

Brazil's Experience with Bioenergy

Brazil's ethanol industry today is an efficient sector that brings substantial economic benefits

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Brazil is the second largest world producer of ethanol, a biofuel used mainly in automobiles as an additive or alternative to gasoline. Although Brazil's program, started in the mid-1970s, was criticized as being uneconomic during periods of low oil prices, the ethanol industry today is recognized as an efficient sector that brings substantial benefits to the Brazilian economy.

All Brazilian ethanol is produced from sugarcane. About 330 privately owned sugar mills each process an average of 1.2 million tonnes of sugar cane per year.

Major Savings and Increased Employment

The government's reasons for supporting biofuels, at first purely economic and triggered by the oil price spikes of the 1970s, have expanded to include concerns about the country's energy security, greenhouse gas emissions and global climate change, rural employment and equity issues, and local air pollution.

Ethanol production has played an important role in guaranteeing fuel security. Since 1975 ethanol has displaced more than 280 billion liters of gasoline and saved more than US\$65 billion in the cost of oil imports.

Moreover, the sugar/ethanol sector has become a major employer: in 2001 it accounted for roughly one million jobs, of which about 65% were permanent and the remainder seasonal. Another 300,000 jobs were created in manufacturing and other sectors. Sugarcane plantations also represent a major activity for small farmers, as around 30% of sugarcane production is in the hands of 60,000 independent producers.

The introduction of gasohol, a combination of gasoline and ethanol, had an immediate positive impact on the air quality of Brazil's large cities, reducing carbon monoxide by more than 25%.

Reasons for the Success

- *Synergies with the sugar market.* The coupled production of ethanol and sugar, which occurs in almost all sugar mills, allows mills to shift to

ethanol production if sugar prices fall and vice-versa. Significant productivity improvements in the sugar industry have benefited ethanol production: the cost of producing ethanol declined by an annual average of 5.7% from 1985 to 2005.

- *Synergies with electricity and heat production.* Cogeneration of heat and electricity from the by-product, bagasse, supplies all the energy needs of the biofuel production process itself, and allows the surplus electricity to be exported to the grid. Presently more than 1,500 MW of this electricity is being supplied to the grid, mainly in the period of low rainfall, which is a very relevant contribution to energy security since more than 90% of electricity is produced from hydro sources. Programs designed for the supply of more than 3,000 MW are in their final stages, having been developed by the government and the private sector jointly.

- *Institutional support.* The Brazilian government has provided necessary incentives to buyers of cars powered by ethanol and service station owners, and has set up a clear institutional framework. The measures included setting technical standards, supporting ethanol production and consumption technologies, providing financial advantages, and ensuring appropriate market conditions.

- *Geographical aspects.* An abundant supply of agricultural land, an appropriate climate for growing sugarcane, a developed sugarcane industry, and the presence of more than half of the country's car fleet in Sao Paulo — the state with the dominant sugarcane industry — have all contributed to the success. In other regions, the government has subsidized the transport costs of ethanol to ensure a wide geographical coverage.

Positive Outlook

Although ethanol supply and demand have not always been properly balanced, since the launch of flex-fuel cars in early 2003, internal ethanol consumption has increased significantly in Brazil. By 2008, around 90% of new cars manufactured in Brazil are to be flex-fuel models. Export of ethanol has also increased since 2001.

The recent expansion of internal and external markets has triggered the interest of investors, resulting in the planned construction of about 90 new sugar mills between 2006 and 2010, expansion of sugarcane cultivation to new areas, and retrofitting old refineries.

Sugar/ethanol production does raise concerns about land use, as it competes with the production of food and export crops. Yet the six million hectares cultivated with sugarcane represent only 8.6% of the total area harvested with essential crops. Moreover, farmers are increasingly rotating between sugarcane and food crops like tomatoes, soy, peanuts, beans, rice, and maize. This has helped maintain the balance between energy and food and has improved land profitability.

Policy Lessons

For countries wishing to improve energy security while promoting rural development, Brazil's experience offers some relevant lessons. The following policies have been most important to Brazil's success:

- Requiring the auto industry to produce cars running on neat or blended biofuels;
- Subsidizing biofuels during market development until economies of scale allowed fair competition with oil products;
- Allowing renewable energy-based independent power producers to compete with traditional utilities in the large electricity market;
- Financing private ownership of sugar mills, which helps guarantee efficient operations;
- Stimulating rural activities based on biomass energy to increase employment in rural areas.

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