

Brazil is on its way to become the first country to no longer depend on crude oil but on biofuels. Thanks to their competitive advantages, Brazilian companies look set to dominate the rapidly growing global biofuels market.

The Brazilian success story

| by Joost L.M. Kanen

Brazilian ethanol production, which started in the 1920s, was intentionally stimulated by the military dictatorship in the 1970s in response to the oil crisis of that time. The government programme, called "Proalcool", was a big success in the 1980s. But in the 1990s, when oil prices plummeted to \$10 a barrel, ethanol had become uneconomical and Brazil had to terminate its ethanol subsidies at the behest of the IMF. Ethanol is competitive with oil at a price of around \$30 to \$40 per barrel.

This almost led to the death of the ethanol industry, but when oil prices started to rise again in the late 1990s, a revival took place. In 2002, Volkswagen introduced the flex fuel car, the "Gol". Fernando Damasceno, chief engineer of Italian parts maker Magneti Marelli, had programmed a car computer to constantly adjust the car engine to the mix of ethanol with petrol in varying percentages. He sold his invention first to Volkswagen and later to other car manufacturers. This gave the ethanol market a big boost.

Thus, ethanol production returned in full force, like a sleeping giant awakening. In 2008 Brazilian consumption of ethanol surpassed that of petrol. In 2006 Brazil had already achieved energy independence, partly thanks to several years of massive growth in ethanol production and to new oil finds off the coast of Rio de Janeiro. Over fifty percent of transport fuel used in Brazil is now ethanol. The regular petrol, called E25, contains a mandatory admixture of 25% ethanol. In the rest of the world on average only 1% of the transport fuels used are biofuels.

Currently over 6 million flex fuel cars are on the Brazilian roads, and over 90% of all new cars sold are flex fuel cars. Up to 10% admixture can be handled by normal car engines, which is the target the European Union has set itself in the year 2020.

Unique |

The success of Brazil's biofuels sector is due to the country's formidable competitive advantages. With its highly modern and large-scale agricultural sector, it is one of the few countries that can grow sugar cane on large areas of land and harvest it

in a highly cost-effective way. Sugar cane is unique in that it has a very high energy content, probably the highest of any plant in the world. The energy balance (the ratio of energy obtained versus spent in acquiring the energy) of ethanol from sugar cane lies between 8 and 10, whereas for ethanol from corn, as it is produced in the United States, the figure is between 1.3 and 1.6. This makes ethanol from sugar cane 6 times as cost-effective as ethanol from corn.

Ethanol production has been growing by about 10% per year in Brazil in recent years. So much ethanol is now being produced that national oil company Petrobras is constructing a new 1,000-kilometre ethanol pipeline from Goias State to Sao Paulo that will be completed in 2010. Petrobras already operates another multi-use pipeline that mainly transports ethanol from Goias state through Sao Paulo state and Petrobras' Paulinia refinery to ports on the coast. Both pipelines have been built to cater to the growing export needs of Brazilian producers.

Biofuels have been criticised because they



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are said to be responsible for higher food prices. This may be true in some cases, such as in the US where corn production has been diverted from food use to fuels. It is not relevant to the Brazilian situation however. Not only is the production of ethanol from sugar cane quite efficient, but Brazil has enough land to grow sugar cane for ethanol without having to divert resources away from food production. Of the land that could be used for agriculture only 2% (7 million ha) is currently used to grow sugar cane and half of this sugar cane is used for ethanol production. Nor are the rain forests at risk. Brazil can easily triple its agricultural production without even touching its rainforests. Besides, sugar cane is planted only in Sao Paulo state and a bit in the Northeast of Brazil, not near the Amazon. Bigger threats to the Amazon are soybean production and cattle grazing. Biofuels production brings other societal benefits as well, which may also be applicable to countries such as India. The main benefit is that ethanol and biodiesel production not only create energy independence but also many thousands of jobs for low skilled laborers, even though

Brazilian agriculture is highly modern and mechanised. In developing countries with growing populations this is an important consideration.

Biodiesel |

In addition to ethanol, Brazil has also embarked on a growth path for biodiesel, which substitutes for regular diesel, whereas ethanol is basically a petrol substitute. Ethanol is a form of alcohol derived from e.g. sugar cane or corn through a fermentation process. Biodiesel is derived from vegetable oils through a process called trans-esterification, whereby the biodiesel oil (also called methyl ester) is separated from the glycerin in the vegetable oils through a catalyst such as sodium or potassium.

Since January 2008 Brazil mandates a 2% blend of biodiesel to regular diesel, called "B2". This will rise to B3 in July 2008 and B5 in 2013. Biodiesel is derived mainly from soybeans, castor beans, canola, sunflowers and *Jatropha curcas*. Castor beans are grown in the North and Northeast of Brazil, while soybeans are grown mostly in Central

and Southern Brazil (Mato Grosso, Mato Grosso do Sul, Goias, Parana). *Jatropha curcas*, a relatively new plant for making biodiesel, comes from India and grows on dry, barren soil, where normal food crops can't grow. In Brazil almost 90% of biodiesel is made of soybean oil. After the US, Brazil is the world's largest producer and exporter of soybeans and Brazilian production has been growing at an annual rate of 14% over the last decade.

Biodiesel is – with an annual production of some 1 billion litres – a much smaller market in Brazil than ethanol. All the biodiesel produced in Brazil is auctioned to one buyer, Petrobras, through auctions controlled by the national petroleum agency ANP, through its Petronoc subsidiary and Refab biodiesel refinery. The biodiesel programme of ANP subsumes 23 licensed producers, of which Brasil Biodiesel/Ecodiesel is by far the biggest. ANP grants subsidies, tax exemptions and buying preferences to producers who have so-called "social seals". These are smaller farmers in poorer regions. At this moment, Brazil still imports 5 billion litres of diesel



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per year on a total diesel consumption of 36 billion litres. Petrobras is now planning to build 13 new biodiesel plants which would render imports unnecessary.

Risk diversification |

The Brazilian government has stimulated biodiesel and ethanol production through relatively simple measures, such as mandatory blending, which has created such a strong demand for biodiesel that biodiesel prices are now higher than regular diesel prices. Ethanol consumption is not subsidised in Brazil, but it benefits from a tax exemption, whereas petrol consumption is heavily taxed (50%).

Another big driver for ethanol production is risk diversification for sugar producers. In the future this will also be an important driver for soybean producers. The attraction of producing ethanol instead of sugar is that world sugar markets are heavily influenced by governmental import taxes, subsidies, and other obstacles to free trade. Two-thirds of global sugar markets are protected. This leads to large price fluctuations. Producing ethanol gives sugar producers the ability to arbitrage between sugar and ethanol prices. The same applies to soybean producers who can arbitrage between soybean and biodiesel prices.

Brazilian biofuel producers look set to dominate the global market in the coming years. Other countries in the world will find it very hard to match the growth of ethanol and biodiesel production in Brazil. Brazilian sugar companies such as Cosan and others

have started to export Brazilian ethanol to Sweden, Japan and the USA. In 2007 ethanol production was 20 billion litres, while domestic ethanol consumption was 16.5 billion litres and petrol consumption was 14.1 billion litres. Ethanol exports from Brazil have grown to 3.5 billion litres in 2007, which equates to 35% growth per year since the year 2000, when Brazil only exported 200,000 litres of ethanol. About 1 billion litres were exported to both the EU and the US, and the rest to Japan.

The US imposes a tariff of \$0.54 per gallon (3,8 litres) on imported ethanol to protect its own farmers and has put in place a 7% limit on Brazilian ethanol imports (i.e. ethanol imports from Brazil can not be more than 7% of all US ethanol consumption). Even so, Brazilian ethanol is so much more efficiently produced that the country still manages to succeed in exporting ethanol to the US. The ceiling on Brazilian imports is circumvented by first exporting the ethanol to Caribbean countries, which then re-export it to the US, as these countries are exempt from the 7% rule.

Europe is also being targeted by the Brazilian players. Recently a group of Brazilian ethanol producers, including

Cosan, Guarani, Novamerica and Alcoeste, have started exporting ethanol to Sweden.

The expansion of Brazilian ethanol export is expected to lead to a strong consolidation of the ethanol industry in Brazil, which is still heavily fragmented. Many companies are still family owned. One of the largest and most aggressively growing players is Cosan, which recently acquired all petrol stations, 1300 in total, of ExxonMobil in Brazil, giving it direct access to the end customer of ethanol. This vertical integration of biofuels producers is a trend that is expected to continue. Petrobras acquired Exxon's petrol stations in Chile and is looking to buy Exxon's and Shell's petrol stations in all of South America, while Ultrapar Participações acquired ChevronTexaco's petrol stations in Brazil and now has 5,000 petrol stations in the country. This shows the decline of the traditional oil majors in markets such as that of Brazil, where they no longer control upstream supply of the fuels. The oil majors not only have a problem accessing large oil and gas supplies in the world, they are also threatened by the rise of biofuels. ■

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