Biofuels – Future Fuel Strategies for Texas

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Major agriculture and energy producing industries have called Texas home for many years, and today, these industries are working together to ensure that Texas is the recognized leader of the rapidly growing biofuel industry. Biofuels are important alternatives to petroleum-based transportation fuels and are manufactured from vegetation or "biomass." The best known biofuel industries in Texas concern biodiesel and ethanol. These fuels are produced by converting oil crops (e.g., cotton or soybean) into biodiesel, a diesel fuel substitute, and by converting sugar or starch crops (e.g., sugar beets or corn) into ethanol, a gasoline fuel substitute. Often having cleaner burning properties when compared to traditional fuels, biofuels are consistent with the President's National Energy Plan and offer significant environmental advantages over petroleum fuels. This paper explains what biofuels are, how biodiesel and ethanol are produced in Texas, and how end-users can take advantage of incentive programs that encourage biofuel use in a number of significant industries in Texas.

Part I – An Introduction to Biofuels

Biofuels are alternative liquid fuels made from vegetation or "biomass," which is the oldest known source of renewable energy and has been used since the discovery of fire.[2] Fuels such as ethanol, methanol, biodiesel, and methane are the most recognizable biofuels today.[3] Traditional applications for alternative fuels are in the transportation fuel market; however, biofuels can be used to fuel stationary diesel engines, fuel cells, and off-road equipment.

Nationally, the attraction to biofuel is rooted in several issues including energy security, economic development, and environmental protection.[4] Replacing our dependence on foreign oil with a renewable domestic resource that supports agriculture is sound policy because it promotes conservation, the development of alternative and renewable energy technologies, and will increase domestic energy production. For example, in 2005, President Bush signed into law the Energy Policy Act (EPAct) creating a Renewable Fuels Standard (RFS), which sets a baseline for renewable fuel use of 7.5 billion gallons, and is projected to reduce crude oil imports by two billion barrels. The RFS is projected to create over 200,000 new jobs adding $200 billion to the GDP. Domestic agriculture revenues will increase, for the RFS is expected to result in $43 billion in purchases of corn and other crops used to produce biofuel.[5] Concerning Texas, biomass-produced fuel is a "rising star," and the state is home to twelve biofuel plants.[6]

The biofuel industry is allowing new growth opportunities and significant economic benefits for certain sectors of the agriculture industry.[7] Traditionally, the growth in the ethanol industry has resulted from farmer ownership and investments,[8] but today, new crops may be grown specifically for biofuel.[9] In the future, new technologies will enable agricultural and forestry residues (e.g., stalks, leaves, branches which are burned or left in the field) to be harvested for biofuel. America's potential farm benefits from ethanol production alone could be $4.5 billion. With the ban of MTBE, the USDA estimates an extra $1 billion in farm cash receipts annually and a doubling of ethanol production that would create a demand for an additional 800 million bushels of corn.[10]

Part II – Biodiesel

> *The use of vegetable oils for engine fuels may seem insignificant today. But such oils may become in the course of time as important as the petroleum and coal tar products of the present time."*
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> *- Rudolph Diesel, 1911*

Biodiesel Production: Biodiesel is a renewable diesel fuel that is made by combining any natural oil or fat with alcohol. Vegetable oils, animal fats, or recycled cooking greases can be transformed into biodiesel in a variety of ways.[11] It takes about 7.3 pounds of soybean oil, which costs about 20 cents per pound, to produce a gallon of biodiesel.[12] Biodiesel is made through a chemical process called transesterification whereby the glycerin is separated from the fat or vegetable oil. The process generates two products, a methyl ester, which is the chemical name for biodiesel, and glycerin, which is a valuable co-product.[13]

Distribution & Usage: Biodiesel does not contain petroleum, and by itself or in "neat form," it is biodegradable, nontoxic liquid that is free of sulfur and aromatic compounds. Biodiesel is commonly sold in blended form (e.g., 20% biodiesel and 80% diesel fuel is known as "B20;" 100% biodiesel is "B100"), and the fuel can be used in existing diesel engines without modifications by public and electric utility fleets to meet federal mandates for the utilization of alternative fuel vehicles (AFVs).[14] As of April 2006, there were 65 biodiesel production plants in the United States. Texas is home to 12 biodiesel plants. A majority of the biodiesel fueling stations are located in the Midwest,[15] but on July 21, 2006, the National Biodiesel Board recognized that Austin Biofuels, along with Triple-S-Petroleum, operate the highest concentration of biodiesel fueling stations of any city in the nation.

Common Advantages for Using Biodiesel: Biodiesel fuel can be used to fulfill the EPAct's alternative fuel transportation requirements. Also, biodiesel significantly reduces the particulate matter, total hydrocarbon, VOC, SO_2, and CO emissions from diesel engines, and has similar payload capacity, range, horsepower, torque, and fuel economy as conventional diesel. Specific applications for biodiesel are utilized by school districts and public transportation

authorities who are interested in eliminating the adverse health effects from petroleum diesel, especially for school-aged children. Biodiesel may be used in a variety of ways in the public works sector (heavy duty land-moving, demolition, and hauling equipment); solid waste disposal (collection vehicles and waste landfills that have diesel-using equipment such as compactors, rock crushers, abrasive blasters, and trucks); water and wastewater treatment plants that have on-site diesel equipment; and in marine applications with obvious benefits associated with the biodegradable nature of the fuel.

Part III - Ethanol

> *"Gasoline is going - alcohol is coming. It's coming to stay, too, for it's in unlimited supply. And we might as well get ready for it now. All the world is waiting for a substitute to gasoline. When that is gone, there will be no more gasoline, and long before that time, the price of gasoline will have risen to a point where it will be too expensive to burn as a motor fuel. The day is not far distant when, for every one of those barrels of gasoline, a barrel of alcohol must be substituted."*
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> *- Henry Ford, 1916*[16]

Ethanol Production: Ethanol is an alcohol-based, clean-burning, high-octane fuel produced from renewable resources.[17] A majority of the ethanol produced in the U.S. is made from corn; however, it can also be produced from other feedstocks such as barley, wheat, and potatoes.[18] In addition, bioethanol is produced from cellulosic biomass such corn plant stalks, grain straw, switchgrass, quick-growing varieties of trees and even municipal solid waste.[19] Each bushel of corn can produce up to 2.5 gallons of ethanol fuel with one acre of corn yielding enough ethanol to take a car 5,000 miles.[20] Ethanol is produced by a dry or wet mill process. The feedstock or other raw material is ground up and added to water and cooked, and through a fermenting process, yeast is added and the sugars are further transformed into ethanol and carbon dioxide. The alcohol is then separated from the water and the solids to produce alcohol at about 96% strength, which is purified and made unfit for human consumption by adding a small amount of gasoline.[21] Bi-products of the process include, carbon dioxide distillers grain, both of which are sold to downstream markets.

Distribution and Usage: Pure ethanol is usually not used as a motor fuel, and it is blended with unleaded gasoline at varying ratios.[22] The most common blends used in vehicles today include E10 (10% ethanol and 90% gasoline) and E85 (85% ethanol and 15% unleaded gasoline). Many modern vehicles will run on E10, which accounts for about one out of every eight gallons of gasoline sold in the U.S., and which is used as an octane enhancer to improve air quality.[23] Existing "flex-fuel" vehicles are able to use E85. There are 6 million E85 compatible vehicles on US roads and about 450,000 of those operate on Texas roads. Texas drivers who currently own flex-fuel vehicles are not able to benefit from its advantages, due to a lack of

ethanol availability in the state---there are currently only fifteen open and planned ethanol stations in Texas.[24]

Current Trends and Future Projection for Ethanol: Internationally, Brazil is the world's largest producer of ethanol. In the U.S., nineteen states are home to ethanol refineries which produced 4 billion gallons in 2005.[25] The leading producer is Indiana with an existing annual production capacity of greater than 1.13 billion gallons. Texas will soon join other ethanol-producing states with the completion of the first plant, in Dumas, Texas, which will introduce an additional 30 million gallons per year to the market.[26] With a number of new plants announced or under construction, industry experts expect that by 2008, Texas will be producing 500 million gallons per year.[27]

Environmental Advantages: E85 has the highest oxygen content of any transportation fuel, making it cleaner-burning and more efficient than gasoline.[28] As a result, many parts of the country use ethanol to meet EPA clean air standards with great success.[29] This is because ethanol produces 39 to 46 percent less greenhouse gas emissions than gasoline and reduces carbon monoxide, exhaust volatile organic compounds and particulate matter.[30] In the future, ethanol may be used as a fuel to produce hydrogen for fuel cell vehicles.

Existing Hurdles for Ethanol: Certain materials commonly used with gasoline may degrade with high level alcohol blends causing contamination of the fuel. Contaminated fuel may result in engine damage and poor performance, eventually causing deposits that may harm the engine.[31] Ethanol must be transported by land because it cannot travel in pipelines like gasoline without picking up excess water and impurities or potentially corroding the pipeline.[32] Approximately 75% of ethanol is moved by rail and the remaining 25% by truck.[33] Many metals such as zinc, brass, lead, aluminum, terne-plated steel (which is commonly used for gasoline storage tanks,) and lead solder are incompatible with E85. Nonmetallic materials that are incompatible include natural rubber, polyurethane, cork gasket material, leather, PVC, polyamides, methyl-methacrylate plastics, and certain thermoplastic and thermoset polymers. Most metal underground storage tanks that meet EPA December 1998 codes and many fiberglass tanks manufactured after 1992, can be used to store E85. Compatible materials must be considered not only in storage tanks, but in all parts of dispensers including, fill pipes, leak detection equipment, piping, filters, hoses, nozzles, fittings, and connectors.[34]

According to the American Petroleum Institute, ethanol increases the volatility of gasoline when blended at levels less than 10% by volume.[35] At levels of 2-10% volume, volatility is increased by one psi. As with gasoline, E85 dispensers will be required to have certified vapor recovery systems. There are currently no certified vapor recovery systems available.[36] In addition, there are no Texas regulations related to the vapor recovery systems for

ethanol. It appears that current systems, once retrofitted for material compatibility, may meet vapor recovery requirements.[37]

Part IV – Federal and State Incentives Promote Biodiesel & Ethanol

EPAct and Alternative Fuel Vehicle (AFV) Credits: The EPAct mandates the purchasing of alternative fueled vehicles (AFVs) for certain fleets, including state-owned and electric utility-owned fleets. For example, since 2001, state and electric utility-owned fleets are required to purchase at least 75% and 90% AFVs, respectively. Fleets covered by these mandatory purchasing requirements may operate existing diesel vehicles and equipment on blends of biodiesel in lieu of purchasing new AFVs or AFV credits.

Federal Tax Credits: The IRS allows two federal income tax credits for using biodiesel. The biodiesel fuel credit is claimed as a general business credit when an end-user purchases and uses biodiesel directly from a biodiesel producer (i.e., the credit may not be claimed if the biodiesel was purchased from a retail sale). This fuel credit is also applicable to the quantity of biodiesel that is used in a blend with dyed or un-dyed petroleum diesel. The biodiesel mixture credit may be claimed by a registered blender when biodiesel (e.g., B100) is blended with diesel fuel. Due to the registration requirements, this tax credit is most commonly used by producers, blenders, and marketers. The biodiesel tax credits are $1.00 per gallon for agri-biodiesel (i.e., produced from virgin seed oil crops (e.g., soy and cotton)) and 50 cents per gallon for other types of biodiesel.

The IRS also allows federal income tax credits for alcohol. For example, an alcohol fuel mixture credit may be claimed for the alcohol (e.g., ethanol and methanol) that is used to produce a qualified mixture of alcohol with gasoline, diesel fuel, or kerosene. As is the case with biodiesel, the IRS also provides an alcohol fuel credit; however, the value of this tax credit is dependent upon the proof content of the alcohol used.

Texas' Biofuel Incentive Program: The Texas Department of Agriculture administers a production incentive program for biofuels, including biodiesel and ethanol. Properly registered producers are eligible to receive grants of 20 cents for each gallon of biodiesel or ethanol that is produced in a registered plant until the 10th anniversary of the first production date of the plant.[38] Grants are limited to 18 million gallons of fuel per fiscal year.[39]

Diesel Fuel Tax Exemption: Biodiesel or ethanol blended with taxable diesel, that is identified when sold or used as a biodiesel or ethanol fuel blend, is exempt from the diesel fuel tax.[40] For example, biodiesel (B100) and the volume of biodiesel that is blended with regular diesel fuel are exempt from paying the Texas 20 cent per gallon "diesel fuel tax;" therefore, a

person producing a B20 blend (20% biodiesel and 80% diesel) would not be taxed on the volume of biodiesel used to make the fuel mixture.

End-user Incentives: Significant economic incentives are available for diesel end-users who choose to use biodiesel blends. For fleets subject to EPAct, the AFV requirements make biodiesel fuel strategies attractive given the ability to use "biodiesel fuel use credits," which currently cost about $600-700 per credit, versus having to pay the much more significant cost of purchasing new AFVs ($25,000+ per each AFV) or purchasing an EPAct credit, which are currently valued at $750-1,200). The tax benefits of biofuels can be leveraged in a number of ways by end-users. For example, traditional end-users have a choice of how best to maximize the $1.00/.50 cent federal biodiesel tax credit. End-users are most likely to enjoy the tax credit in the form of a discounted biodiesel price offered by fuel jobbers/registered blenders who can reduce the price by blending the fuel and then claiming the blender's credit. For end-users interested in maximizing the direct benefit of the biodiesel tax credit, they can purchase B100 directly from a producer and blend and use the biodiesel without registration requirements and themselves claim the $1.00/.50 cent tax credit for each gallon of B100 used in their business, so long as they obtain and keep biodiesel certification records from the producer or biodiesel importer.

Conclusion

The success of Texas' biofuel industry will depend on feedstock development, biofuel production incentives, and increased end-user demand. Fortunately, for the short-term, Texas biofuel producers are able to take advantage of the existing economic incentives, including the Texas Biofuel Production Incentive, and will be able to use existing energy distribution networks to deliver their products to the end-user. Ultimately, biofuel production in Texas will help secure a sustainable, affordable, and domestic fuel strategy for our State and nation.

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