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Ethanol Production in Brazil

Introduction

In the popular movie, *Back to the Future*, the brilliant scientist named Doc comes racing out of the sky in his De Lorean, drives up to the story's hero, Marty, and tells him to jump in. Doc has just come from the future where cars hover in the sky instead of driving on the ground. Before they take off, Doc grabs some pieces of garbage from a nearby trashcan and throws it into the "Mr. Fusion Home Energy Converter" attached to the car. "Doc, what are you doing?" asks Marty. Doc replies, "I need fuel."

Wouldn't it be wonderful if cars could run on garbage? Two problems fixed with one solution. One problem is the excessive amount of waste humankind produces. And the other problem is pollution of the atmosphere from excessive CO_2 emissions. Though garbage as fuel is unrealistic, the adverse effects of dependence on oil have never been more prevalent. Using coal and oil comes with numerous problems: pollution, climate change, reliance on politically unstable and intolerant nations, and even the fact that coal and oil are fossil fuels and will run out in a relatively short period of time. Climate change is by far the biggest problem caused by the use of these fossil fuels. Climate change unfairly targets the poorer countries. Unpredictable weather patterns force periods of severe rain and drought upon people whose entire fortune depends on a good crop yield ("Equality 'threatened by climate'). Massive amounts of CO_2 being released into the air produce devastating effects for the earth.

While garbage might never become a viable fuel option, biofuels might. Biofuels are described as "liquid fuels and blending components produced from biomass (plant) feedstock, used primarily for transportation" ("Explain Biofuels"). Ethanol is considered a definite option for reducing use of fossil fuels. Ethanol is an alcohol-based alternative fuel produced by fermenting and distilling starch crops that have been converted into simple sugars. Corn, soybeans, switchgrass, and sugarcane are some examples of crops used to produce ethanol. Developing countries are looking towards biofuels as a way to generate wealth and industry. Brazil is one of the leaders in producing ethanol by using sugarcane. Currently 77% of new cars sold in Brazil are fuel flexible vehicles which can run on both ethanol and gasoline ("Fuel for Friendship").

For being a middle-income country, Brazil has a surprisingly high percentage of people living in poverty. Brazil's drought-prone northeast has Latin America's largest concentration of rural poverty. 50% of Brazil's population lives on less than $2 a day. Brazil ranks second in the world for income inequality. One of the main causes of poverty is extreme inequality of land tenure. Most of the farms in Brazil are very small and dedicated to subsistence production. A large number of smallholder farmers work as day laborers in agriculture. 21% of Brazil's population lives in rural areas. About 30 million people living in rural areas exist in conditions of poverty. The rural poor are considered to be more disadvantaged than the urban poor because they have less access to education and health facilities and their water supply and sewage systems are generally considered inadequate. People who live in semi-arid regions with poor soils are the poorest in the country ("Rural Poverty in Brazil").

After nearly three decades, Brazil has prevailed where many countries have stumbled: in developing a viable alternative to oil. Brazil uses half of their sugarcane crop to convert into fuel for vehicles. “Ethanol accounts for as much as 20% of Brazil’s transport fuel market” (Luhnow). To understand the advantages and disadvantages of using biofuels, one must take a closer look at Brazil. The ancient Greek philosopher, Pratgoras, said “There are two sides to every question.” The question is: “Should the global community produce biofuels?” The answer is a little more complicated than it seems.

History of Biofuels in Brazil

In 1973, Brazil experienced quadrupled gas prices resulting from an oil embargo amid war in the Middle East. At the time, Brazil imported 80% of its fuel. Soon after, Brazil fell into an economic recession. The country was not prepared for such a crisis. Government leaders scrambled for a solution. By 1975, General Ernesto Geisel required that Brazil’s gasoline be mixed with 10% ethanol. This was raised to 25% over a period of five years. The government helped the growing industry by giving sugar companies corporate loans for the construction of ethanol plants and ensuring prices for their product. The government also funded Urbano Ernesto Stumpf who was developing a car that would run on 100% ethanol (Luhnow).

The 1979 Iranian revolution caused the world’s second oil price jump and pressed Brazil to speed up its efforts (Luhnow). Brazil launched the Proalcool program which “was based on increased production of sugarcane-based ethanol through fermentation of molasses, a sugar industry byproduct, and developing cars that would run on pure hydrated ethanol” (Bastos). Tax incentives lured car companies into selling ethanol-powered vehicles. Within a year, all the auto companies in Brazil had bought into it. For consumers, ethanol has its advantages and disadvantages. For example, while ethanol-powered cars are hard to start in cold weather, ethanol provides better acceleration. By 1983, nine out of ten cars sold in Brazil were 100% ethanol-powered (Luhnow).

Brazil paid big bucks to sugar companies- about $16 billion in 2005 dollars from 1979 to the mid nineties- in order to provide loans and price supports. Unfortunately for ethanol, in 1986 a perfect storm was created in a year of severe drops in worldwide oil prices, hyperinflation, and creditors urging Brazil to cut spending. Ethanol-powered cars stopped selling and the citizens of Brazil felt the whole experiment was a loss. Despite this, sugar companies continued to make fuel and cut costs, thanks in part to the standing state requirement for all gasoline to be mixed with ethanol. The Centro de Tecnologia Canavieria researches varieties of sugar cane that are more resistant to droughts and pests and produce higher yields of sugar. They have helped lower costs by more than 1% a year. By 2006, nearly 6,000 liters of ethanol was produced from a hectare of sugar cane, compared with just 2,000 liters in 1975. Recently as oil prices have soared, ethanol is looking more attractive as a source of fuel. Still, consumers are wary of the cheap ethanol price, wondering if gas prices will decrease again. To solve this problem, Fernando Damasceno, chief engineer at the Brazilian unit of the car parts company, Magneti Marelli, created a device that would calculate the mixture of ethanol versus gasoline. The result of this device was the fuel flexible vehicle. Buyers could now choose which fuel they want to use on a given day, and be able to drive the car out of the gas station (Luhnow).

Problems

Many arguments are made against ethanol production in Brazil. Four major problems are: reduced food productions and increased food prices; threat to food sovereignty; devastation to natural forests and biodiversity; and biofuels save less energy then originally thought.

Problem 1: Reduced food productions, increased food prices, and threats to food sovereignty

If crops are expanded to take up a larger land area they could threaten the food security of the local populations. Instead of growing food to feed an already significantly hungry nation, farmers would concentrate on producing crops for biofuels (Bravo and Ho). This produces a strain on crops used for food. Without political intervention, food prices will increase and food production will decrease. Many citizen organizations in Brazil argue that expansion of ethanol production would subvert the needs of the people and ecosystems in order to maintain the lifestyle of other countries. One of the reasons Brazil's ethanol is cheap is its cheap labor. Sugarcane fieldworkers have one of the most laborious jobs in the world. They work long hours in extremely hot temperatures, cutting as much cane as they can since pay is based on the weight of cut sugarcane. As the monoculture of sugarcane increases and control of the industry falls to fewer individuals, rural poverty increases. Maisa Mendonca, director of NGO Rede Social in Sao Paulo states that "our evaluation is that the government needs to combat hunger" (Kenfield), instead of supplying rich countries with cheap energy.

Problem 2: Devastation to natural forests and biodiversity

Currently there is not enough land to grow crops for biofuels, so forests are making way for crop fields. In an Institute of Science in Society article written by the director of I-SIS, Dr. Mae-Wan Ho, it is stated: "Sugarcane encroaches on the Amazon, but far more so on the Atlantic forest and the Cerrado, a very bio-diverse and unique savannah-type ecosystem. Two-thirds of the Cerrado have been destroyed. If sugarcane cultivation were to expand, the outlook for the world's natural biodiversity would be grim." While Dr. Ho is right that the use of the Cerrado is affecting the ecosystem, careful consideration must be implemented when weighing the benefits from a rather vast and infertile plain with a preserved ecosystem compared with the need and ability to morph the existing land into highly productive crop fields. Marcos S. Jank, president of the Brazilian Institute for International Trade Negotiations (ICONE) and professor of economics at the University of São Paulo, argues that "increased sugarcane production will not crowd out other crops, but will most likely expand into lands currently used as pastures (of which there are currently 440 million acres)" ("The Global Dynamics"). Jank also maintains that ethanol production promotes rural development. Eric Holt-Gimenez of the NGO FoodFirst based in Oakland, CA states in opposition that in order to meet future global demand, Brazil will have to clear 148 million acres of additional forest. Increasing sugarcane production starts a chain reaction. Sugarcane producers will occupy land formerly used by grain producers; grain producers will move to land used by cattle; and "cattle ranchers will seek new areas such as the Amazon region" (Kenfield).

Dr. Ho maintains that "80 percent of the country's greenhouse gas emissions came from deforestation" (Ho). Clearing land to plant crops used for biofuels cancels out any positive energy gain received from using ethanol instead of oil. In extreme cases, too much deforestation could produce permanent drought over the Amazon basin and US grain belt, may severely reduce global food supply, and send large amounts of CO_2 into the atmosphere leading to species' extinction (Ho).

Problem 3: Biofuels may not save as much carbon as originally thought.

While the simple action of burning 100% ethanol does not add any CO_2 to the environment (the CO_2 in plants is already counted in photosynthesis- no "new" carbon dioxide is being added to the atmosphere), it requires a higher energy input than oil because of the production process. The production process includes farming, transport, conversion to liquid ethanol, and production of fertilizers, pesticides and herbicides. While second-generation biofuels (non food crops) are being considered as a way to decrease the amount of energy input of

biofuels, there is also concern about soil degradation and whether stripping the land of these waste products would encourage that (Ho).

Solutions

While biofuels have a set list of obstacles to overcome, they are a much more attractive option than sticking with oil. Most of the biofuels' limitations can be overcome with advances in research and technology.

Solution 1: Government set regulations for amount of crop used for ethanol

Many organizations agree that Brazil must incorporate concepts of food sovereignty into its development policy. It must establish that producing crops for food is its first priority, with fuel as a second priority. "Food sovereignty includes both the obligation of governments to ensure that their populations have access to nutritious foods in adequate quantities, and the right of people and countries to define their own agrarian policies, and produce foods destined to feed their populations before producing for export" (Kenfield).

Solution 2: Conservation of eco-systems

The destruction of forests in order to make way for agriculture is unsustainable. Creating preserves is a must; The Nature Conservancy established a 22,000-acre private preserve in the heart of the Cerrado grasslands. According to their website:

> "The Conservancy's work in the region focuses on landscape conservation planning, biodiversity and ecological processes within agricultural lands. Activities include the allocation of private land set-asides for biodiversity corridors and the promotion of best agricultural management practices" ("The Cerrado")

Organizations like the Nature Conservancy are essential in preserving diminishing ecosystems. State parks established by the government of Brazil are a possibility.

Solution 3: Researching ways to cut costs of ethanol production

Processes must be designed and implemented so as to supply the maximum amount of fuel at the cheapest cost while providing maximum environmental benefits. Researching ways to increase yields per hectare will be key, as well as producing strains that require less pesticide use. Exploring second generation biofuels will be the next step. Researching practical things farmers can do to grow, harvest, and store biomass in a sustainable manner will help combat the high energy needed for ethanol production. Nations working together as one to pool our brain bank is the only way we are going to solve this global crisis ("Dupont").

Solution 4: Encouraging young academics to enter the field of energy research

Though not a direct solution of biofuels' shortcomings, gifted students should be introduced to the possibility of a career in alternative energy research. DuPont announced on September 21, 2007 that it would donate $1 million to Iowa State University to focus on producing cellulosic ethanol on the farm, and enhancing the production, processing and utilization of feedstocks for biofuels ("DuPont"). Programs like the World Food Prize youth institute expose the smart younger generation to food problems and the need for research and technology.

Conclusion

Biofuels have become a strong option for the new alternative energy source. Something must be done to rid industrialized nations of their addiction to oil. The burning of oil releases carbon dioxide into the air that was stored underground for millions of years. In other words, it introduces new carbon dioxide into the atmosphere. The burning of biofuels releases old carbon dioxide into the atmosphere because of photosynthesis. Brazil has successfully implemented ethanol policy for nearly three decades. “Brazil has the most advanced and efficient ethanol program in the world and is eager to collaborate with other producers to meet global energy needs” (“The Global Dynamics”).

As countries like China and India grow and demand more energy, ethanol is going to become even more important. Brazil’s goals include establishing international standards, coordinating joint investments, and devising a common strategy to increase the number of producer and consumer nations. Brazil currently produces biofuels from about half of their sugar cane yield. The benefits of ethanol use are significant. Unlike fossil fuels, ethanol is a renewable energy source, emitting low levels of carbon dioxide (“The Global Dynamics”).

Developing technologies is extremely vital to the future of alternative energy. Perhaps a new energy will emerge- one found by extensive research. As the ethanol industry grows, more research on reducing costs of production will be important. Conserving ecosystems is a priority in order to prevent the dangerous effects of monoculture. The alternative energy predicament will be impossible to solve without technological development and engaging globally. Recruiting researchers from the coming generation to further develop the alternative energies and vehicles is vital to the well-being of our planet and its inhabitants.

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