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## **Brazil's Biofuels: An Alternative Energy Source**

In the 21<sup>st</sup> century, many issues have come to the forefront of international relations and foreign policy, including the debate over the growing need for alternative energy sources. Countries have begun the task of looking inwards and utilizing their natural resources to develop these energy sources. One such country is Brazil. Located on the east coast of South America, Brazil has become one of the leading countries in the world of ethanol production. By taking advantage of its vast sugar cane production, Brazil has managed to become one of the world's largest producers and consumer of ethanol from sugarcane as transportation fuel. Although this hike in alternative fuel production has caused an economic boom, many parts of Brazil still suffer from rampant poverty and staggering social inequality. With advances in alternative fuel technology now underway, Brazil must translate its biofuel blessing into a viable source of food security for its population. Ethanol has its advantages and disadvantages. One disadvantage to ethanol is the energy content. Ethanol has close to one-third less energy than gasoline. This lower energy content can produce lower fuel economy. This means, because of the lower fuel economy, the prices of ethanol would have to be less than gasoline to have the same number of miles driven. Another disadvantage to ethanol is the high cost of production. Because they are used to replace gasoline and diesel, the prices of these fuels have increased. One advantage to ethanol is that because ethanol can easily be mixed with water, it has to be handled with care, but these precautions are much smaller than handling gasoline. Also, only minor adjustments have to be made on cars to make them run on ethanol, although the E-85 cars have to special engines that run on 85 percent ethanol. One advantage that car companies are trying to sell to the consumer is that the cars that run on ethanol is more environmentally friendly. They are said to lower green house gas emissions. In the rural regions of countries where ethanol is being produced there has been an increase of jobs.

Today, most of the population of Brazil survives under deplorable conditions. Households consists of 2.3 people per household and in the poorest areas the size is 3.8 people (Bauerman, 2006). The income that half of the families earn is under two U.S dollars per day or 100 reais. The average farm size of a farmer is less than 1 hectare. In northeastern Brazil, for example, a subsistence farming family lives on a diet of meat, rice and beans. Schools in this region do not meet the needs of the population. The children of subsistence farmers usually attend school from third to eight grades, but usually spend most of their time at home helping their parents. In the case that children are allowed to go to school, the education system is so under-funded or poorly kept that some children, who have no previous education background, are allowed to continue through school sometimes up to third grade without being able to read or write.

The north-northeastern region has one of the highest levels of food and nutrition insecurity in Brazil. 55% of the population lives with food insecurity (Bauerman, 2006). This fact is not due to the lack of food but to the fact that the Brazilians don't have the income to buy any. In the northeastern region there is only one period of rain per year. The rain saturates the sub-soil but the people have no method of extracting it efficiently. Also, the rain comes at a time when the people are not farming. Another barrier to this region is that it doesn't have the technology to irrigate their land. Farmers use outdated methods that waste the little water that they have. Brazil is now in the process of trying to combat this poverty. To understand how biofuel affects food security in Brazil, it is important to first understand what biofuels actually are.

Biofuels are liquid or gaseous fuels derived from biomass or organic matter, for the purpose of fuel...Ethanol is made from microbial exchanges of biomass materials through fermentation. The

production process continues with the biomass being converted to fermentable sugars, the fermentable sugars being converted to ethanol, and the final step is the distillation of the ethanol because at this stage it is made up of 95 percent water. Ethanol is exclusively produced from corn and sugarcane. (Kojima & Johnson, 2005).

The central-southern region is the hub of Brazil's ethanol production. In the central-southern part of Brazil, production of ethanol is much higher and there are lower production costs. Since this region has more technology there are fewer workers but these workers are paid significantly more than the workers in the north-northeast region. Over 85% of Brazil's sugarcane and ethanol production is in the central-southern region (Kojima & Johnson, 2005). In the state of São Paulo, irrigation is not used because everything is rain fed. Also in this region there is one of the largest ethanol plants in the world. The north-northeast region is characterized by much more workers and lower wages. This region also has lower yields than the central-south region and a higher cost of production.

Brazil and the United States alone produce over 80 percent of the world's ethanol (Kojima & Johnson, 2005). One half of the sugarcane output from Brazil has been used for the purpose of being made into ethanol (Mae-Wan Ho, 2006). Between the years of 1974 and 2004 Brazil began substituting close to 230 billion liters of gasoline for ethanol (Kojima & Johnson, 2005). Brazil began incorporating ethanol in gasoline about 70 years ago. In 1931, they began blending 5 percent ethanol and in 1938 it was mandated (Kojima & Johnson, 2005), in 1993 the blend of ethanol was raised to 22 percent (Kojima & Johnson, 2005). Ethanol from Brazil is now cost-competitive with gasoline. Because Brazil was the first country to experiment with ethanol on a national and international scale, it was also the first to confront and address issues concerning this biofuel. In 1973 when the price of oil quadrupled, Brazil was importing nearly 4/5 of its oil (Kojima & Johnson, 2005). Brazil wanted to rid itself of oil so they began to look towards ethanol as a substitute for gasoline. In the 1970's an estimated 200 families controlled cane production and processing (Kojima & Johnson, 2005). A couple years later 104 ethanol distilleries were erected and the consequence were extremely lucrative offers from the government (Kojima & Johnson, 2005). The problem with this is that the larger companies bought out the land and forced the family farmer off. The government made their official fleet run by ethanol and fixed the price of ethanol so people would save from buying ethanol.

Because 59 to 65 percent of the total cost of ethanol is sugarcane Brazilians have gone to great lengths to control pest, disease and weed infestations (Kojima & Johnson, 2005). Brazilians protect against crop disease by using genetically engineered sugarcane varieties; they have made over 500 varieties of sugarcane because there is always the chance of a new disease (Kojima & Johnson, 2005). Some epidemics have been controlled due to the fact that the diseased crops could be replaced quickly; furthermore Brazilians have used pesticides and other biological control methods to fight pests. Weeds are controlled by mechanical and chemical methods. As the ethanol industry grows, so will the need for land. Farmers are moving closer and closer to the Amazon and have already used most of the Atlantic forest and the Cerrado, which is a very bio-diverse ecosystem. If more and more of the Amazon is deforested, that would mean more carbon dioxide would be released when already 80% of Brazil's carbon dioxide emissions is from deforestation (Volpi, 2006).

These methods are very important in helping and protecting crop yields. Without these methods a certain epidemic could wipe out a year's crop which would spell disaster for Brazil's economy. These methods can increase yields, but the cost of sugarcane and other plants would rise. The plants that are being used for fuel might not be used as food, for example, to fill an SUV with a 25 gallon tank of ethanol would require the same amount of the plant to feed someone for one year (Runge & Senauer, 2007). Since 50 to 80 percent of the poorest people in the world spend their income solely on food, an increase in

the prices of common foods would mean malnutrition and starvation and it would be the same for subsistence family farmers (Runge & Senauer, 2007).

Since 1975, the production of ethanol has had a three-fold increase (Kojima & Johnson, 2005), in 1975, 2,000 liters of ethanol were being produced per hectare, but by 1999, that figure had risen to 5,000 (Kojima & Johnson, 2005). The crop yields increase at the expense of the environment. Field burning is used in Brazil in order to make work easier for workers who have to manually cut the sugarcane. This releases methane and nitrous oxide into the air, gases that are very harmful to the environment. As the production of ethanol grows there will be a demand for more sugarcane which will bring the price of food up; increasing starvation and malnutrition for subsistence family farmers. If Brazil made more disease resistant sugar cane that would be an advantage to rural areas in the north-northeast region of Brazil, in that region there is three-times as much labor so with more sugarcane to grow there would have to be more workers (Kojima & Johnson, 2005).

As the demand for ethanol in Brazil and the world grows, the need for more disease-resistant and pest-resistant sugarcane will always be a concern. Making these kinds of crops will take on a larger role because it is necessary to protect the sugarcane that is running Brazil's economy. The income Brazil generates from exporting ethanol should be used to improve the infrastructure of the country, for example, revenue could be used to build more schools and provide education, especially in the north-northeast region of Brazil. The revenue could be used to provide education to farmers on how to farm the land properly and it should also be used to help the subsistence farmers acquire new technology that would allow them to grow more food for their families.

I think it is the responsibility of the Brazilian government to spread the revenue that comes from producing the ethanol wisely so as to benefit the country. They should educate farmers on how to use the correct farming practices in order to take in maximum yields from that certain region. They should also spread the revenue equally so that in the other regions new technology could be acquired to help the farmers. Brazil should also try to focus on producing more ethanol but not at the expense of the environment. Brazil is currently trying to stop deforestation by making 42% of their energy coming from renewable resources and 90% percent of electricity from hydroelectric power (Wolfowitz, 2005). For example, at one of the largest ethanol plants in the world is complexly self sufficient. The plant, São Martinho, uses the waste created from sugarcane to power and heat the plant. Organizations like the World Bank should give loans to developing countries to allow the government to provide more education and to improve the farming in some regions of the country.

Brazil is quickly approaching a crossroads where it must decide what is best for its country. There are many advantages to Brazil's biofuel production including a decrease in greenhouse gas emissions and an increase in jobs in the rural areas where plants are being produced. In the same vein, however, Brazil will have to deal with all of the disadvantages associated with the production of biofuels, which include decreases in energy content and the high cost of production. The decrease in the energy content associated with biofuels requires more consumption of those biofuels which in turn increases the need for production. Therefore, biofuels may not be the most viable option when it comes to energy needs, in that increasing their use will decrease the sustainability of the venture. Currently, technological innovation has not allowed the production costs of biofuels to equal that of conventional fuels in Brazil, or elsewhere in the world. Without these improvements, and the above mentioned question of sustainability, the extended use of biofuels comes into question. Lastly, as we have seen in the United States, an increased interest in biofuel has led to higher prices for biofuel precursors like corn. This increase in price has had a trickle down effect for consumers, in that products made from corn have begun to have higher prices.

The incentives for the use of biofuels are many, but if countries like Brazil and the United States do not proceed with caution, a potential breakthrough in energy may turn out to be a burden on consumers, and the environment. Furthermore, developing countries like Brazil will have to find a way to distribute its wealth gained from the production of biofuels evenly, making the advancement of energy a boon for all, and not just for some.

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