

A Global Vision of Ethanol: The Demystification of a Successful Green Brazilian Concept

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Abstract

This paper sets out EcoEnergy's vision for the Brazilian ethanol industry and challenges the notion that ethanol is not a truly "green" fuel option. Skeptics maintain that although the use of ethanol may result in lower levels of carbon emission than the use of gasoline, it does indirect damage to the environment through increased deforestation of the Amazon rainforest. They also claim that greater reliance upon ethanol as a fuel source leads to a rise in food prices and is thus a policy that is socially unsound. The bottom line, ethanol's detractors argue, is that switching gasoline for ethanol is hardly a "green" strategy at all; it merely replaces one social and environmental evil for another. In this paper I show that these skeptical claims are both misleading and false, and that the growth of ethanol as a fuel source is both a welcome development in the fight against global warming and sound social policy.

1. Introduction

There is no day in which one does not hear news about the environment and global warming. This has become as one of the main preoccupations of our time. Indeed, it is a problem that many of us have had to come to terms with in one way or another. It is therefore an issue that many of us have had to confront, both in the sense of pondering its roots causes and speculating about its potential solution. In this paper I discuss EcoEnergy's view of one such solution, namely greater reliance upon ethanol as a fuel source. In particular, I describe EcoEnergy's vision of ethanol as a viable and sustainable option in the face of the unprecedented challenge of global warming and climate change. Accordingly, the first section of this paper discusses the historical background of this problem together with the realities and experience of the ethanol industry. The second section examines the industry today and offers a response to much of the criticism directed towards it. The final section presents a "global vision" of the role of ethanol in a worldwide "green" economy, one that is needed in the 21st century.

2. Historical Background: Rise of the Brazilian Ethanol Industry

This section examines the history of the Brazilian ethanol industry and the development of its expertise and technology in this area. Brazil's sugar cane production dates back to the middle of its colonial period in the 16th century. This industry eventually emerged as the major supplier of sugar for Europe and the world for over 150 years. As a response to the petroleum crisis of the 1970's Brazil initiated its well-known Ethanol program. As a result, there are no longer any light vehicles in Brazil running on pure gasoline. In 1975 the government founded Proalcool and guaranteed the acquisition of ethanol through large volumes of credit at concessionary rates to annex distilleries. (At the time there was an interest rate of 17 percent per year when inflation was more than 30 percent per year – a shortfall the government needed to offset to render this project economically viable). Today, the Brazilian ethanol program constitutes the largest commercial application of biomass for energy production and use in the world.

To make this program work, the Brazilian government enacted a number of measures in the agricultural sector, including concessionary interest rates and funds for research and development. In the processing sector it created special credit conditions for modernization of mills and distilleries as well as economic incentives for corporate mergers and acquisitions. Finally, the government offered various financial benefits to industry players, such as subsidies to offset the high cost of sugar production in the Northeast.

Since 1977 the Brazilian government has made mandatory the blending of 20% of ethanol (E20) with gasoline (gasohol), which requires just a minor adjustment of standard gasoline engines. The economic stimulus for sugar cane production from 1970 until the mid-1980s was brought about by government programs and by 1980 the production of ethanol was already taking up more than 40 percent of sugar cane production. This resulted in the expansion of sugar cane production in the first half of that decade. It is important to note that the rising skepticism concerning ethanol as a fuel source toward the end of the 1980s reduced both demand and growth. However, sugar exports then took the lead in providing stimulus for expansion of the crop's production. Until the 1990's there was considerable government intervention in

the industry. (In the 1930's the Sugar and Alcohol Institute (IAA) was created to set both prices and production quotas for mills). Today, the industry is structured according to free-market principles.

3. Present State of the Industry: Development, Challenges and Criticism

Ten years ago the Kyoto Agreement declared ethanol to be one of a number of future green fuels. Since then worldwide concern over the effects of carbon emissions on climate change and the need for greater energy security has greatly intensified. Today, across the globe, many see ethanol production as a promising path towards an economically sustainable and environmentally responsible energy industry as well as towards a greener way of life. (In Brazil this view has been widespread since the 1970's). However, some are still hesitant to embrace this position. They argue that ethanol is not as sustainable as claimed and that it has deleterious side effects such as the rise of world food prices. (It is important to note in this context that Brazil is responsible for 45% of the world's fuel alcohol).

The main argument concerning ethanol's affect on the rise in food and commodities prices has been based on the rise in prices of crops such as maize in Mexico and corn in the United States of America due to the production of ethanol in those countries. That has indeed led to the rise of North American food prices. But the Brazilian ethanol market is a completely different story and should not be confused with the North American experience. Although ethanol production in Brazil might have initially had some affect on domestic food prices and crop production, it has not in any significant degree led to a rise in the cost of food and commodities.

According to a recent article in *The Economist* ("Ethanol, schmethanol", issue 39), the real reason ethanol receives so much popular attention is that people simply know how to make it. Critics, it notes, like to claim the following: ethanol produces carbon dioxide emissions at rates similar to that of normal gasoline; ethanol as a fuel source is less energy efficient than gasoline; ethanol damages car engines; the most employed mixture – the E85 blend of ethanol and gasoline – produces lower mileage per litre than pure gasoline; ethanol production pushes up the cost of food; ethanol production displaces farmers and contributes to deforestation.

The issue is not a new one, as two years ago it was already part of the debate. As the statement below indicates, neither research by government agencies nor analyses by private consultancy firms has produced any evidence of a negative effect of ethanol on the prices of food and commodities:

"Sugar cane is not going to new areas. Logistically, it is not possible for the areas to expand. What has happened is only a conversion, not very significant, of pastureland to cane, since cattle-raising has become more intense" [1].

Furthermore:

"We have monitored the expansion of sugar cane and seen which activities have been substituted. Basically they are cattle-raising areas. And where do the cattle go? We have observed that cattle-raising area has been reducing in size, while head of cattle per hectare has been increasing. This means that cattle-raising has been intensifying, going from 1.1 to 1.2 head of cattle per hectare. Translated this means that there is no pressure on the production of food nor the migration of economic activities to other areas" [2].

Some even argue that ethanol is therefore a green solution and that it could be a major source of alternative fuel in the fight against global warming. The main concern is that while much of the criticism and concern might be appropriate in the case of the American ethanol industry, it should not be treated as such in the case of the Brazilian one. It is a multi-step process requiring a lot of energy and engineering to get to the end product of ethanol when corn is used. Transforming sugarcane into ethanol, however, is much more straightforward, requiring much less in the way of energy and engineering.

Apart from this fundamental advantage in production, Brazilian sugarcane-based ethanol has a number of distinct advantages compared to corn-based one. First of all, Brazilian ethanol is more-cost effective compared with corn-derived ethanol – sugarcane ethanol yields the best energy balance in production (an 8.3 ration of energy output/energy input) compared with corn based (a 1.31 ration of energy output/ energy input). Secondly, the cost of ethanol production per litre is US\$0.19 for sugar cane, compared with US\$0.36 for corn-based. Lastly, since Brazilian car engines are designed to run on any mixture of E85 (a fuel mixture consisting of up to 85% ethanol and 15% gasoline) or even higher percentages of ethanol, they can better exploit the fuel by using higher compression ratios.

The result is that Brazilian ethanol blends produce the same number of miles per litre as a car run on gasoline. Also, Brazil's infrastructure allows for a lower cost of production, as much of the country's ethanol is distilled within easy reach of its ports. Regarding the criticism that ethanol pushes up food prices, there is very little – if any – hard research to suggest that ethanol production has increased food prices in Brazil.

Finally, in perhaps the most potent anti-sugarcane argument around, some analysts suggest that the growing of sugarcane pushes local farmers into using rain-forest land, thus contributing to deforestation and all of its negative consequences for the environment. This is a feeble argument for four reasons. First, Brazil uses only 4% of its agricultural land to produce sugar cane. Second, the climate in the Northwest –

where the Amazon rain forest is located – does not favour sugar cane plants, as it is too humid. Third, given the large expanses of arable land in Brazil, ethanol production can be, and is being, diversified to the North East of the country where it does not affect natural reserves like the Amazon. Fourth, growth in production is also coming from the Sugarcane Genome Program, which has allowed scientists to map sugarcane's DNA, thus leading to higher levels of sucrose from the sugarcane produced in the Northeast.

Brazil has established the world's most competitive ethanol industry. Brazil is the lowest cost major sugar producer in the world, with high returns on its sugar and ethanol production compared with other crops. Brazilian sugar producers have benefited from large amounts of available cultivable land, improved technological advancements, expansion of production capacity of mills, and a decades-old government policy that has encouraged the establishment of a vibrant ethanol industry.

Although other forms of ethanol have been researched, such as cellulosic ethanol (second generation) there is not enough evidence to suggest that it will grow fast and be capable of supplying worldwide demand. While it is certainly true that cellulosic ethanol would minimize the use of large arable land, the technology for producing this type of ethanol is still in its infancy. The same is true for most other biofuels which range from rapeseed oil to Malaysian palm tree oil. The biodiesel most commonly used is the esters, the most common being the rapeseed oil (RME-Rapeseed oil Methyl Ester) and other blends with sunflower and soya.

4. Future prospects: The Green Future of Brazilian Ethanol

Globally, the use of biofuel is growing fast, but not at a pace to overcome the increasing demand for gasoline. However, as the world becomes greener and cleaner, the question confronting us is what type of biofuel holds the most promise of being as cost-effective as possible. Rapeseed oil, for instance, is rather costly, being more expensive than normal diesel fuel and most types of ethanol. According to Caio Carvalhal, an analyst with Cambridge Energy Research Associates in Rio de Janeiro:

"It's amazing how sharply the level of interest in our experience here has jumped in recent months," said Eduardo Pereira de Carvalho, president of Sao Paulo's sugar cane producers union. "We receive visiting politicians from the U.S., and we get invitations to speak to the Senate Foreign Relations Committee and to leaders of investment funds. They know that Brazil's ethanol program exists, but beyond that, most of them have very little information about our actual experience" [3].

It is vital that policymakers should bear this in mind when making strategic decisions on which bio-fuels to invest in for the future. Perhaps the coming tour of Brazil in June 2009 by members of the European Parliament might help contribute to a more well-informed debate on the true prospects of ethanol as a bio-fuel.

The Brazilian evolution in the production of ethanol in 2013 will go to 24.95 billion liters per year. Indeed, it would be greater were it not for the limiting capacity of petroleum extraction (approximately 85 mm barrels per day), the cost of Brazilian subsidies (merely 30% of that in the United States), new environmental regulations (e.g. the Kyoto protocol), an increase in flex cars, and various changes in the world energy matrix.

This growth translates to a need for 100 distilleries with the capacity of 1.2 millions of tons per year per harvest. Indeed, according to new estimates, the planned creation of a further 157 distilleries might not even be enough to supply this increase in demand. In Brazil there are already 334 functioning distilleries, with another 89 to be built between 2008 and 2010. However, even 423 domestic distilleries might not be enough sugarcane-based ethanol, should the global demand increase. The present expectation is that sugarcane-based ethanol might soon offer Europe and North America an energy alternative which is cheap, clean, and, perhaps most importantly, produced in a country marked by political stability and friendly relations with the West.

There are new projects underway that entail a more holistic approach to the idea of sustainable energy and higher financial returns. They are designed to produce not just ethanol, sugar, and electricity, but to offer an advantage in terms of carbon credits as well. As such, they are helping to redirect the industry towards more socially and environmentally responsible goals. The basic idea is to help maintain and protect biodiversity while promoting the social and economic development of the region. It is nonetheless a business enterprise, and a very successful one at that. Such projects can also diversify the production of land when it needs to be at rest from growing sugarcane; alternative cultivation could be cereals, soya, banana, latex, and palm oil as well as poultry and cattle breeding.

The world is looking toward Brazil for leadership in providing a solution to the problem of energy dependency on fossil fuels. Brazil's efforts are being closely followed by countries with especially high fuel costs. Developing and emerging world powers such as "India and China have sent a parade of top officials to see Brazil's program" [4]. Without doubt Brazil is the future and this future is already on display, according to Monte Reel and others in Brazil. They argue that this can be seen as "most of the plants burn bagasse, the leftover tissue from the sugar cane stalks, to power the production facilities and especially because Brazilian cane has been genetically bred to yield more sugar throughout the years, the stalks are particularly weak -- which makes them easy to break down, and ideal for converting to energy" [5].

One could construct the argument for Brazil's competitive advantage around four pillars giving Brazil its edge in terms of ethanol production. The first is that this production "synergies" with the sugar market, which with "significant improvements in the productivity of the sugar industry have benefited ethanol production" [6].

The second pillar is that it "synergies" with electricity and heat production. It is important to note that "another important contributor to the success of biofuels lies in the energy content of sugarcane residues." This means that many of the distilleries and sugarcane plants are new ones that can produce their own energy. In addition, there are already in place projects which do produce electricity and supply much of it to the community surrounding the production plants. This is an attractive social and developmental aspect of the industry, one that provides jobs, education and healthcare for surrounding communities that are often very much in need. Furthermore "at present, cogeneration of heat and electricity from bagasse supplies most of the energy needs of the biofuel production process itself, as well as allowing an increasing amount of electricity to be exported to the grid" [7].

The third pillar is the institutional support, as the government at federal and at state level are very supportive of these programs for the production of sugarcane. The government has an essential role to play in providing incentives and setting up a clear institutional framework. This role includes setting technical standards, supporting the technologies involved in ethanol production and use, providing financial advantages, and ensuring appropriate market conditions.

The fourth pillar is the geographical aspect, as "Brazil has abundant agricultural land and an appropriate climate for sugarcane. Its sugarcane industry is already developed" [8]. This also leads to the logistical aspect of Brazil having the structure for transport not only in its southern ports but now in its northern ports (due to recent development) which will facilitate exports to North America, Europe and the rest of the world.

5. Conclusions

The forces of change are leading us, inexorably, towards a greener future. A more sustainable approach to energy production is today as necessary as it is inevitable. It is quite clear that Brazil, through its lengthy experience regarding this matter, is well positioned to lead on the question of ethanol production. In the years to come it will almost certainly play a crucial role in helping to resolve the problem of global warming and climate-change. Because of this, it is vital that more research be conducted and more money invested in the ethanol industry. Ethanol use is not some vision of the future; rather, it is already a reality in one of the largest economies in the world. Moreover, as Brazil's experience clearly shows, reliance upon ethanol as cleaner energy source really works. The rewards here are quite considerable, both in environmental terms and in financial terms.

The present period is marked by the need for a cleaner and more sustainable source of energy. Because of this, money is now pouring into Brazil's ethanol industry as major investors begin to embrace the vision that Brazil has been guided by for more than thirty years. Brazil is presently where the rest of the world wants to be. In this respect, Brazil defines our new age of ethanol.

6. References

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