



The scale of Brazil's ethanol production, demand and competitiveness is largely attributable to government initiatives. The varying levels of success of such initiatives can provide interesting lessons for other countries.

# GOVERNMENT INTERVENTION TO STRENGTHEN THE ETHANOL SECTOR: LESSONS FROM BRAZIL

## SUMMARY

The development of Brazil's ethanol sector - its expansion, commercialisation, up-take, competitiveness and profitability - can largely be attributed to government policies. Strategies to make ethanol production more attractive, practices to enable the use of ethanol in automobiles, tax breaks and price fixing, are just some of the policies underpinning ethanol's early commercial development in Brazil. Since the beginning of the *Próalcool* programme, the ethanol sector has depended upon government support, making a series of demands to which the government has responded. Even given these public efforts to boost and stabilise the ethanol market, there have been gains and losses in terms of competitiveness and profitability due in part to dynamic interactions with the gasoline and sugar markets. Other factors, including an increase in production costs and reduction in investments, also affected ethanol's competitiveness. The lessons learned by Brazil about managing these ups and downs could be useful for policymakers and private sector leaders from other regions facing the same challenges. In particular, these key lessons learned might allow other countries to avoid losses, such as investments in technologies now deemed redundant, and provide guidance about how and when to introduce - or reduce - government support like subsidies and tax breaks.

## THE CHALLENGE OF BOOSTING ETHANOL DEMAND

Brazil embarked upon its national ethanol programme in an effort to decrease its dependence on imported energy and reduce economic constraints caused by international oil crises. The country encountered several considerable barriers, in particular the need to enhance both production and consumption of ethanol, though it did enjoy the advantage of an existing sugarcane industry. However, even after overcoming these challenges, the ethanol market demonstrates high volatility, requiring policies to boost demand and production. Brazil's ethanol sector has been unable to achieve sustainable growth in supply without government

## KEY LESSONS LEARNED

Government intervention was fundamental for boosting Brazil's national ethanol programme, in particular policies requiring mandatory blending and promoting the Flexible Fuel Vehicle.

The government's active support of the ethanol programme attracted private investment, which encouraged producers to focus on efficiency and productivity gains.

Flexibility to choose between producing ethanol or sugar increases producer profitability, but may jeopardise national energy security.





support, due to both international and domestic factors. On the international side, fluctuations in the prices of oil, gasoline and sugar contributed to destabilising the market. From the domestic point of view, lack of three important factors - investments, infrastructure and long-term planning - decreased competitiveness throughout the ethanol chain. For other developing countries, effectively managing domestic market volatility is made even more difficult due to lack of funding and adequate capacity in biofuel production, distribution and use. In many cases, local demand is quite low, therefore exporting ethanol may encourage higher production levels on a scale which would allow ethanol to compete with fossil fuels. Taking examples from the problems faced and strategies implemented by Brazil to increase production may enable other countries to plan and prepare for expanding biofuel production with smoother management of the ups and downs that Brazil experienced.

This Brief describes the government’s efforts to promote and support the ethanol industry as well as the results of such policies. The first section analyses the government’s flagship policy for the development of the ethanol sector, *Proálcool*, then moves on to discuss declining support for the programme and the period of relatively low government intervention in the sector. It also discusses one of the government’s most important incentives to bolster the ethanol industry: promotion of the flexible fuel vehicle. The final section presents the current panorama facing the sector.

## KICK-STARTING ETHANOL’S EXPANSION

As a reaction to the 1970s oil crisis, the Brazilian government focused on establishing an ethanol industry as a strategy to reduce its economic and energy vulnerability caused by high dependence on imported oil. In other words, promoting ethanol became a policy to strengthen national energy security and reduce balance of payments deficits. In 1975, the Brazilian government launched its large-scale national sugarcane ethanol programme, *Proálcool*, through decree 76.593.<sup>1</sup>

The government decided to produce ethanol from sugarcane because of the low cost of sugar at the time and the country’s ample tradition and experience with this feedstock. An additional impetus came from the fact that sugar prices

### TEXT BOX 1: Types of Fuels Available in Brazil

**Hydrous Ethanol** – the liquid fuel generated from ethanol. It can be used as fuel in pure ethanol driven engines or in Flex Fuel Vehicles (FFVs).

**Anhydrous Ethanol** – pure ethanol made through the process of dehydrating the hydrous ethanol, taking out 4% of the water content. Is it used as an additive to be blended with pure gasoline. It is not sold in pure form at the pump.

**Gasoline A** – pure gasoline. While gasoline A is produced in Brazil, it is only used for blending, and is not sold in pure form to customers at petrol stations.

**Gasoline C** – Blended gasoline that is made up of between 75% and 82% gasoline A and 25% to 18% anhydrous ethanol. It can be used in gasoline cars or FFVs.

were falling as a result of international market saturation at that time. The *Proálcool* programme was able to bail out the sugarcane sector, shifting part of the crop to ethanol production and taking advantage of the idle productive capacity of mills and distilleries.

The basic provision of *Proálcool* was to mandate that gasoline be blended with 20% anhydrous ethanol (see Text Box 1). Public sector subsidies to ensure competitive compensation for the producer, along with tax breaks in the sale and licensing of ethanol vehicles, helped kick-start the programme. In addition, the government gave incentives to ethanol producers, such as ‘soft’ agricultural and industrial loans and guaranteed purchase of their product through the Sugar and Ethanol Institute (*Instituto do Açúcar e do Álcool* - IAA). They also fixed prices, taking into account sugar prices and setting the ethanol price so that producers would be indifferent to manufacturing sugar or ethanol from the same raw material, sugarcane. This was set at a parity of 44 litres of ethanol for every 60 kg of sugar, which was in effect between 1975 and 1979.<sup>2</sup> Many of these early initiatives were financed by high taxes on gasoline, complemented by a World Bank loan.

This initial push proved quite successful: farmers planted more sugarcane and investors built distilleries to convert the crop into ethanol. Between 1975 and 1979, ethanol production grew approximately 350%, from 555.6 million to 2.49 billion litres per year.<sup>3</sup>

<sup>1</sup> To learn more about the story of the programme’s launch, read the [ELLA Guide to Brazil’s Ethanol Programme](#).

<sup>2</sup> Moraes, M., Rodrigues, L. 2006. *Brazil Alcohol National Program*. Piracicaba.

<sup>3</sup> Ibid.; For more information, see also the Brazilian Government’s official [website](#) about biofuels.



## STRENGTHENING AND CONSOLIDATING ETHANOL PRODUCTION

The second phase of *Proálcool* began in 1979, and focused on the production of hydrous ethanol to be used as fuel in cars that ran exclusively on this biofuel, reinforcing incentives for producers and consumers alike. In general, the combination of incentives behind both stages of *Proálcool* for producers and consumers were as follows:

*For the producer:* ethanol production was stimulated by reducing ethanol-sugar price parity from 44 litres of ethanol per 60 kg of sugar to 38 litres;<sup>4</sup> establishing higher minimum levels of anhydrous ethanol in gasoline, which progressively increased to 25%; guaranteeing remuneration through a state trading enterprise that began purchasing ethanol at favourable prices; and creating credit lines with favourable conditions, such as low interest rates for mills to increase their production capacity. Finally, Petrobras, the state-owned oil company, made investments to facilitate ethanol distribution throughout the country.<sup>5</sup>

*For the consumer:* automakers designed vehicles to run on 100% ethanol. The government-supported measures to encourage consumption included: a guaranteed maximum selling price which was lower than the price of gasoline (66% of the gasoline price); gas stations had to sell hydrous ethanol at the pump; 50% price reduction on the Flat Road Tax for those using ethanol driven vehicles; exemption for taxis from the Tax on Manufactured Goods (Imposto sobre Produto Industrializado - IPI); and 5% IPI reduction for ethanol-driven cars.<sup>6</sup> Finally, though not an incentive, but a guarantee of supply, the government established the maintenance of strategic reserves out of season.<sup>7</sup>

Again, these initiatives were successful: ethanol production grew from 3.7 billion to 11.6 billion litres per year between 1980 and 1988, showing an average annual growth of 15%.<sup>8</sup>

One factor that contributed to production increases was the parity of sugar and ethanol prices. At that time, the

government regulated everything, right down to the amount that each plant could produce. Until 1985, Brazil's government was both a central player in the nation's economy and a military dictatorship. So, when the gasoline price increased, the government adjusted the price of sugar and ethanol in order to preserve competitiveness between them.

All these policies behind *Proálcool* were developed through large investments and subsidies from the Federal Government. In the beginning of the programme, the Brazilian economy was in a period of high growth, also known as 'the economic miracle', boosted by government expenditure and investments. In other words, this high economic growth was achieved through domestic and external financing, contributing, along with both international oil crises, to a significant increase in Brazilian foreign and public debt. In the 1980s, the scenario changed. The country fell into a serious public debt crisis, inflation rates exceeded 100% per year,<sup>9</sup> and finally, the economy stagnated.

## DECLINING GOVERNMENT SUPPORT: THE END OF PROÁLCOOL

During the early 1980s, the Brazilian ethanol programme flourished with the help of government pricing policies and a World Bank loan to cover the programme's costs; by the mid-1980s, ethanol had grown to make up roughly half of Brazil's liquid fuel supply. However, in 1985, *Proálcool* began to experience problems. World oil prices dropped sharply in the period 1985-86, reducing the immediate benefit of replacing oil imports with ethanol. Huge fiscal deficits and high inflation led Brazil to implement economic reforms that included a cutback on ethanol production subsidies. As part of a broader reduction of 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 programme from state trading companies slowed, then stopped completely.<sup>10</sup>

In addition to the drop in world oil prices, world sugar prices

<sup>4</sup> Moraes, Rodrigues 2006, above n 2, 3.

<sup>5</sup> BNDES, 2008. *Sugarcane-Based Bioethanol: Energy for Sustainable Development*. BNDES, Rio de Janeiro.; Xavier, M.R. 2007. *The Brazilian Sugarcane Ethanol Experience*. Issues Analysis n3. Competitive Enterprise Institute, Washington, DC.

<sup>6</sup> Almeida, E. F., Bomtempo, J. V., Silva, C.M.S. 2007. *The Performance of Brazilian Biofuels: An Economic, Environmental and Social Analysis*. Discussion Paper No 2007-5. OECD, International Transport Forum, Paris.

<sup>7</sup> BNDES 2008, above n 5; Xavier 2007, above n 5.

<sup>8</sup> Moraes, Rodrigues 2006, above n 2, 3, 4.

<sup>9</sup> Data from Brazil's Institute of Applied Economic Research (*Instituto de Pesquisa Econômica Aplicada* - IPEA), published on its online information portal. [IPEADATA](#).

<sup>10</sup> Sandalow, D. 2006. *Ethanol: Lessons From Brazil*. In: Monsma, D.W. (ed) *A High Growth Strategy for Ethanol*. The Aspen Institute, Washington, DC.





grew, making ethanol production unattractive and creating difficulties for the ethanol industry. As a result, sugarcane producers diverted crops to sugar exports and away from ethanol.

By the late 1980s, ethanol production began to decline, but due to inertia, Brazilian automakers continued to manufacture ethanol-only cars in significant numbers. The result was a serious shortage of ethanol in 1990 which strongly affected consumer confidence. To keep these cars on the road, Brazil was forced to reduce the blend of anhydrous ethanol with gasoline, first from 22% to 18%, and then to 13%,<sup>11</sup> so as to save hydrous ethanol for the pure ethanol vehicles.

Political support for the ethanol programme disappeared. Drivers stopped buying ethanol-fuelled cars, car manufacturers stopped producing them and the fleet of ethanol-only cars quickly decreased. By the mid-1990s, only fleet vehicles, such as taxis and rental cars, were being made to run exclusively on ethanol. All the previous investment in developing engines to run entirely on hydrated ethanol was rendered worthless.

In 1988, the new national constitution was promulgated, which marked a new phase for the *Proálcool* programme. Through the constitution's art. 174, the economy would be based on state non-intervention and on indicative planning for the private sector.<sup>12</sup> As a result, during the 1990s, the Brazilian economy experienced profound transformation. Economic policy emphasised stabilisation, privatisation and liberalisation - priorities into which an industrial policy programme like *Proálcool* did not fit. The government gradually freed ethanol prices to fluctuate with the market. Nevertheless, the government did continue to require that all gasoline sold in Brazil contain roughly 20% ethanol by volume.<sup>13</sup>

Deregulation gave freedom to the sector to manage the volumes of ethanol traded on domestic and international markets. However, it also increased the possibility that the country would suffer from a new shortage crisis, since it allowed for producers to allocate their production according to more economically viable and attractive markets.

## FLEXIBLE FUEL VEHICLES (FFVs): AN INNOVATION IMPACTING PRICES AND COMPETITIVENESS

In addition to its concerns with energy security, in the 1990s the Brazilian Government was faced with the challenge of reducing greenhouse gas (GHG) emissions in line with international climate change discussions. Brazil was already recognised for its high production, consumption and exportation of ethanol, and it was motivated to become the world leader in the biofuel market. One potential means of reducing GHGs was to increase the consumption of ethanol in road vehicles, and thus attention was paid to motivating car manufacturers to come up with a technical solution. The Federal Government started mobilising and encouraging the sector through seminars and meetings about flex fuel technology.

During the late 1990s, Brazilian engineers interested in potential market share gains began developing the flex fuel engine, an engine that could be run on any percentage blend of gasoline and ethanol. This technology was developed in Brazil with investment from international carmakers based in the country. At the same time, negotiations between the automakers and the government evolved to broaden tax breaks for biofuel cars.

In 2001, the Brazilian government agreed to give FFVs the same preferential tax treatment as ethanol-fuelled vehicles, namely a 14% sales tax, rather than the 16% sales tax on non-ethanol cars. Thanks to this tax break, in March 2003, [Volkswagen Brazil](#) launched the Gol 1.6 Total Flex, the first commercial FFV sold at the same price as a regular model. Indeed, there was great uncertainty regarding the commercial viability of the new car, mainly due to consumer perception about the resale value of the vehicle. It was therefore only when the government reduced the tax on FFVs that the industry was motivated to launch the product.

FFV technology was largely accepted by consumers and producers and marked a new era for Brazilian ethanol, essentially reviving the declining industry. Consumers understood that FFV meant flexibility, choice and possible

<sup>11</sup> CGEE, 2009. *Bioetanol Combustível: uma Oportunidade Para o Brasil (Bioethanol Fuel: An Opportunity for Brazil)*. CGEE, Brasília.

<sup>12</sup> According to art. 174, the state is "a normative and regulating agent of the economic activity, practices, in accordance with the law, the functions of monitoring, incentive and planning, which is determinant for the public sector and indicative for the private sector."

<sup>13</sup> Xavier 2007, above n 5, 7.



economic savings because they could now choose between ethanol and gasoline C according to price fluctuations. This choice is made according to price per kilometre calculations. As the energy value of gasoline is 30% higher than that of ethanol, filling up with ethanol is only economically advantageous if the price is at least 30% cheaper than gasoline. Since the implementation of FFV technology, ethanol prices have been competitive in Brazil in comparison to gasoline. This is, however, because Brazilian gasoline taxes are high, around 54%, while ethanol taxes remain lower, varying between 12% and 30%, depending on the state.<sup>14</sup> Brazilian producers estimate that ethanol can remain competitive as long as the price of oil does not fall below US\$30 per barrel.<sup>15</sup>

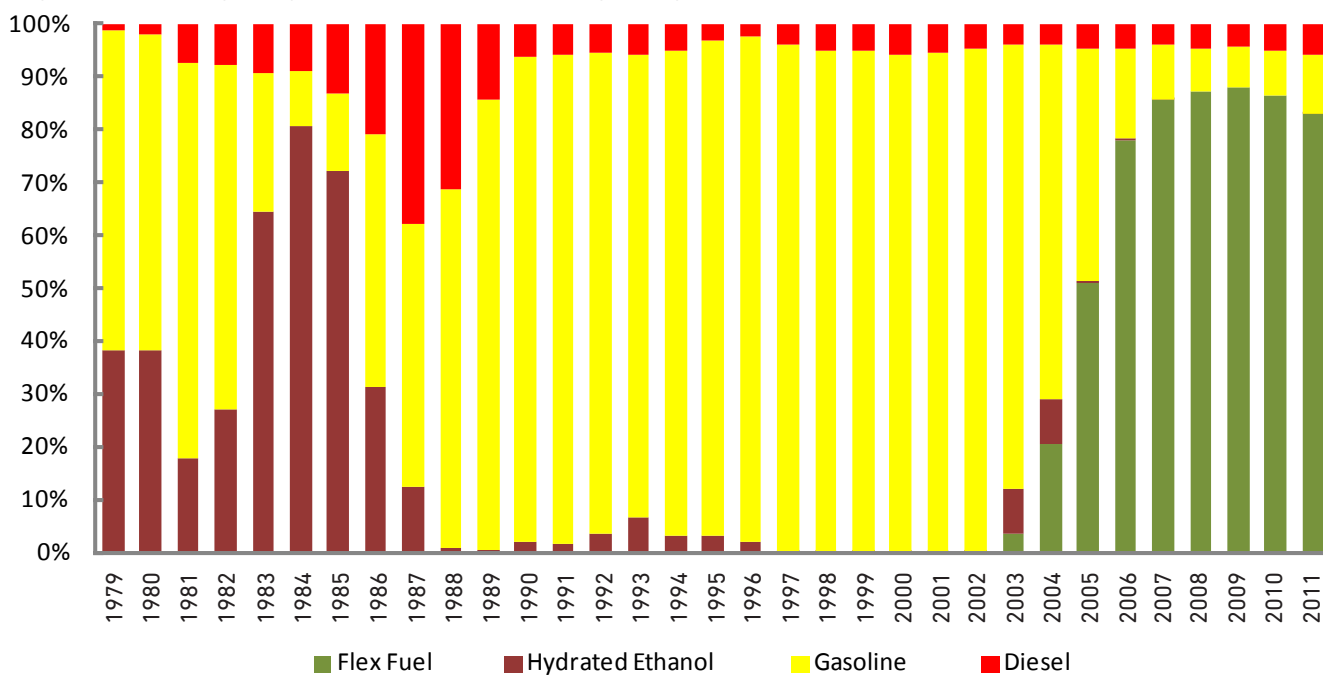
Car manufacturers also gained from the tax breaks, thus encouraging them to increase their production of FFVs.

Indeed, consumer acceptance of FFVs grew much faster than the auto industry expected. By 2011, 12 carmakers were supplying FFVs to the Brazilian market.<sup>16</sup> By July 2012, the sale of FFVs made up 86.3% of total annual car sales in Brazil.<sup>17</sup> Figure 1 demonstrates this evolution for light fleet vehicles, meaning cars and light commercial vehicles.

## GOVERNMENT INTERVENTION IN GASOLINE PRICING

Once ethanol and gasoline became substitute fuels – when FFV drivers could simply choose between them – taxation became crucial for the competitiveness of each. Since 2008, the Brazilian government has used the Contribution of Intervention in the Economic Domain (CIDE)<sup>18</sup> to dampen the impacts of international market fluctuations on the price of gasoline. The CIDE can be increased or decreased according

**Figure 1: Licensing of Light Fleet Vehicles According to Engine Type in Brazil, 2003-2010 (%)**



Note: Light fleet vehicles refer to cars and small commercial vehicles only.

Source: *National Association of Manufacturers of Motorised Vehicles (ANFAVEA)*. 2012. *Anuário da Indústria Automotilística Brasileira (Brazilian Automotive Industry Yearbook, 2012)*. ANFAVEA, São Paulo.

<sup>14</sup> Cavalcanti, M.C.B. 2011. *Tributação Relativa Etanol-gasolina no Brasil: Competitividade dos Combustíveis, Arrecadação do Estado e Internalização de Custos de Carbono (Relative Ethanol-gasoline Taxing in Brazil: Competitiveness of Fuels, State Revenues and Internalisation of Carbon Costs)*. PhD dissertation. Federal University of Rio de Janeiro. As of October 2008, the average price of gasohol (with a 25% ethanol blend) was US\$ 4.39 per gallon, while the average price for pure ethanol was US\$ 2.69 per gallon. Data obtained from the official website of the [National Agency of Oil, Natural Gas](#).

<sup>15</sup> Flammini, A. 2008. *Biofuels and the Underlying Causes of High Food Prices*. Global Bioenergy Partnership, FAO, Rome.

<sup>16</sup> Cavalcanti 2011, above n 14.

<sup>17</sup> Data obtained from the official website of the [National Agency of Oil, Natural Gas](#).

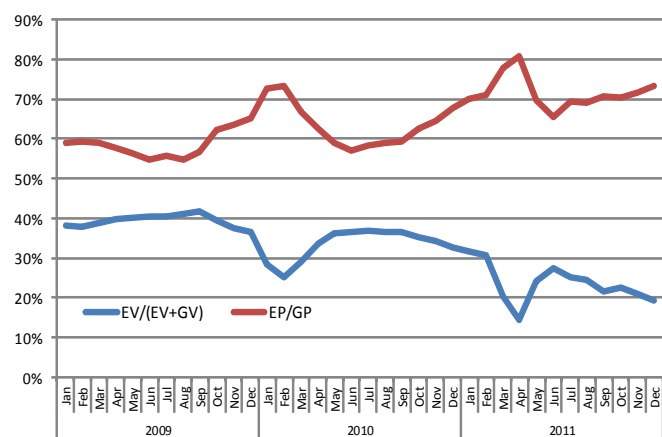
<sup>18</sup> CIDE is a federal contribution, decreed by the Brazilian House of Representatives, whose income is designated to: pay subsidies on prices or transport of ethanol fuel, natural gas and its derivatives and oil derivatives; finance environmental projects related to the oil and gas industries; and finance transport infrastructure programmes.



to market fluctuations. Recently, the government reduced the CIDE to prevent domestic market fluctuations as a result of fluctuations in the international price of oil. In other words, even while oil prices are going up, the price of gasoline in Brazil remains stable, thanks to the government intervention.

However, while the Federal Government stabilised the gasoline price<sup>19</sup> to contain inflation and absorb the rising costs of gasoline due to the increase in oil prices, the cost of ethanol continued to rise, following the global oil price trend. To offset this cost increase and maintain profitability, producers had to increase ethanol prices, which made the biofuel less competitive, inducing people to choose gasoline. Also, as the FFV fleet grew faster than ethanol supply capacity, the price of ethanol greatly increased, thus reducing ethanol's competitiveness compared to gasoline even more. As a consequence, consumers who used to fill up with ethanol, started to fill up with fossil fuels, as the next chart shows.

**Figure 2: Participation in Volume of Hydrated Ethanol in Total Fuel consumed by Otto Cycle X rate of Prices EP / GP**



Source: Energy Research Company (Empresa de Pesquisa Energética - EPE). 2012. *Análise de Conjuntura Econômica dos Biocombustíveis 2011 (Analysis of Economic Environment of Biofuels 2011)*. EPE, Rio de Janeiro.

The red line shows the evolution of hydrous ethanol prices in comparison to gasoline (EP/GP) in the last three years. The ratio of ethanol to gasoline prices has increased, as the

Federal Government holds gasoline prices constant while ethanol costs continuously increase. The higher the ratio, the less competitive ethanol becomes. The consequence is a change in consumers' choice of which fuel to use. The blue line, relative consumption of ethanol compared to gas [EV/(EV+GV)], shows consumers' changing demand as the price ratio changes. As the price of ethanol relative to gasoline rises, consumer demand for ethanol falls.

## THE ETHANOL MARKET FALLS AGAIN... WILL THE GOVERNMENT INTERVENE ONE MORE TIME?

For the first time since 2003, sales of hydrous ethanol fell in 2010, declining by 1.9% as compared to 2009, while gasoline consumption increased by 17.5%.<sup>20</sup> The decrease in hydrous ethanol consumption and supply was due to a number of factors:

- Beginning in 2008, and for three subsequent years, the weather has been unfavourable for the production of sugarcane, with first a rainy season, then a dry season reducing sugarcane productivity
- The global financial crisis took place in a period when sugarcane companies already had high debt, reducing investment even more
- A decrease in private investment, both in the construction of new mills, as well as in land productivity, reduced sugarcane and, consequently, ethanol supply
- The artificial maintenance of the price of gasoline, while ethanol costs kept on rising, made ethanol less competitive
- Increase in sugar prices in the international markets, which reached a 30-year high in 2010,<sup>21</sup> augmented the profitability of sugar in comparison to ethanol, pushing producers to shift part of the biofuel to sugar production, thereby reducing the ethanol supply

All these factors contributed to reducing both ethanol supply and competitiveness. In response, the government has implemented some policies to stop the recent trend of price increases, in order to strengthen competitiveness and boost

<sup>19</sup> Until this government practice, the price of gasoline was determined by the market, in relation to oil price movements.

<sup>20</sup> Energy Research Company (Empresa de Pesquisa Energética - EPE). 2012. *Análise de Conjuntura Econômica dos Biocombustíveis 2011 (Analysis of Economic Environment of Biofuels 2011)*. EPE, Rio de Janeiro.

<sup>21</sup> Cavalcanti 2011, above n 14, 16.



production and productivity. Policies have included:

- Resolution ANP 67, establishing criteria for the acquisition and formation of an anhydrous ethanol stock, with the main goal of stopping off-season price volatility
- Increase the ratio of anhydrous ethanol blend in gasoline<sup>22</sup>
- Providing a credit line of US\$ 4 billion with a low interest rate, through [BNDES – PRORENOVA](#)

So far, however, the effects have not been felt. Resolution ANP to ensure supply during the low season and dampen the increase in the price of ethanol was only passed in 2011, so there is still some uncertainty about its effectiveness. Reducing or increasing the blend of anhydrous ethanol in gasoline is a very short-term action (reducing or increasing demand, avoiding shortages and dampening price volatility), but it does not increase competitiveness nor encourage investments in production. Finally, only US\$1.4 billion (35%) from the PRORENOVA credit line has been requested by producers because of their high level of indebtedness.<sup>23</sup> The credit line was only left open to the end of 2012.

As a result, the private sector is asking the Federal Government for another package of policies in order to recover ethanol's competitiveness. Specifically, they are requesting liberalisation of gasoline prices, reduction of ethanol taxation, an increase in the minimum price per megawatt hour (MWH) from sugarcane cogeneration and low-interest financing for the construction of new mills with better conditions.

For the present time, it is not clear whether or not the government will meet these requests. No recent policies have been implemented to support producers or improve the competitiveness of ethanol. Besides, the official projections from the [Brazilian Energy Research Company](#) (*Empresa de Pesquisa Energética - EPE*) show a scenario in which both production and consumption of ethanol decrease in the medium-term future in comparison to the previous projections.<sup>24</sup> It suggests that the government does not expect the ethanol sector to recover, and does not intend to intervene with another set of policies. This also suggests that any increase in production will be due to inertia in the industry and not as a consequence of new governmental policies.

<sup>22</sup> Anhydrous ethanol is more profitable than hydrated ethanol. Thus, augmenting the blend from 20% to 25% of anhydrous in gasoline, besides ensuring a minimum level of demand, increases the company's profitability.

<sup>23</sup> Estado de São Paulo. 2012. [Economia e Negócios - Linha do Bndes para Usineiros não Decola \(Economics and Business. BNDES Line to Producers Does Not Take Off\)](#). Online publication.

<sup>24</sup> Energy Research Company (*Empresa de Pesquisa Energética - EPE*). 2012. [Plano Decenal de Expansão da Energia 2021 \(National Energy Plan 2021\)](#). EPE, Rio de Janeiro; Energy Research Company. 2011. [Plano Decenal de Expansão da Energia 2020 \(National Energy Plan 2020\)](#). EPE, Rio de Janeiro.

# CONTEXTUAL FACTORS

# UNDERPINNING BRAZIL'S POLICY RESPONSE



Public policies have formed the cornerstone of the Brazilian ethanol industry. Since the *Próalcool* programme, the government has been responsible for enabling ethanol to gain and regain competitiveness. This has been achieved through direct government support and private sector actions in response to favourable policies. Brazil's well-developed market is a result of government support, such as the two phases of *Próalcool*, the establishment of mandatory blending as federal law, preferential taxation on ethanol and tax breaks to FFVs.

The introduction of FFVs was fundamental to the recovery of both the sugarcane industry and consumers' reliability on ethanol market. It pushed up demand and boosted production, and the ethanol market grew at high rates until 2008. The FFV technology is a consequence of private research and investment as well as public policies. Automakers invested money to develop this technology, though it only became viable when the Federal Government decided to give the FFV vehicle the same preferential tax rates enjoyed by ethanol cars.

The fact that national energy security was the motivation

for the Brazilian government to nurture the ethanol industry allowed a whole series of policies and instruments to be developed and implemented without substantial opposition. Although launching *Próalcool* was a decision made by the Federal Government during a military regime, it was well accepted by civil society and the private sector, mostly because the ethanol industry generated jobs, increased agribusiness and income, and encouraged trade. The existence - and mandatory involvement - of the national oil company, Petrobras, facilitated the distribution and sale of this new fuel, as ethanol was able to piggy-back on Petrobras' well-established distribution network.

In short, ethanol's competitiveness was largely enabled by the intricate web of government policies and support which facilitated a lucrative development of the sector. With this, the efficiency and cost competitiveness of ethanol production evolved rapidly. On the other hand, downturns were caused by a combination of exogenous factors, such as weather conditions, market price fluctuation and endogenous factors, such as government control of the gasoline price and reduction in investments in land productivity and new mills.

## LESSONS LEARNED

- 1 In Brazil, the government's involvement in kick-starting and managing the ethanol industry was absolutely fundamental. The government effectively created a market by making it mandatory to blend ethanol with gasoline, which proved to be the backbone of the ethanol programme. Even with the gradual withdrawal of government support, mandatory ethanol blending continues to guarantee a certain level of ethanol demand.
- 2 The front-loading of government support attracted capital investment in the agricultural and industrial phases of ethanol production and in the development of engines that could run on ethanol. This investment enabled gains in terms of both quantity and quality of production with falling costs, contributing to ethanol's ability to later stand alone without additional direct government support.
- 3 Deregulation proved to be good for producers, allowing them to produce more sugar or ethanol according to profitability. Previously the Federal Government mandated the amount of sugar and ethanol each producer should yield. On the other hand, high international sugar prices have, in recent years, compromised ethanol supply, as producers prefer to grow as much sugar as possible.
- 4 The focus on producing vehicles that run on 100% ethanol proved to be counter-productive, resulting in wasted investment in an obsolete technology and a negative consumer perception of ethanol. Consumers were once again dependent upon a fuel that was in limited stock, because demand for ethanol itself had grown faster than supply and high sugar prices discouraged sugarcane producers to divert crops to ethanol production.
- 5 Producers' flexibility to shift production from sugar to ethanol, and vice versa, may increase profitability. However, the decision to produce in favour of the more profitable output may not converge with national energy requirements, meaning producers decisions are completely economic, and not linked with energy security concerns.

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