed. Petrojam has annexed a full fermentation facility to its sugar mill which produces hydrous ethanol for blending and dehydrating with non-CBI hydrous ethanol for export to the United States. Tropicana plans to add such a facility as well, but it will only do so when the future of CBI ethanol in the United States becomes clearer and it becomes economically feasible to do so. Petrojam has also invested in a sugar mill which was closed in Belize in order to obtain more CBI feedstock. The company says it plans to annex a full fermentation facility to it at some time in the future depending on how the local feedstock issue is resolved by Congress. In the interim, both companies create employment for hundreds of workers in the sugar industry whether or not the cane is used for ethanol production.

Other Companies

VIAG told us that it plans to meet up to a 30-percent local feedstock requirement by building a full fermentation facility and importing corn from the United States to use as the feedstock.¹ Neither BioCom nor Allied currently have plans to build full fermentation facilities.

¹ According to a company official, U.S. corn can be imported into a U.S. insular possession under Headnote 3(a) of the U.S. Tariff Schedules and be considered a local product.

CBI Feedstock Limited

A local feedstock requirement may encourage Caribbean fuel ethanol producers to make use of local resources to the extent that they can fulfill the requirement and still be competitive in the United States. However, it is important to recognize that a feedstock requirement will not necessarily result in a significant increase in production and employment in the region. One reason why is that it takes several years to develop new sugarcane fields. Substantial investments are required to plant the fields and build new full fermentation facilities.² Considering the current cost structure and that the U.S. excise tax exemption and blender's credit for ethanol are due to expire in a few years, Caribbean fuel ethanol producers are not likely to make sizable investments in new facilities at this time.

It is important to note that there may be a limit on how much feedstock fuel ethanol producers can obtain in the Caribbean region, which could affect their ability to meet a local feedstock requirement, depending on its size. Besides the time it takes to grow new cane, availability of sugarcane and molasses is affected by regulated prices of these commodities, dedication for human consumption, use as cattle feed, long-term molasses contracts, and preferred sale to traditional markets.

CBI producers told us they have experienced difficulty in obtaining adequate supplies of local feedstock. For example, one company official said he had traveled to 16 CBI countries looking for long-term feedstock contracts but was unsuccessful. Another company said potential suppliers will not sell to the ethanol industry without long-term guaranteed contracts due to the precarious status of the CBI ethanol industry. Another company said sugar producers prefer to sell to rum producers. All of the CBI producers who do not produce their own full fermentation ethanol said CBI feedstock is very expensive and not available in sufficient quantities to allow them to produce at full capacity.

Until the cost structure and outlook for ethanol improves, most companies who do not have sugar-based feedstock and full fermentation facilities for fully meeting a local feedstock requirement may try to buy CBI wet ethanol feedstock from other Caribbean companies. This has been their practice in the past for meeting the 35-percent, value-added requirement of the CBERA or the 1987 30-percent local feedstock requirement of the Tax Reform Act.

²According to an official of the Organization of American States, if distilleries were to be annexed to 26 existing sugar mills they could produce 127 MGY of ethanol. The capital investment cost would be around \$300 million.

If a local feedstock requirement is higher than can be met from available CBI supplies, production from dehydration facilities will be reduced. In this case, the foreign exchange and employment benefits which such facilities generate would also be reduced.

Benefits Provided by Dehydration Facilities

The CBI dehydration plants do create some employment and earn foreign exchange. The companies and government officials informed us that

- all dehydration plants are capital investments in CBI countries;
- although none of the companies pay customs duty, most of them do pay taxes on local purchases and salaries of employees in the CBI countries;
- the dehydration plants directly employ about 25 to 40 persons, many of whom are college-educated, as well as maintenance, security, seaport, and other contract personnel;
- these companies use and pay for local goods and services; and
- they also provide revenue for the local port authorities.

If a local feedstock requirement is higher than what is economically feasible, companies can be expected to stop producing.

CBI Governments Support Ethanol Industry

Government officials in Costa Rica, Jamaica, and the U.S. Virgin Islands told us that they support the development of their ethanol industries under CBI. The most important benefits are foreign exchange earnings and creation of employment. U.S. Virgin Islands officials see ethanol as a way to reduce dependence on tourism. In Jamaica and Costa Rica, the governments see ethanol as a way for the countries to diversify their use of sugar and maintain employment in the sugarcane industry. In Costa Rica, LAICA is owned by the sugar industry, so income from the country's ethanol industry, both full fermentation and dehydration, is split among all LAICA members, thereby benefiting the entire industry. LAICA and Petrojam officials told us that they will maximize use of local feedstock in all of their ethanol exports to the United States, regardless of a local feedstock requirement, to the extent that they remain competitive.

All CBI government officials we spoke with expressed concern because the United States changed the rules for CBI investments in ethanol by establishing the local feedstock requirements after investments had

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already been made. They say the change has created a climate of uncertainty which is not conducive to further CBI investments in Caribbean countries.

Impact of CBI Ethanol Imports on the U.S. Ethanol Industry

The 1988 Omnibus Trade Act required that we assess the impact of CBI ethanol imports on U.S. ethanol producers. If we found it necessary to recommend a modification to the existing local feedstock requirement, we were asked to recommend one that would not result in harm to the U.S. ethanol industry.

The impact of CBI ethanol imports on the U.S. industry will depend on their size. This, in turn, is related to the size of the local feedstock requirement, CBI plant capacity, and CBI producers' ability to secure low-cost European wine alcohol. It also depends on developments in the U.S. ethanol market that are independent of CBI imports.

CBI Ethanol Imports

To date, the largest amount of CBI fuel ethanol imports into the United States occurred in 1987, about 29 million gallons or about 3 percent in a total U.S. market of over 800 million gallons. Questionnaire responses from several U.S. ethanol producers to the International Trade Commission in the fall of 1988 indicated little impact to date from CBI imports. Only a few examples of price suppression or lost sales over the past several years were provided.

However, if Congress lowers the local feedstock requirement, future CBI ethanol imports could be considerably larger. As discussed in chapter 1, currently operating dehydration facilities in the Caribbean region have an estimated aggregate effective capacity of about 88 MGY. The amount of future CBI dehydration capacity that could affect the U.S. industry appears to range between 88 to 212 MGY.

Surplus European Wine Alcohol

The European Community (EC) and its member nations have large quantities of surplus wine alcohol. Beginning in 1970, the EC established intervention mechanisms for supporting wine prices, including distillation of table wine into wine alcohol when there is a serious imbalance in the wine sector. There currently is a structural production surplus of about 30 percent.

Distillation of the surplus wine differs according to whether it is voluntary or mandatory and who becomes the owner of the alcohol. Under voluntary distillation, the stocks are owned by private distillers. Under mandatory distillation, the stocks are owned by member states or the EC; in both of these cases, the stocks are held by member state intervention agencies. The stocks are heavily subsidized.

To date, all of the European wine alcohol purchased by CBI ethanol producers has been bought through intervention agencies or alcohol brokers. Most CBI companies told us that it is difficult to purchase European wine alcohol stocks of adequate quality and at prices which would allow them to produce fuel ethanol at a price competitive in the U.S. market.

In December 1988, the EC approved a proposal for disposing of surplus mandatory alcohol stocks. The Commission of the EC advised us that the stocks on hand equaled about 264 million gallons of alcohol at the end of 1988. The stocks are at least 92-percent alcohol by weight. The Commission has also estimated that during the 1989-1992 period an additional 291 million gallons of wine alcohol will be acquired by the intervention agencies.

The EC plans to sell a sizable part of the 264 million gallons of existing stocks during 1989 and additional stocks that it acquires in the next several years. In September 1988, the Commission outlined a proposal for selling about 200 million gallons in 1989 and about 110 million gallons in each year from 1990 through 1992. It estimated that by the end of 1992 the only surplus intervention stocks left would be those purchased during that year (estimated at 58 million gallons). However, this depends on how successful the EC is in reducing the surplus in wine production; their repeated efforts over the past 25 years to bring the market into balance have not succeeded.

In addition to the intervention stocks, millions of gallons of wine alcohol accrue from the EC voluntary distillation. The Commission advised us that it is difficult to assess the size of these stocks, but it estimated that if no sales had occurred in recent years, their size at year-end 1988 would have been about 345 million gallons. The Commission did not estimate the extent to which recent sales reduced the stocks. An alcohol broker we spoke with said that the voluntary stocks are minimal, since the practice of the private distillers is to sell the inventory as it is produced.

According to information we received from industry sources, aside from the EC surplus alcohol stocks, the French intervention agency has about 26 million gallons of surplus stocks and the Italian agency about 50 million to 100 million gallons. However, the French stocks are said to be unsuitable for the fuel market due to their quality and price, and the Italian agency may not sell any of its stocks in 1989.

Amount of the Alcohol Stocks Available to CBI Producers Uncertain

If CBI ethanol producers could purchase all the intervention stocks which the EC plans to dispose of over the next several years, the purchases could average about 105 to 135 MGY. This would be more than enough to sustain the estimated current effective CBI capacity of 88 MGY but far short of a potential future capacity of 212 MGY. However, it is questionable whether CBI producers will be able to acquire all or even most of these stocks.

The EC has not decided into which markets it will sell the alcohol. It wants to avoid disturbing EC industrial and beverage alcohol markets, so it may preclude sales to these sectors. At the same time, it has said that preference must be given to the EC fuel sector without excluding any other sales opportunities. Given low crude oil and gasoline prices, however, the stocks may not be attractive to most oil refiners.

The EC stocks are to be sold by tenders, and to the extent stocks are available for sale outside the EC, CBI producers will have to bid against other interested parties. Some industry sources indicate that there are buyers who want to purchase large amounts of the stocks for import into Brazil for use in its fuel ethanol program. The purchases would reportedly free up some of Brazil's ethanol, which is made from sugar and is of a higher quality than the wine alcohol stocks, for sale to Japan.

According to some industry sources, EC officials have indicated they will sell about 80 million to 105 million gallons of the alcohol stocks in 1989. About one-half of this amount would be for export, and of that about 60 percent might be sold for the fuel sector. If so, the maximum amount of EC stocks sold to the fuel sector in 1989 would be about 32 million gallons.

Timing is a final factor which may limit the amount of stocks purchased by the CBI producers. A large amount of the EC stocks may be sold in the spring of 1989, but CBI producers may not be willing to bid for large amounts until and unless the Congress revises current law requiring all CBI producers to meet the 75-percent local feedstock requirement after 1989. Since Congress may not act on this issue until after the spring, much of the stocks for sale in 1989 could be bought by others.

Developments in the U.S. Market

In addition to the size of CBI imports, impact on U.S. producers depends on (1) what it costs U.S. companies to produce ethanol and hence their ability to compete, (2) what happens to crude oil and gasoline prices; (3) the role of state subsidies, (4) what U.S. and CBI companies do to further

develop U.S. markets for ethanol, (5) whether Congress extends the favorable federal tax treatment for fuel ethanol to the year 2000, and (6) whether ethyl tertiary butyl ether, which is made from ethanol, receives favorable tax treatment.

Cost Structure of the U.S. Industry

U.S. costs to produce ethanol have been estimated as low as 57 cents a gallon to as high as \$1.80 a gallon. Information Resources, Inc., in a September 1988 study¹, estimated production costs of 57 cents a gallon in a low cost plant with corn costing \$1.70 a bushel and \$1.55 a gallon for a high cost plant with corn costing \$1.90 a bushel. These estimates considered net feedstock costs; direct manufacturing expenses (energy, chemicals, labor, and maintenance) related to the plant; and fixed costs of taxes, insurance, and interest related to the plant.

In 1987, the National Advisory Panel on Cost-Effectiveness of Fuel Ethanol Production cited a range of production costs from 80 cents a gallon for a low cost plant to \$1.80 a gallon for a high cost plant. These estimates accounted for net feedstock costs, direct manufacturing expenses, and fixed costs of depreciation, interest, taxes, and insurance related to the plant.²

U.S. producers' ability to compete will depend importantly on prices for corn and corn by-products, which significantly affect their costs of production and vary considerably from one year to the next. From 1981 to 1986, the average cost of corn to wet millers was \$2.72 a bushel, which was equivalent to \$1.09 a gallon of ethanol. In 1987, corn cost \$1.59 a bushel, or 64 cents a gallon. The average net corn cost to wet millers after deducting for by-product credits, was 56 cents a gallon of ethanol during 1981 to 1986, and 12 cents a gallon in 1987.

Corn prices are currently high due to the 1988 drought which resulted in a dramatic drop in carryover corn stocks. This, in turn, is expected to result in a significant increase in corn acreage in 1989, an increase that had not been expected to occur until the early 1990s. Wharton Econometric Forecasting Associates recently forecast that corn prices will remain high in 1989 (e.g., \$2.62 a bushel for No. 2 yellow, Omaha). However, in the absence of another severe drought and production

¹Understanding the Challenges and Future of Fuel Alcohol in the United States, a report prepared for the U.S. Department of Energy.

²Fuel Ethanol Cost-Effectiveness Study, a report prepared for the Congress and Secretary of Agriculture, Nov. 1987.

shortfall, they estimated that corn prices will range from \$2.09 to \$2.37 a bushel between 1990 and 1995.

Crude Oil and Gasoline Prices

Changing oil prices in the past few years have significantly affected ethanol's ability to compete with gasoline. World crude oil prices averaged \$30.70 a barrel between 1980 and 1985. However, they declined dramatically in early 1986 and averaged only \$16.37 a barrel between 1986 and the end of the third quarter of 1988. As a result, fuel grade ethanol has sold for about 45 to 75 cents less a gallon than it did during 1980 to 1985.

If crude oil prices increase during the next several years, ethanol producers should be able to increase their prices and offer more of a price incentive in seeking to find new outlets for their product. A January 1989 price projection by the Energy Information Administration shows world crude oil prices ranging from about \$14.00 in 1989 to \$21.00 in 1995 (1988 dollars).³ Of course, such projections are subject to considerable uncertainty.

State Subsidies

Many states have provided ethanol tax incentives. Growth in U.S. sales during the past decade has been particularly strong in such states, since they have often allowed ethanol producers to charge 20 to 40 cents more a gallon for their product. Reportedly, for many companies the subsidies have often meant the difference between making a profit or not.

CBI ethanol is not eligible for tax incentives in most states. This gives domestic producers an important advantage. However, during the past few years, a number of states have reduced or eliminated their subsidies and more states are expected to do so during the next few years. In January 1987, 28 states provided tax incentives whereas in January 1989 only 23 states had them. During 1988, incentives were eliminated in several states which have been major sales areas, including Alabama, Tennessee, and Kentucky.

Development of New Markets

Between the beginning of 1979 and the end of 1985, U.S. ethanol sales increased rapidly, at an average of 73 percent a year. Since then, however, sales have stagnated, increasing an average of 2 percent a year

³Under alternative cases, it projected that prices in 1995 might be as low as about \$17.00 a barrel or as high as \$24.00 a barrel.

during 1986 to 1988. Low oil prices since early 1986, declining state subsidies, and high corn prices from the 1988 drought contributed to the stagnation.

Fuel ethanol blend consumption accounts for about 7 percent of the U.S. gasoline motor fuel market and varies significantly by region of the country. For example, ethanol is represented in about 17 percent of gasoline sales in the Midwest, 3 percent on the west coast, and less than 2 percent on the east coast. Thus, industry analysts believe ethanol sales are far below their potential.

Caribbean producers say there is considerable potential for expanding existing markets and opening new markets, particularly in coastal areas, and indicate that is where they will concentrate. They note that if ethanol market penetration on the Eastern Seaboard increased to 5 percent, ethanol sales would increase by about 150 MG, which would represent a large proportion of maximum anticipated CBI production capacity.

Caribbean producers say that coastal markets are essentially closed to high-volume distribution by U.S. ethanol producers due to unfavorable transportation economics and a general absence of available state subsidies. Data we reviewed show that relative to national ethanol sales of about 850 MG, more than 150 million gallons of domestic ethanol were sold in coastal states in 1987.

Caribbean producers say that because of the cost of transportation they frequently cannot compete in Midwest markets where the U.S. companies sell most of their ethanol production. Information we reviewed indicated shipping costs of about 4 to 8 cents a gallon to east and southern coast states, about 10 cents a gallon to the west coast, and 10 to 17 cents a gallon to Midwestern states.

Domestic producers say domestic markets are saturated⁴ and that CBI producers will primarily market their goods to existing customers of domestic producers on the basis of price and in both Midwestern and coastal markets. They say there is little economic incentive for CBI producers to expend the time and resources to create new markets when established, readily accessible, and profitable domestic markets already

⁴The difficulty of assessing the U.S. market is illustrated in the following example. A detailed June 1985 study concluded that the market was entirely saturated, that 1985 domestic sales would not exceed 655 million gallons, and that, due to competition from foreign ethanol, U.S. production would only reach 555 million gallons. However, actual U.S. ethanol production in 1985 was 650 million gallons and ethanol sales were 793 million gallons.

exist. They claim CBI ethanol will displace domestically produced ethanol, which cannot compete with CBI ethanol.

Marketers of CBI ethanol believe that they can earn more by opening up new coastal markets than competing head-to-head with domestic producers in existing markets. An important point about this debate is that companies must be able to offer a stable source of supply. Gasoline marketers and retailers have to make special preparations and investments to handle gasohol. To date, Caribbean producers have been handicapped because of uncertainties about whether and, if so, how much ethanol they could import duty-free into the United States. Of the four companies which had exported to the United States, two had to cease exports in 1988 because they could not meet the 60-percent local feedstock requirement; one was forced to close down operations because it could not meet the requirement; and the other was exempted from the local feedstock requirement.

CBI ethanol producers told us that they have not been able to guarantee regular supplies to potential new customers who are looking for reliable, long-term ethanol supplies. One marketer of CBI ethanol told us that at least three oil companies are willing to buy from CBI producers if the latter show they can be reliable suppliers. If Congress sets new local feedstock requirements that CBI companies can meet and if it appears these requirements will not change in the future, CBI companies should be better positioned to develop new markets.

Other considerations relevant to developing new markets are octane value and air pollution problems. Ethanol has competed in the transportation fuels market primarily as a blending agent for extending gasoline supplies. However, the octane of ethanol is about 30 percent higher than regular gasoline and ethanol has also been sold for its octane value. If ethanol were marketed more as an octane enhancer, additional profitable markets might result.

Many areas in the United States have failed to meet ambient air quality standards for carbon monoxide, as required by the Clean Air Act. Studies of the emissions performance of oxygenated fuels, such as ethanol, show that carbon monoxide emissions are reduced. In June 1987, the State of Colorado adopted mandatory use of oxygenated fuels during the winter months in Denver and nearby areas. The requirement is being met by blending gasoline with ethanol or methyl tertiary butyl ether (MTBE). In Arizona, a mandatory program got underway in Phoenix during winter 1988 to 1989 and a program will start in Tucson in October

1990. Nevada has adopted a mandatory program for Las Vegas which will begin in the fall of 1989. A voluntary program got underway in Albuquerque, New Mexico, in November 1988. Oxygenated fuels programs are also being examined in California and New York City. Air quality concerns and octane demand in northeastern states may improve opportunities for ethanol to break into or expand in these markets.

Possible Extension of the Federal Tax Exemption

An April 1988 study by the Department of Agriculture's Economic Research Service (ERS) found that many industrial facilities, including abandoned corn wet mills, could be converted to ethanol plants. With \$2.00 a bushel corn and the current 60-cent excise tax exemption for ethanol, ERS said, the use of existing industrial sites results in ethanol being competitive with \$18.00 a barrel crude oil. With additions to existing wet mills, ethanol is competitive with \$13.00 a barrel crude oil.

ERS said that major expansion of the domestic industry was not occurring because favorable existing conditions are unlikely to continue long enough to recoup capital investment except for inexpensive additions to already operating ethanol facilities. In general, ERS said, industry expectations include continued low corn prices and modest increases in crude oil prices, both favoring ethanol industry expansion. The major expected negative effect on ethanol competitiveness, it said, is the expiration of the federal excise tax exemption in 1993. A plant planned today, under expectations common in the industry, would begin operating around 1990, operate profitably for 3 years, and suffer losses at least through the year 2000.

ERS concluded that extending the excise tax exemption to the year 2000 would provide the incentive to expand U.S. ethanol production by as much as 1 to 2 billion gallons by 1995. If the U.S. industry expanded by this much, the impact of CBI ethanol imports on the domestic industry would be reduced. U.S. corn growers, who are concerned about reduced markets if the domestic ethanol industry loses sales to CBI ethanol imports, would experience increased demand for corn.

Possible Impact of ETBE on Ethanol Demand

A final factor which could significantly affect demand for ethanol in the United States is the oil refining industry's growing interest in ethyl tertiary butyl ether (ETBE), still in the research stage, for enhancing motor fuel octane. As a result of the lead phasedown and increasing demand for gasoline and higher octane unleaded gasoline, the U.S. refining industry has been straining to meet octane demand.

Ethanol is a major component used in the manufacture of ETBE. If the U.S. Internal Revenue Service rules that ETBE is eligible for the same favorable tax treatment as ethanol and if ETBE is successfully commercialized, there could be substantial added demand for ethanol. ETBE would compete against MTBE, which is made using methanol. In 1988, over 1.2 billion gallons of MTBE were blended with gasoline.

ETBE and MTBE are more attractive to the U.S. petroleum industry than ethanol and methanol. They can be blended at the refinery because they are fungible or transportable in the existing gasoline distribution system. They are less volatile; consequently, drivability problems are not expected and evaporative emissions should be reduced. In addition, there may be other important air quality benefits. According to an industry analyst we spoke with, if ETBE is commercialized, the U.S. market for ethanol could expand by from 400 million gallons to 1 billion gallons by 1995. The most likely addition, he said, would be 650 million gallons.

Possible Harm to U.S. Producers of a Lower Feedstock Requirement

As the above discussion indicates, it is difficult to assess in advance the impact of a lower feedstock requirement on the U.S. ethanol industry. CBI ethanol imports to date have been relatively small. Current effective capacity of dehydration plants is considerably larger and could increase considerably in the future. Moreover, it is not clear whether CBI producers could secure sufficient quantities of low-cost European wine alcohol to supply their existing capacity. Also, the ability of U.S. producers to compete depends importantly on what happens in the U.S. market independent of CBI imports.

212 MGY seems to be an upper limit on the amount of CBI ethanol imports into the United States but that depends on completion of two plants, upgrading of some other plants, and no other facilities being built. At this time, effective capacity is about 88 MGY. If a few plants which are already operating are upgraded, effective capacity would increase to 120 MGY.

It is questionable whether Caribbean producers can currently secure sufficient quantities of surplus European alcohol stocks to supply 88 to 120 MGY of capacity. If the EC succeeds in its objective of substantially reducing the structural surplus in wine production over the next several years, CBI producers may no longer be able to secure low-cost European wine alcohol.

Chapter 4
Impact of CBI Ethanol Imports on the U.S.
Ethanol Industry

If one assumes that CBI ethanol imports will fully displace domestically produced ethanol, then relative to 1988 sales of about 850 million gallons, 88 to 120 MGY of imports would represent 10 to 14 percent of the market. If, on the other hand, one assumes that CBI producers successfully seek new outlets for at least one-half of their product, the impact would range between 5 and 7 percent. As earlier noted, CBI ethanol imports accounted for about 3 percent of the U.S. market in 1987.

If corn prices are low, CBI producers will find it harder to displace existing markets of U.S. producers. If oil prices increase, both CBI and U.S. producers will be better positioned to develop new markets.

If Congress extends the favorable federal tax treatment for ethanol to the year 2000 and/or if ETBE receives the same tax treatment and is commercialized, the U.S. ethanol industry may expand considerably. In this case, the impact of CBI ethanol imports relative to the total U.S. market would be reduced.

Chapter 5 examines three options for altering the current feedstock requirement.

Possible Modifications to the Scheduled 1990 Policy

Given the current cost structure and recent prices, it is not economically feasible for CBI ethanol producers to meet the 75-percent local feedstock requirement. As required by the Omnibus Trade Act, we assessed possible modifications to the 75-percent local feedstock requirement for promoting the following policy objectives: (1) insure meaningful production and employment in the CBI region, (2) discourage pass-through operations, and (3) not result in harm to U.S. ethanol producers.

At current prices, CBI companies can be competitive with no more than a 10 to 30-percent local feedstock requirement. Therefore, the 75-percent requirement will not permit CBI producers to be competitive and contribute to the economic development of CBI countries. To date, ethanol imports from CBI countries have been small and have not had much impact on the U.S. market. However, eliminating any requirement would give CBI ethanol producers an advantage in the U.S. market if the CBI companies can obtain subsidized European wine alcohol supplies at low prices.

Setting a local feedstock requirement based on today's market conditions is difficult because its impact can vary significantly as sugar, corn, and/or oil prices change. Prices for these commodities have varied substantially in the past. In addition, individual company cost structures differ.

An added difficulty in modifying the 75-percent local feedstock requirement as contemplated by the 1988 trade legislation is that the several policy objectives of the legislation are in conflict. Thus, the three options discussed below are presented only to show the possible range of options available depending on the priorities of Congress.

1. Set a much lower local feedstock requirement, say 10 percent in the first year, possibly rising to 20 then to 30 percent in later years.
2. Eliminate the feedstock requirement, while maintaining the 35-percent, value-added requirement of the original CBERA.
3. Permanently extend 20 MGY caps for all companies which are currently exempted through 1989 under the Omnibus Trade Act; establish a 30-percent or higher local feedstock requirement for additional production above the 20 MGY caps for exempted plants and for all production of any new plants.

Set Lower Local Feedstock Requirement

Based on the analysis of the recent cost structure (see ch. 2), it appears that most companies could meet a 10-percent feedstock requirement and some could meet perhaps as high as 15 to 30 percent. Under the assumption that oil prices will increase in future years, Congress could require that companies initially meet a 10-percent requirement, with increases to 20 or 30 percent in future years. This would be in addition to the 35-percent, value-added requirement of CBERA.

Effects of this option are that

- all companies would be required to use certain amounts of local feedstock, thus promoting use of local resources;
- most companies could probably meet a 10-percent requirement; therefore, they could continue in business and provide some benefits to the host countries;
- because of differing circumstances concerning access to local feedstock, some companies may not be able to compete—one CBI company said it could not meet a 10-percent requirement—and companies which go out of business will not contribute anything to the local economy;
- if a requirement is set to meet the lowest common denominator, companies that could meet a higher requirement may choose not to do so; to the extent they do not, reliance on low-cost imported feedstock will continue; and
- at least some companies can be viable at the 10 to 30-percent level with the current cost structure of the industry and world oil prices; however, with changing prices of sugar and oil, for example, these percentages would no longer be appropriate.¹

¹In principle, to promote maximum CBI production and employment, one could mandate a feedstock requirement which is adjusted over time to reflect changes in sugar and gasoline prices. For example, as sugar prices fall and/or gasoline prices rise, the local feedstock requirement would increase. However, short-term changes in a feedstock requirement will not guarantee increased production and employment in the region. Until the cost structure and outlook for ethanol improves over the long-term, CBI ethanol companies may simply compete for existing CBI sugar and wet ethanol supplies that have other uses. A variable feedstock requirement could also be cumbersome to implement.

Eliminate Local Feedstock Requirement; Maintain 35-Percent Value-Added Requirement

Effects of this option are that

- it meets the original intent of the CBERA—as such, it would not change the rules in the middle of the game; it should reduce uncertainty about U.S. implementation of CBI and thus contribute to a better investment climate in CBI;
- it would allow all currently exempted plants to continue to operate as long as they could meet the 35-percent, value-added requirement; CBI companies have used some local feedstock to meet this requirement;
- some existing companies may not make as much use of existing local feedstock as they would with a local feedstock requirement; and
- to the extent that CBI companies continue to use predominantly low-cost imported feedstock, U.S. companies could face increased competition.

Continue Existing Exemptions; Set Local Feedstock Requirement for Additional Production

This option would permanently extend the exemption for all companies that are currently exempted through 1989 and set a 30-percent or higher feedstock requirement for any production above the 20 MGY caps and for all production of any new plants. Effects of this option are that

- investments undertaken in response to the CBI program will be preserved as long as they can meet the 35-percent, value-added requirement; companies would continue to contribute to local economies;
- the ceiling on exempted imports limits imports of CBI ethanol that rely heavily on low-cost European wine alcohol;
- it would encourage further development of local resources when it is economically feasible to meet the higher local feedstock level required above the 20 MGY per company ceiling; and
- for the first 20 MGY each, exempted companies may not make as much use of local feedstock as they would with a feedstock requirement.

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