

The Re-emergence of Ethanol Fuel in Brazil

Eduardo Luiz Correia

The development of the ethanol agro-industry generated complex relationships within Brazilian society, an understanding of which requires analyses from a political, economic, anthropological and especially historical perspective. ProAlcool (National Ethanol Programme) induced changes in labour relationships and rural migration, while reinforcing technological development and economic and political capacities. It is important to mention, moreover, that the cultivation of sugarcane is closely related to the formation of the Brazilian economy and society since colonial times (i.e. since the beginning of the sixteenth century), having been the first economic activity developed by the Portuguese colonists.

The objective of this article is more modest: to analyse the resurgence of the automotive use of ethanol in Brazil with the introduction of flexible fuel vehicles, and to briefly describe the history and use of ethanol as a fuel in Brazil.

Ethanol has been used as a fuel in Brazil for almost a century. We can segment this history into five distinct periods:

1. Experimentation (1923–1974)
2. The first phase of ProAlcool (1975–1979)
3. The second phase of ProAlcool (1980–1988)
4. Crisis (1989–2003)
5. Resurgence (2004 –)

Historical Antecedents of ProAlcool

In 1923, Brazil's National Institute of Technology began an experimental programme to test the use of pure ethanol as a fuel in Otto cycle engines. In August 1923, as a consequence of these experiments, a Ford vehicle using hydrous ethanol took part in an automobile race in Brazil.

For the owners of the sugar factories, ethanol was still a by-product, produced only in small hydrous ethanol distilleries. After 1930, the new government stimulated industrial modernisation and financed the establishment of distilleries to produce anhydrous ethanol. The desire to intensify the ethanol production had a double purpose: to use it as a fuel and to make possible the transformation of the sugar surpluses. Thus, in 1931 a decree was issued requiring that 5 percent of the total volume of gasoline imports be supplemented by domestically-produced ethanol. Also in 1931, the Brazilian government created the Commission of Studies on Ethanol Fuel and the Institute of Sugar and Alcohol (IAA). When gasoline production started in Brazil, a law of 1938 obliged the national producers to add anhydrous ethanol to the gasoline produced in the country as well as imports, in a proportion determined by the National Council of Oil (CNP) in

agreement with the IAA.

Until 1975, the addition of ethanol to gasoline was made in a disorderly way, by satisfying only the desires of the agro-sugar industry, since there was a very close relation between the price of sugar and ethanol in the external market and their production in the domestic market. A consequence of the chaotic changes in the ethanol content of fuel was the variable efficiency of the engines and then the dissatisfaction of consumers and the automobile industry.

The Oil Crisis and the Creation of ProAlcool

After the first oil prices shock of October 1973, the Brazilian strategy in this new context was, initially, to seek to maintain the high growth rates which had been observed since the end of the sixties. In 1973, Brazil imported 78 percent of its oil requirements. The road transport sector used 42 percent of the total consumption of oil products. It was clear that, should the country adopt a policy of substitution of oil, this sector would have to be a priority.

ProAlcool was created by decree only in November 1975. The government described the programme as an essential instrument of Brazilian energy policy. With the creation of ProAlcool, ethanol fuel not only provided the sugar industry with a new source of demand, but became a means of reducing the impact of the oil crisis on the trade balance and of reducing foreign energy dependence.

It must be observed, moreover, that ProAlcool was a great victory for the groups related to the production of sugarcane. The country had a surplus of sugar production, difficult to put on the international market, and the owners of the factories had a significant ability to put pressure on the government. ProAlcool provided subsidised financing to the industrialists willing to install new distilleries. With this policy, the government met the needs of the ethanol and sugar producers and justified its action by social and economic arguments related to the balance of payments.

During this first phase of ProAlcool there was a strong increase at the national level in the use of anhydrous ethanol added to gasoline. However, by 1979 this phase of the programme had allowed for a substitution of only 14 percent of gasoline consumption, suggesting that, at this stage of the game, the programme reflected more the needs of sugar factory owners than a determined policy of energy substitution. The priority of economic policy at this time was, above all, the growth of the national product.

The Second Oil Crisis and the New Phase of ProAlcool

After the second oil price shock of 1979, a new phase of

economic and energy policy took hold in Brazil. Combined with the rise in oil prices, 1979 was marked by a strong upward movement of international interest rates. For Brazil, which imported 86 percent of its domestic needs for oil and was burdened by a high level of foreign debt, these upward movements caused a serious imbalance in its balance of payments. In this context of adversity, economic policy gave priority to rebalancing the country's external accounts.

Programmes of oil product substitution were set up. ProAlcool, which already existed, received special attention. The government established an ethanol production target of 10.7 million m³ for 1985 and increased subsidies and credit for investment in new ethanol distilleries. This helped to create a market for hydrous ethanol for a fleet of cars that ran exclusively on this fuel (the automotive industry began the sale of these vehicles at the end of 1979). The government stimulated ethanol sales with subsidies that reduced the retail price and by setting lower value-added taxes (VAT) for ethanol vehicles. The ethanol market received a further boost from subsidies for the cost of ethanol transport from distilleries to the service stations, the revenues for which were generated by taxes on gasoline consumption.

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By creating an exclusive market for pure ethanol, this second phase of the programme gave a strong impulse to ProAlcool. Ethanol fuel consumption, which was 2.5 million m³ in 1981, reached 12.7 million m³ in 1989 (60.5 percent of total automotive fuel consumption in Brazil for Otto cycle).

The Crisis of ProAlcool

After the oil counter shock of 1986 gasoline and ethanol prices declined on the domestic market, reducing in turn the profitability of ethanol production in Brazil. Due to an unfavourable pricing policy, ethanol and sugar production had stabilised, at the time when the demand for ethanol was growing quickly. This structural difference between the two growth rates indicated that a serious supply crisis would inevitably arise in the near future.

When sugar prices on the international market started to rise in 1989, Brazilian sugar-cane growers diverted their harvests towards sugar exports, thus reducing ethanol production and causing the demise of ProAlcool. The reduction of ethanol supply created a serious problem for owners of vehicles running exclusively on this fuel,

immobilising them for several days and forcing the government to import ethanol and methanol. Consequently, ProAlcool's credibility was destroyed, causing a sharp fall in ethanol vehicles sales. This fall ultimately modified the profile of the vehicle fleet and thus the structure of the fuel market.

With the recovery of oil prices since 1999, ethanol has once again become an attractive option, boosting, though only marginally, ethanol vehicles sales. The credibility of the ethanol supplies being always available at competitive prices had been destroyed by the 1989 crisis.

The Resurgence of the Use of Ethanol Fuel

The substantial increases in oil prices and the introduction of flexible-fuel technology brought to an end the ethanol fuel crisis. Research on flexible-fuel technology began in the 1980s. Since 1988, such vehicles have been produced in the United States with a practically fixed blend of ethanol or methanol (85 percent) and gasoline (15 percent). The research continued in the 1990s and into the present decade. In May 2003, Volkswagen produced for the first time a flexible-fuel car in Brazil and was followed shortly after by other manufacturers. These cars can run with variable combinations of gasoline and ethanol (up to 100 percent of ethanol), but current engines cannot use pure gasoline (they are designed to run on gasoline mixed with 20–25 percent of ethanol, which is obligatory in Brazil). For the final consumers, who acquire the ability to engage in arbitrage when choosing the fuel for their vehicle, the ghost of a possible ethanol supply interruption and/or an extreme increase in price disappears. The vehicle therefore is not, as in the early 1980s, captive to the use of only one fuel and consumers have a flexibility they never enjoyed before. For the ethanol producers, focused on the growing external market (for ethanol to be blended with gasoline, and for sugar, because the end of the European subsidies brightens the prospects for an increase in exports), it means the continuing existence of a domestic ethanol market.

The production of vehicles for exclusive use of ethanol must end this year. Next year only FFV, gasoline and diesel vehicles will be produced in Brazil. The FFV option, whose share of light vehicles sales in Brazil has already exceeded 70 percent, is likely to reach a 90 percent share in at most two years time. The light vehicles fleet in Brazil, which at the end of 2005 reached 21 million units including 5 percent FFV, would reach more than 35 million units in 2020, two-thirds of which will be FFVs.

The FFV was designed according to the gasoline vehicle model, and is generally optimised for the use of gasoline type C. Thus, the efficiency of the FFV is similar to the gasoline equivalent car, when this makes exclusive use of gasoline type C. According to the automobile manufacturers, the use of ethanol as fuel in the FFV will enable the consumer to cover 70 percent of the distance achieved with the same quantity of gasoline. In other words, if the

retail price ratio between ethanol and gasoline is equal to or greater than 70 percent, the consumer will use gasoline in his FFV.

The relative use of ethanol and gasoline in FFVs depends on a series of factors, the most important of which is the regional ethanol balance, as this is critical in determining the relative ethanol/gasoline price. In general we must consider the following variables to assess possible developments of the ethanol fuel market in Brazil: the forecasted and potential investments in distilleries and sugar plants and the rate of expansion of sugar cane cultivation; the logistical structure and the costs of transport for ethanol and gasoline in the country; the regional tax policy for automotive fuels; the trends of Brazilian sugar and ethanol exports; the evolution of the national demand for sugar; potential regional ethanol requirements for addition to gasoline and to supply vehicles; market trends for alcohol for non-energy uses; international oil prices and their effect on gasoline prices in Brazil.

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In synthesis, there are several factors that define the relative competitiveness of ethanol at the regional level and thus, the amounts of gasoline and hydrous ethanol consumed by FFVs. The main problem brought about by the FFV, given the rapid increase of its share of the national fleet in recent years, is the risk of increasing volatility in the gasoline market, due to uncertainties concerning levels of ethanol and sugar exports. What is certain is that they will be much higher than at present and more volatile.

Another important aspect concerns the sensitivity of demand to fuel prices. The renewal of the vehicle fleet, focused more and more on the FFV, implies a strong change in the average profile of the owners of these vehicles. The new fleet is associated to consumers with higher incomes whose price elasticity of demand tends to be lower than average. On the other hand, the average age of the gasoline fleet will increase over time, implying greater price elasticity for gasoline and less use of gasoline vehicles. The gradual increase in the price elasticity of gasoline demand can thus be taken as given for two reasons: a higher substitution effect (more options for the FFV owner) and lower average income of the owners of gasoline vehicles.

Conclusion

After almost a century of experience using ethanol as an automotive fuel, Brazil seems to have reached a degree of maturity in this field. Depending in the first phase of

implementation on a structured programme of subsidies, the ethanol from sugar cane in Brazil has now reached self-sufficiency and is no longer dependent on governmental subsidies. It has uncontested competitive advantages on the international market. The production costs of sugar and ethanol in Brazil are lower than those of other international players, and Brazil is now the largest world exporter and a market-maker of sugar and ethanol.

With the worldwide emergence of programmes for the use of ethanol as a fuel, brought about by the Kyoto Treaty and higher oil prices, Brazil assumes a leadership role in ethanol supply on the international market. Higher prices translate into higher profitability, which attracts various international companies to Brazil. The availability of vast cultivable lands will allow Brazil to maintain its leadership in this market for some time.

With regard to the domestic ethanol market, the growth in the use of flexible-fuel vehicles brings new dimensions to this market. These vehicles have allowed greater flexibility in the use of fuel and have allowed consumers to overcome the fear of a possible shortage of ethanol supplies. However, the introduction of the FFV affects gasoline demand in several ways: higher price elasticity, greater market volatility and greater market uncertainty in the long term.

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