

ETHANOL: LESSONS FROM BRAZIL

by David Sandalow

Ethanol is hot. In the United States, production increased by more than 20% in 2005. The nation's 97 ethanol plants are operating at close to full capacity, with another 33 plants under construction. Politicians from President George W. Bush to Senator Richard Lugar to Senator Barack Obama to Democratic National Committee Chair Howard Dean all support aggressive programs to promote ethanol.

Yet today ethanol provides only about 3% of the United States' transportation fuel. Few experts expect this figure to increase to more than 7% by 2010. In Brazil, in contrast, ethanol provides more than 40% of the fuel for transportation. Flex-fuel cars – capable of running on gasoline or ethanol -- grew from less than 1% of the Brazilian new car market in 2001 to more than 70% today.

As the United States explores ways to reduce oil dependence, many observers are looking south for guidance. This paper summarizes the history of the Brazilian ethanol program, describes the program's current status and considers lessons for the United States from the Brazilian experience.

1. History

The early 1970's were a boom time in Brazil, with many observers heralding the "Brazilian economic miracle." Yet President Ernesto Geisel faced twin problems. First, the cost of Brazil's oil imports tripled in late 1973, due to the Arab oil embargo. Second, world sugar prices, which had been climbing upward since the mid-1960's, declined sharply in 1974.

Faced with these problems, Geisel launched the Brazilian National Alcohol Program in late 1975. The program was intended to reduce the need for oil imports and provide an additional market for Brazilian sugar. As a first step, the federal government immediately began promoting the production of ethanol for blending into gasoline, to the maximum extent feasible in existing vehicles (approximately 20% by volume).

In promoting ethanol, Geisel's government had many tools at its disposal. (Brazil's government during this era was both a central player in the nation's economy and a military dictatorship.) First, the government offered credit guarantees and low-interest loans for construction of new refineries. Second, a state trading enterprise began purchasing ethanol at favorable prices. Third, gasoline prices were set to give ethanol a competitive advantage. Fourth, a marketing program was launched, with the slogan "Let's unite, make alcohol." Finally, the state-owned oil company, Petrobras, began making investments for distribution of ethanol throughout the country.

The results were dramatic. Between 1975 and 1979, ethanol production increased more than 500%.

A second stage of the program was launched in 1979, when the Brazilian government signed agreements with major car companies to install assembly lines for 100% ethanol cars. Participating companies – including Fiat, VW, Mercedes-Benz, GM and Toyota – agreed to produce 250,000 ethanol-only cars in 1980 and 350,000 in 1982. A government program provided taxi drivers with incentives to convert their cars to 100% ethanol. Several leading race car drivers made highly visible use of 100% ethanol cars.

During the early 1980's, the Brazilian ethanol program flourished. With the help of government pricing policies, which kept the cost of ethanol to consumers significantly cheaper than the cost of gasoline, ethanol production more than tripled between 1979 and 1985. A World Bank loan helped cover costs of the program. By the mid-1980's, ethanol made up roughly half of Brazil's liquid fuel supply.

In 1985, however, Brazil's ethanol program began to experience problems. World oil prices dropped sharply in 1985-86, reducing the immediate benefit of replacing oil imports with ethanol. At the same time, Brazil faced serious inflation problems and began a series of difficult economic reforms. As part of a broader cut back on subsidies, the price differential between ethanol and gasoline was eliminated, soft loans for the construction of new refineries were cut, and support for the ethanol program from state trading companies was slowed and then stopped.

These changes had a significant impact on ethanol production, which stagnated. By the late 1980's ethanol production even began to decline slightly, as world sugar prices rose and export markets for refined sugar became more profitable.

Yet these trends in ethanol production had little immediate impact on Brazilian automakers, which continued to manufacture ethanol-only cars in increasing amounts. By the late 1980's, almost all new cars in Brazil were made to run on ethanol only. The result was a serious shortage of ethanol in 1990. In a rich irony, Brazil was forced to import ethanol and turn to methanol blends to keep cars on the road.

Political support for the ethanol program evaporated. Brazilian auto manufacturers quickly retooled to build gasoline cars. By the mid-1990's, only fleet vehicles (such as taxis and rental cars) were being made to run on ethanol.

The 1990's were a quiet decade for Brazil's ethanol program. With deregulation and privatizations underway throughout the Brazilian economy, and world oil prices low, there was little political support for returning to programs of the kind that helped build Brazil's ethanol infrastructure during the '70's and '80's. Nevertheless, throughout this period, the national government continued to require that all gasoline sold in Brazil contain roughly 20% ethanol by volume.

As the decade progressed, some Brazilian engineers and policymakers showed increasing interest in flex-fuel vehicles of the kind being built by U.S. manufacturers seeking credits under the CAFÉ law. Toward the end of the 1990's, several auto manufacturers began talking with the Brazilian government about manufacturing flex-fuel vehicles for the Brazilian market.

In 2001, the Brazilian government agreed to treat flex fuel vehicles as ethanol-fueled, entitling FFV's to preferential tax treatment (a 14% sales tax, as compared to a 16% sales tax on non-ethanol cars). Ford launched the first flex fuel prototype in 2002, with VW following in 2003.

2. Brazilian Ethanol Program Today

Today ethanol provides roughly 40% of transportation fuels in Brazil, a higher percentage by far than in any other nation. In 2005 Brazil produced just over 4.23 billion gallons of ethanol, roughly the same as the United States (which produced 4.26 billion gallons).

The most dramatic development in the Brazilian ethanol program in recent years has been the explosive growth of flex-fuel vehicles. In November 2004, FFV's represented 30% of new car sales in Brazil. For calendar year 2005, the figure was 53%. In February 2006, more than 70% of new cars sold in Brazil were flex-fuel.

Production costs for ethanol in Brazil are the world's lowest. UNICA, the industry trade association, estimates average production costs of approximately US\$0.80 per gallon (Estimates of costs in the U.S. vary from US\$0.90 - US\$1.30 per gallon.) A favorable climate, low labor costs and mature infrastructure built up over several decades are among the factors producing this advantage.

The Brazilian government's principal intervention on behalf of its ethanol industry is the requirement that all gasoline sold contain a minimum percentage of ethanol. This blending ratio is currently set at just over 20%. In addition, the government provides a slight tax preference for the purchase of new flex-fuel cars (14% sales tax, as compared to a 16% sales tax on gasoline-only vehicles, as noted above). Brazil maintains a 30% tariff on imports of ethanol and 20% tariff on imports of sugar. Government price-setting for ethanol in Brazil was phased out during the 1990's.

Brazil is currently courting export markets for ethanol, focusing on Asia and North America. Petrobras recently signed a deal with Mitsui to pursue study ethanol logistics for the Japanese market.

The ethanol industry enjoys widespread political support in Brazil today. The industry takes credit for more than 1.8 million jobs in Brazil and for replacing, since 1976, more than 1.44 billion barrels of oil. Brazilian ethanol refineries generate their own process heat and electricity from portions of the sugar crop known as "bagasse," with many refineries selling surplus electricity into the grid. Ethanol contributes significantly to

improving air quality in Sao Paulo and to cutting emissions of heat-trapping gases from the Brazilian transport sector.

In March 2006, ethanol prices reached record highs due to sharp increases in global prices for refined sugar. In response, the government reduced the mandated blending ratio from roughly 25% to 20%. Possible supply shortages are looming, as sugarcane growers divert ethanol feedstock to the refined sugar market. With oil prices also reaching record highs, market analysts differ with regard to likely growth trajectories for Brazil's ethanol industry in the months and years ahead.

3. Lessons for United States

Brazil and the United States share many characteristics. Both are continent-sized countries. Both are agricultural powerhouses. Both have mature domestic automobile industries.

There are many differences between the two countries, of course. Brazil's climate is warmer. Brazil's wage rates are lower. Cultural attachments to the automobile are different in each country. Brazil's government, until recently, owned key industries and set prices throughout the economy.

With these comparisons as background, what lessons can the United States draw from Brazil's ethanol program? I suggest five.

First, rapid expansion of ethanol production capacity is possible with government support. Matching the growth rates in the Brazilian industry during the 1970's – when ethanol production grew 500% from a small base in just a few years -- is not a realistic objective. But the Brazilian experience suggests several policy tools that could be used in the U.S. today. Credit guarantees and low-interest loans such as those used in Brazil could help speed construction of the first generation of commercial cellulosic ethanol plants. (The Energy Policy Act of 2005 includes authorization for such programs, though Department of Energy guidelines and appropriations are needed to make those programs a reality.) Mandates for blending ethanol into the fuel supply – part of the Brazilian program since its inception -- can provide powerful signals to producers and help promote rapid growth in capacity.

That said, we should be careful in drawing conclusions about rapid supply expansion from the Brazilian experience of the '70's. Several subsidies provided by the Brazilian government in that era – such as infrastructure investments by a state-owned oil company – could not be duplicated in the U.S. today. Rather than look for ways to duplicate policies of the Brazilian government 30 years ago, we should identify the specific objectives of those policies and ask how these objectives could best be achieved under current conditions. In the absence of a state-owned oil company, for example, how should the cost of converting distribution infrastructure (such as service station tanks) best be funded? If promoting rapid expansion of ethanol consumption is our larger goal, we need to devise a uniquely U.S. answer.

A second lesson from Brazil – consistency counts. Perhaps the most important part of Brazil’s ethanol program over the past three decades has been the requirement that ethanol make up a certain percentage of the fuel supply. The Brazilian government has used this requirement to help control the ethanol market, varying the percentage somewhat depending on market conditions. Yet even during periods of relatively modest political support for the ethanol program, such as the 1990’s, the requirement did not disappear. This was important in sustaining the industry through hard times.

A third lesson -- any ethanol program must anticipate commodity price swings. Enthusiasm for ethanol is always highest when oil prices are high and sugar prices low. Yet the relative prices of oil and sugar will vary with time.

One essential way to prepare for price swings is with flex-fuel vehicles. The explosive growth of FFV’s in Brazil during the past few years is a hopeful sign – both about the ability of auto companies quickly to scale up production and the instant acceptance of such cars by consumers. Precisely because commodity prices will vary, as Brazil saw in the ‘80’s, a vehicle fleet in which FFV’s predominate is essential to a successful long-term ethanol program

Fourth, public attitudes change quickly. In the 1970’s and early 1980’s, enthusiasm for ethanol in Brazil was high. In the late ‘80’s and early ‘90’s, public support collapsed with astonishing speed amidst shortages in supply. In the past several years, enthusiasm climbed steeply with higher oil prices and flex-fuel cars. Policymakers should anticipate and plan for significant short-term swings in public attitudes on ethanol, in response to market conditions and other factors.

Finally, ethanol technologies improve steadily with time. This is true of almost all technologies, but the Brazilian experience of the past 30 years provides some compelling data when it comes to ethanol. Between 1975 and 2000, production of ethanol per hectare in Brazil more than doubled. During the same period, harvesting costs fell by half. We can anticipate similar improvements if the U.S. ethanol industry grows substantially – staying “hot” -- in the years ahead.

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