Introduction

Ethanol has recently been put into the limelight throughout the world. Politicians in the United States, the European Union and others are quickly learning that if they wish to reduce dependency on foreign oil - many times coming from politically unstable regions of the world - they need to push for alternative sources of energy. Further backing the new political craze is a heavy worldwide interest to live in a cleaner world and to fight global warming by reducing greenhouse gas emissions into the atmosphere. For most, it would appear that ethanol's hand in politics is a product of a new phenomenon, only being driven by the Kyoto Protocol and a post-911 world. But at least since the mid 19th century, politics have played a noteworthy role in its history.

Ethanol's Political History

During the Civil War, President Lincoln placed a heavy tax on ethanol to raise money for war efforts. In the turn of the 20th century, "Henry Ford designed his Model T to run on a mixture of gasoline and alcohol, calling it the fuel of the future. In 1919, when Prohibition began, ethanol was banned because it was considered a liquor. It could only be sold when it was mixed with petroleum. With the end of Prohibition in 1933, ethanol
was used as a fuel again. Ethanol use increased temporarily during World War II when oil and other resources were scarce" (Department of Energy).

A newfound "interest in ethanol as a transportation fuel" formed as a result of the 1973 Arab-Israeli War when "Arab oil-producing countries cut back oil production and embargoed oil shipments to the United States and the Netherlands," leading to consumer panic and wild bidding (Department of Energy, Microsoft Encarta 2006). To make matters worse, the 1978 Iranian Revolution "that eventually drove the Shah... from his throne... forced up oil prices [again] during 1979" (Microsoft Encarta). "Since that time ethanol use has been encouraged by offering tax benefits for producing ethanol and for blending ethanol into gasoline. In 1988, ethanol began to be added to gasoline for the purpose of reducing carbon monoxide emissions" (Department of Energy).

**What is Ethanol?**

The Department of Energy's website describes ethanol as a "clear, colorless alcohol fuel made from the sugars found in" certain crops such as: grains, corn, sorghum, wheat, potato skins, rice, yard clippings, barley, sunflower, sugar cane, and sugar beets. "A new experimental process which breaks down cellulose in woody fibers, is called 'cellulosic ethanol'. With this process we can make ethanol from trees, grasses, and crop wastes" (Department of Energy).

Ethyl alcohol, or Ethanol, has been used since ancient times. It was used for drinking and eventually as a lighting fuel in the same way that kerosene can be used. Today, it is used to power vehicles as a replacement for gasoline. Sometimes it serves as a complete
replacement, others it is blended with the gasoline to form what is called gasohol. Ethanol to gasoline ratios of 10:100 and 85:100 are the most commonly seen.

A process known as denaturing takes place when ethanol is mixed with anything that is harmful to the human body. This is done to keep ethanol strictly used as a fuel so it is not consumed. "The removal of all these substances would involve a series of treatments more expensive than the federal excise tax on alcoholic beverages" (Microsoft Encarta).

For many, the biggest attraction is the environmental factor. Ethanol starts as a crop. During that crop's life, oxygen is supplied into the atmosphere, therefore sustaining human life. When ethanol is used as a fuel, it "releases carbon dioxide that is reabsorbed by the original crops" (Department of Energy). Therefore, a full-cycle takes place.

There are heated debates, particularly in the US, that argue ethanol's true atmospheric contribution. Ethanol's opposition says that after all the energy invested into the production and logistics process (many times using coal for distillation and fossil fuels for transportation), that there is an equal or even a net loss of total energy. This will be addressed later with more depth.

In the last few years, scientists have been working on exciting new ways to produce ethanol. In the US, where ethanol is primarily made from corn, only the cornstarch is generally utilized. The corn goes through a fermentation process and the starch turns into sugar. The sugar is fermented a second time, turning the sugar into alcohol.

Through new advancements of cellulosic ethanol, ethanol can be produced from wood wastes, agricultural residues, and various grasses (such as switch grass). As this science develops, dependence on crops that are heavy in starch will diminish more and more.
**Who Supplies/Demands Ethanol?**

I sat down for an interview with UNICA's General Secretary, Fernando Moreira Ribeiro in São Paulo. UNICA (União da Indústria de Cana-de-Açúcar/Sugarcane Industry Union) represents around 60% of Brazil's sugarcane industry. As Mr. Ribeiro puts it, there are two primary ethanol markets in the world: The United States and Brazil. Between these two countries, 70% of the world's ethanol is produced.

A worldwide production estimate is posted at the Renewable Fuels Association's website. Although Brazil's production is slightly behind the US in the following list, the RFA estimated Brazil in the lead in 2004 with 3,989 million gallons and the US with 3,535. This is the 2006 list by country, in millions of gallons, including all ethanol grades:

- United States - 4,855
- Brazil - 4,491
- China - 1,017
- India - 502
- France - 251
- Germany - 202
- Spain - 122
- Russia - 171
- Canada - 153
- South Africa - 102
- Thailand - 93
- United Kingdom - 74
- Ukraine - 71
- Poland 66
- Saudi Arabia - 52
- Indonesia - 45
- Argentina - 45
- Italy - 43
- Australia - 39
- Japan - 30

For a more complete list, see the RFA's website.

The United States exported 7.99 million gallons of ethanol in 2005. This is the most recent estimate available by the RFA. In 2006, the US imported 653.3 million gallons. Brazil was the largest supplier with 433.7 million gallons. Next on the list were Jamaica with 66.8, El Salvador with 38.5, Costa Rica with 35.9, and Trinidad & Tobago with 24.8.

Brazil, as a country, is the largest ethanol exporter, the second largest producer and has the largest consumption (Money News). "Brazil exports around 15-17% of its ethanol. In
the US, supply follows demand, but in Brazil, it's the opposite... around 85% of Brazil's [new] cars are Flex Cars" (Fernando Ribeiro). "Brazil is aggressively expanding its sugarcane plantations and expects to more than double its annual exports... of ethanol, by 2010" (Money News).

The European Union as a whole, has a GDP only second to that of the United States (CIA World Factbook). So what is to come of ethanol in the EU? Ribeiro says that roughly 70% of vehicles on the road in Europe are diesel. But ethanol cannot run properly in a diesel vehicle. To add yet another twist, the ethanol in Brazil generally comes from sugarcane. But biodiesel is not made from crops high in sugar, but rather high in vegetable oil (like soy) or even animal fats. This means that if Brazil wants to continue to lead the world in biofuels, it must continue to develop itself as a well-rounded supplier.

The European Union takes a bow to Brazil as a leader in the world of biofuels. On July 4th, 2007, Brazilian President Luis Inácio Lula da Silvia (or Lula) met with European Commission President José Manuel Durao Barroso and Portuguese Prime Minister José Socrates for a Summit in Lisbon. In the words of the European Union's website: This was a "strategic partnership". Among other aspects, this summit was intended to discuss "environmental issues (particularly climate change, forests, water management and biodiversity)" and "sustainable energy resources" (European Union). The very next day, President Lula traveled to Brussels, Belgium to conduct the International Conference on Biofuels.

The EU's goal for the year 2020 is for vehicles to be powered by at least 20% renewable fuel. And 10% of that is to be from biofuel (European Union). The EU has accepted that
to meet this demand, a large portion of the fuel will need to come from outside the
continent. Brazil, who knows the business better than anyone, seems to be the perfect
partner.

**An Evaluation of Brazil**

After the 1973 oil crisis, Brazil (like many others) began to fear energy stability for its
vehicles. In 1975, Brazil formed the Pro-Álcool Program (Programa Nacional do Álcool,
or National Alcohol Program) to reduce foreign oil dependence. This program used
government financing to move toward ethanol use in lieu of fossil fuels. It eventually led
to "the expansion of sugarcane production and the development of two types of ethanol:
hydraulic alcohol for use in pure alcohol vehicles and anhydrous alcohol for blending with
gasoline" (Department of Agriculture). The program has served Brazil well domestically
and ultimately led to major international attention.

To find out more about how ethanol fits into Brazil's big picture and international and
economic future, I went to Petrobras, Brazil's state-owned oil company, in Rio de Janeiro.
I sat down with Petrobras' Renewable Fuels Coordinator, Danny Aronson. Mr. Aronson
is very bright and keeps himself informed on all aspects of the business. During the 3
hours that I spent with Mr. Aronson, and much note taking, there were many things that
catched my attention. But nothing worth remembering more than his vivid description of
how a Brazilian gas station compares to a full service, up-scale restaurant. The next
paragraph is his description, paraphrased, to the best of my memory.

When you go to a gas station in Brazil, you go to a full-service, upscale restaurant. You
sit in your air-conditioned car and you order from a menu with great options to choose
from. Because most cars in Brazil are now Flex Cars (generally called FFV's or Flexible Fuel Vehicles in the US), you are not limited to a single choice. You can choose gasoline or you can choose alcohol. Or if you like, you may choose any mixture of the two. The Petrobras employee (your waiter, with full uniform) comes to your vehicle and takes your order. He/she can even wipe your windows. When he or she is finished tending to your vehicle, you pay, and you are on your way. And you never left your vehicle.

Many may remember when gas stations in the US were more service-oriented like Brazil's (minus the great fuel options, of course) and someone pumped your gas for you. Things have changed since then. When I tell the above description of a Brazilian gas station to Americans, I always get the same response: "Well, that's what we need here in America!" It would appear the Brazilian model is one well worth respect.

And the Flex Cars in Brazil that keep its consumption so strong are made by manufacturers from all over the world. When one drives through any busy Brazilian street in São Paulo, Rio de Janeiro, or elsewhere he/she sees Flex Cars by companies such as Volkswagen, Honda, Toyota, Fiat, Chevy, Ford, and many more.

These Flex Cars can generally run on E100. That means they can run on any combination of gasoline and ethanol, even up to 100% ethanol. But in the United States, many are unaware of the very existence of Flex technology. In fact, Flexible Fuel Vehicles in the US are only made to run on E85 fuel at best, meaning the car is limited to 85% ethanol and requires a minimum of 15% gasoline in the tank to run properly. Although any gasoline-powered car can run on E10 (a gasoline blend containing 10% ethanol), gas
stations with E10 fuel available are difficult to find unless you live in a state such as Minnesota where blending is generally mandatory (Department of Energy).

**Different Suppliers, Different Ethanol**

As previously mentioned, ethanol in the United States is primarily produced from corn. For corn ethanol in the US, the energy gain (after fossil used for farming, production, and distribution) is between 1.3-1.8 times the original energy investment. Brazilian sugarcane ethanol on the other hand, has an energy gain of 8.9 times the original energy investment (UNICA). For Brazil, this is an exceptionally outstanding accomplishment considering the constant challenge it faces do to a much-lesser developed road system than that of the US. Many of the trucks carrying the ethanol travel throughout Brazil and to the ports in Santos (in the South of the state of São Paulo) in order to be exported internationally.

On the profit margin, once again, Brazil has the US beat. As always, depending on the sources, the numbers vary. Yale's website posted a Wall Street Journal article from January, 2006. This article stated that a "recent U.S. energy bill, signed into law in August, calls for more than doubling ethanol use by 2012. But U.S. ethanol, which is made from corn, costs at least 30% more than Brazil's product, in part because the starch in corn must be first turned into sugar before being distilled into alcohol. It may take the U.S. a few more decades to bring the cost of ethanol down to 80 cents a gallon -- equivalent to Brazil's most efficient producers -- according to the U.S. Department of Energy" (Yale).

Another article, published in the Brazilian newspaper O Estado de São Paulo in June of 2007, states that the production process used by the US is twice as expensive than that of
Brazil's. The article attributes the high cost of the US method to the use of coal and natural gas in the process of making the ethanol.

In the US, ethanol is produced by a handful of states, conveniently, corn-producing states. Iowa and Illinois being the top two producers. In Brazil, production regions are scattered as well but primarily take place in two sugar-producing regions: the Center-South region and the Northeast region. Yet, the bulk of Brazil's industry is focused in the Center-South region, and the state of São Paulo accounts for the majority of this region (Department of Agriculture).

**Ethanol Back in Politics**

Once again, ethanol has come back into politics, this time, stronger than ever. The US has begun to get serious about biofuels, particularly ethanol. Newsweek's Daniel Gross introduces the new craze best:

"July 20, 2007 - Ethanol, the substitute for gasoline that in the United States is largely derived from corn, is hot. Statistics from the Renewable Fuels Association show that production doubled between 2002 and 2006, from 2.1 billion to 4.9 billion gallons, allowing the United States to surpass Brazil as the Saudi Arabia of ethanol. When the 86 plants under construction today are completed, American production capacity will top 13 billion gallons per year. In his most recent State of the Union address, President Bush called for the United States to produce 35 billion gallons of renewable fuels in 2017" (Newsweek).

So if ethanol is "hot" and the US is to become the new "Saudi Arabia of ethanol", then ethanol needs a strong political backing. And quite a backing ethanol has! Even
politicians who have opposed ethanol in the past are learning that if they want to be reelected, they need to take ethanol seriously. Some welcome Brazilian ethanol, some don't. But lately, it seems that very few will rule out ethanol altogether.

BBC News posted an article on its website in March quoting corn-state-Illinois Senator Obama: "It does not serve our national and economic security to replace imported oil with Brazilian ethanol." And a few weeks later, he told BBC: "Brazil has done an excellent job in encouraging its own biofuels industry. America should follow suit" (BBC News).

And in an episode of ABC's 20/20, John Stossel said, "Hillary Clinton, Barack Obama, John Edwards and Mitt Romney all want the government to subsidize the development of ethanol." Later that episode he mentioned "Hillary Clinton made 17 votes against ethanol until she started running for president" (ABC News).

But we've only scratched the surface. On March 8th, 2007 US President, George W. Bush met with Brazilian President Luiz Inácio Lula da Silva in São Paulo, Brazil. The visit was part of a seven day, five-country Latin American tour. On the Brazil agenda: bio-fuels.

The trip was meant to strengthen ties with Brazil and "to establish renewable fuels as an internationally traded commodity with the intent to expand biofuels use in the Western Hemisphere". US Secretary Condoleezza Rice and Brazilian Foreign Minister Celso Amorim both signed a Memorandum of Understanding (MOU) to put US/Brazilian goals in writing (Ethanol Producer Magazine).

An article by Brian Sims at Ethanol Producer Magazine described the new US/Brazil relation and the MOU. The article summarized the words of Dr. Brenda Haendler, the
science and technology officer and international energy coordinator liaison of the US Department of State's Bureau of Economic, Energy and Business Affairs:

"...the agenda is highlighted by three important parts: to promote the advancement of cooperative research and development efforts between the United States and Brazil for second-generation biofuels, to foster a climate of growth for developing countries in the region that will stimulate private investment for local production and consumption, and to establish a multilateral framework to work through the International Biofuels Forum to examine the harmonization of biofuels standards and codes in an effort to facilitate the commoditization of biofuels. 'The United States and Brazil account for 70 percent of the world's ethanol production and so we really felt, as the two leaders in biofuels, that we should strengthen our relationship and make biofuels into a global commodity,' Haendler tells EPM" (Ethanol Producer Magazine).

Bush and Lula both are reminding the public that "increasing bio-fuel use would lead to more jobs, a cleaner environment and less dependence on oil." And Lula was quoted calling the new relation a "strategic partnership" (BBC News).

Although the US corn and ethanol industry is thrilled to see their own president promoting their product internationally, many fear the new joint relation could lead to unwanted competition from Brazil.

To protect America's own ethanol industry, there is a 54-cent tariff in place on each gallon of Brazilian ethanol imported to the United States. But many still complain that the Caribbean Basin Initiative allows a loophole to legally bypass this tariff.
The Caribbean Basin Initiative (or CBI) is "an international trade mandate that has provided countries in Central America and the Caribbean to have duty-free access to the United States since 1989". The fear is that Brazil can also take advantage of the CBI by having its ethanol dehydrated in the Caribbean, then forwarded to the US (Ethanol Producer Magazine).

I interviewed the Department of State's Dr. Brenda Haendler about the CBI. Haendler says that this is true; the CBI does allow the bypass of the tariff. But she points out that certain security measures are in place to protect against abuse. The initiative, she says, can only be used up to 7% of the previous years [total] consumption for that product. And in previous years, no country has yet even come close to 7%. The highest percentage that has ever been reached was around three and half percent (Brenda Haendler).

I asked UNICA's Ribeiro if any Brazilian companies have taken advantage of the CBI. He verified that, in fact, some have and continue to do so. He then gave me the same ballpark figure that Haendler gave me, pointing out that the CBI has not been abused.

The primary objective of the MOU is to standardize ethanol into an internationally traded commodity. But many in Brazil, say the tariff is counterproductive. "As long as you have a barrier in trade", Ribeiro says, "you cannot have a commodity".

In the United States, the blending of ethanol with gasoline is federally subsidized. Through the Volumetric Ethanol Excise Tax Credit (VEETC), blenders currently receive a rate of 51-cents per gallon when they blend ethanol with "gasoline, diesel, and ETBE, including ethanol in E85 and the proposed E20 in Minnesota". This incentive currently extends until December 31, 2010. (Iowa Corn Growers Association).
Bob Dinneen, President of the Renewable Fuels Association, takes the stance that the tariff should stay in place. He tells BBC News that:

"Refineries in the United States that blend ethanol get a tax incentive whether the product is imported or domestic. So in order to ensure the investments the payers are making in renewable energy are focused here, we ask the imported product to pay the incentives they are going to receive upfront... Brazil has built a heck of a programme, with years of incentives and government intervention, in a way that I commend and that makes a lot of sense. I don't believe they need additional support of the American taxpayers" (BBC News).

When I met with UNICA, I asked if Brazil is still subsidizing its ethanol industry. I was told that Brazil no longer does. At the end of the interview I was given a book published by UNICA. The English version of the book, just under 300 pages, is called Sugar Cane's Energy: Twelve studies on Brazilian sugar cane agribusiness and its sustainability.

When I got home, I looked through the book extensively to find any more information on Brazil's government subsidy practices. A particular paragraph caught my eye:

"Government controls (production and export quotas, prices, and subsidy grants for production and transportation of both sugar and ethanol) have been eliminated by a transition system implemented in the early 1990's and concluded in 1998. Today, the government is present in the regulation of hydrous and anhydrous ethanol specification and in the determination of the ethanol content of gasoline. The prices are free at all levels of the supply chain, and ethanol is sold in nearly 29,000 fuel stations all over the Brazilian territory."
I asked Mr. Dinneen from the RFA about this by e-mail. Because of a new energy bill on its way to the House floor, he was unable to conduct a telephone interview with me. But he did comment, however, that he firmly believed the notion that Brazil does not continue to subsidize its ethanol industry to be false.

Does a little bit of tension mean that the two sides cannot work together? Absolutely not. For the most part, both sides of the industry believe that the US/Brazil interdependence is both appropriate and of good timing. Even outside of ethanol politics, the US needs this South American powerhouse to remain an ally in order to maintain its influence in South America. The US has a long history of unpopularity throughout Latin America, and an ongoing unpopular war in Iraq only makes things worse.

And Brazil needs the US just as badly in order to maintain its strong leadership image in the continent. But Brazil's aspirations are not limited to the continent. It knows that it has come a long way since the beginning of its Pro-Álcool Program in 1975 and the end of its military dictatorship in 1985. It's Gross Domestic Product for purchasing power parity is the tenth largest in the world and far higher than that of any other country in Latin America (CIA World Factbook). It seeks to be respected as a worldwide superpower. And respect it has earned.

We've discussed ethanol's supporters; now let's identify its opposition. Gross gives four groups of what he calls "ethanol-skeptics": inflation hawks, poverty activists, efficiency freaks, and environmentalists. The inflation hawks, he says, tend to remind us that crops used for ethanol drive up food prices. The poverty activists build on the argument of the inflation hawks, saying that crops used to make ethanol, such as corn, are many times
imported from poorer countries, therefore rising food prices in those countries as well. The efficiency freaks focus on the fact that cars running on ethanol won't get as many miles to the gallon as a car running on gasoline. And the environmentalists remind us that the production of ethanol requires heavy use of fertilizer, tractors, and chemicals - all which are bad for the environment (Newsweek).

Gross concludes that he is as skeptical as anyone else and agrees that each skeptic group has truths to their arguments. Yet for Gross, the gains outweigh the losses when considering aspects such as: coal and oil are probably more pollutant than ethanol, China's "subsistence farming economy into a more modern one" also drives up food prices, and the amount of money we continue to spend in Iraq. "Factor those in," he says "and ethanol no longer seems like such an economic loser" (Newsweek).

**The Economics of Ethanol**

Various futures exchanges have offered their own ethanol futures contracts. But unfortunately for the industry, none have quite taken off to the level most have hoped. The Chicago Board of Trade, now joined with Chicago Mercantile Exchange to form CME Group, and the New York Board of Trade are the two exchanges offering contracts within the United States.

Fred Seamon, CME Group's Senior Economist told me in a phone interview, "Ethanol has become much more standardized in the last 2 years". He says that when it comes to ethanol in the US, "We [CBOT] are the only game in town" because CBOT has the only active futures contract, and NYBOT's contract traded initially but hasn't traded in over a
year. Interestingly enough, NYBOT's contract is an international one designed for Brazilian ethanol. CBOT's is domestic.


CBOT dictates that contracts are to be in the latest version of ASTM's standard and shall be "in conformance with all applicable Federal, State, and Local laws and regulations. In addition, delivery grade ethanol shall meet California specification for lower sulfur content and California limits on other compounds". "Ethanol not meeting A.S.T.M. standard D4806... shall not be deliverable". A complete rundown of the standard's specifications is available on CBOT's website at www.CBOT.com.

In Brazil, the active futures exchange for ethanol futures is the BM&F (Bolsa de Mercadorias & Futuros, or Brazilian Mercantile & Futures Exchange). The first contract, launched in 2000, was the first ethanol futures contract worldwide. This contract was "quoted in Brazilian reals," had "prices negotiated in the interior of São Paulo state," and was "subject to the federal PIS/Cofins social security tax". The replacement futures contract "is quoted in dollars... in order to better cater to the growing global ethanol market, rather than just Brazil's domestic market". Furthermore, "prices [are] negotiated at the country's principal commodities port of Santos and doesn't have taxes imposed on contracts bought for the export market" (Commodities-Now.com).
Sometime before June 25th, UNICA's website posted that on that date they would present this new contract in London. The website states as follows:

"The contract will be presented during the seminar organized by the Brazilian and the British trade and investment promotions agencies (Apex and UKTI) to promote business opportunities in Brazil. The agenda also includes four simultaneous workshops, regarding bio-fuels, Clean Development Mechanism (CDM), healthcare and information technology."

BM&F's futures contract is available in PDF format at its website at www.bmf.com.br.

When I spoke with Jeffry Kuijpers, the manager of CME Group's Commodity Business Development, he reminded me of one of economics' most basic principles of supply and demand. In the long run, he says, it depends on who becomes the ultimate customer of ethanol that will set the standardization grade, not the supplier. In other words, the country that produces the most ethanol will not necessarily have the greatest influence on ethanol's commoditization standards. The customer, or country, with the greatest consumption needs will eventually dictate what ethanol's standards are to become.

**Conclusion**

So what's the hold up? Why can't ethanol be quickly standardized into a commodity and traded in large scale? There are several reasons. For one, the politicians need to convince ethanol's opposition that although ethanol has its problems, it's probably better than the alternatives.
As for Brazil's side of the house, UNICA's Ribeiro says that Brazil's National Agency of Petroleum, Natural Gas and Biofuels (Agência Nacional do Petróleo, Gás Natural e Biocombustíveis, or ANP) requires that Brazil only sell ethanol to oil companies. And these "oil companies are one of the sugarcane industry's biggest challenges. They don't want to sell a product they don't produce."

Opposition comes from all sides - there is no internationally set commodity, a 54-cent tariff exists, and the oil companies don't even prefer to buy the product to begin with. Each of these factors presents a serious challenge for ethanol. But for now, we are slowly moving along the right direction.

Ribeiro says that when an economic superpower such as the US comes to Brazil and makes such a big deal about a certain product, that allows the rest of the world to look at that product in a different light. Others begin to take it seriously. Bush's visit in March, he says, is just the push ethanol needed.

So what is ethanol's place in the future? Petrobras' Danny Aronson's view into ethanol's destiny is the most honest I've heard or read from anywhere. "Ethanol is not the future. Ethanol is simply the bridge." He says, it's the path that we're taking until we find something even better.

Amen to that. I agree whole-heartedly. When we can find energy sources that are more environmentally-friendly, more cost-efficient, equal or comparable in power, easily traded as a commodity, and readily available, then we wont need ethanol. And we most certainly will not need oil. But for now, and for the next few decades, it may prove itself to be a damn good bridge.
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