Developing State Policies Supportive of Bioenergy Development

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Abstract

Working within the context of the Southern States Biobased Alliance (SSBA) and with officials in each state, the Southern States Energy Board (SSEB) is identifying bioenergy-related policies and programs within each state to determine their impact on the development, deployment or use of bioenergy. In addition, SSEB will determine which policies have impacted industry's efforts to develop, deploy or use biobased technologies or products. As a result, SSEB will work with the Southern States Biobased Alliance to determine how policy changes might address any negative impacts or enhance positive impacts.

In addition to analysis of domestic policies and programs, this project will include the development of a U.S.-Brazil Biodiesel Pilot Project. The purpose of this effort is to promote and facilitate the commercialization of biodiesel and bioenergy production and demand in Brazil.

Introduction

The Southern States Energy Board (SSEB) is an interstate compact that includes 16 southeastern staes and Puerto Rico and the U.S. Virgin Islands. One of the Southern States Energy Board's goals over its 40-year life is to ". . . develop, promote, and recommend policies and programs on energy and environment that encourage economic development." The Board accomplishes this goal primary through a number of task forces comprised of members from its states, the private sector, non-profits and others.

Southern States Biobased Alliance (Tasks 1-3)
SSEB's Southern States Biobased Alliance works closely with the Southeast Biomass State/Regional Partnership which SSEB hosts. Activities of the Southern States Biobased Alliance are focused on creating awareness and providing information and education for its members. In July 2004, the Southern States Biobased Alliance and the Southeastern Biomass State Regional Partnership met jointly to develop a regional action plan to enhance public awareness on the opportunities for biomass and biobased products in the southern states. Task 2 of this project encompassed a survey of industry and other parties to ascertain general awareness of policies and incentives that encourage the use and production of biomass. This task is completed and revealed that outreach and education are the keys to developing a stronger biobased economy.

While awareness of existing policies and programs needs further development, state legislatures are moving forward with new policies and incentives that should create more favorable attraction to the bioenergy industry. During the 2004 state legislative sessions, Georgia, Maryland, North Carolina and Tennessee enacted bills that provide pathways for initiating and benefiting bioenergy production and use.

U.S.-Brazil Biodiesel Pilot Project
On June 19, 2003, Energy Secretary Spencer Abraham and Brazilian Mines and Energy Dilma Rousseff signed a Memorandum of Understanding (MOU) to conduct a Ministerial Summit in energy issues by January 2004 in Brazil. Pursuit of joint objectives in clean energy and biofuels were specifically addressed in the MOU. In support of this collaboration, U.S. DOE modified this cooperative agreement DE-FC26-01NT41128 to include a U.S.-Brazil Biodiesel Pilot Project as a bilateral effort to enhance the prospects for success in developing biodiesel use in Brazil.

This project involves continuous monitoring of any developments affecting biodiesel production in Brazil. As reported last quarter, U.S. Secretary of Energy Abraham and Brazil's Minister of Mines and Energy, Dilma Rouseff, signed another MOU for cooperation in energy in April 2004.

Activities during this quarter involved further development of the pre-feasibility study. Completed sections as well as areas under development are included in this report.

Executive Summary

Goal

The goal of this project is to have state and international policies positively impact the development, deployment, or use of bioenergy and are consistent among states.

Statement of Work

Southern States Biobased Alliance (Tasks 1-3)
Working within the context of the Southern States Bio-Based Alliance and with officials in each state, a staff member and/or contractor will identify bioenergy-related policies and programs within each state and determine their impact (in any way) on the development, deployment, or use of bioenergy. The staff member and/or contractor will be asked to determine as quantitatively as possible how this impact occurs, and how the legislation originally came to be promulgated.

Additionally and simultaneously, the staff member and/or contractor will be interviewing bio-based industry officials to determine what policies (or lack of policies) have impacted their efforts to develop, deploy, or use biobased technologies or products. The staff member and/or contractor will also try to determine the nature of these impacts and how policy changes might address any negative impacts or increase positive impacts.

In addition to attaining the project goal, this project approach will facilitate information sharing and education on state policies and their ramifications, create peer reaction, and ultimately provide more uniform regulations across the region that are supportive of bioenergy development, deployment, and use.

U.S.-Brazil Biodiesel Pilot Project (Task 4)
Task 4 is to develop a U.S.-Brazil Biodiesel Pilot Project to promote the commercialization of biodiesel and bioenergy production, technologies, and usage in Brazil. This task will consist of three primary components: Policy and Program Development; Feasibility Study and Technical Analysis; and bioenergy meeting design and execution to meet the U.S. Department of Energy goals.

Experimental

Due to the nature of the project, no experimental methods, materials or equipment are necessary.

Results and Discussion

Task 1-3 Activities
The SSEB, through the Alliance, is assisting the U.S. Department of Energy to determine the effectiveness of relevant government policies and programs. The **goal of this project** is to identify and compile into one document bioenergy and biobased-related government policies

and programs in the US and to determine the effectiveness of these policies and programs. Tasks 1 and 3 are the remaining on-going tasks related to the project. Task 2 which encompassed a survey of industry to ascertain general awareness of policies and incentives to encourage the use and production of biomass was completed and reported upon last quarter. SSEB expects to complete Task 1 as well as Task 3 by December 31, 2004.

Task 1: Bioenergy related Policies and Programs

The SSEB member states continued to enact legislation that supports the use of bioenergy. During the 2004, state legislative sessions, the SSEB member states passed a number of bills that support and encourage the use of bioenergy. The following summaries describe the most substantive bills.

In ***Georgia***, SB 356, the *Carbon Sequestration Registry Act*, establishes a registry of offsetting reduction in greenhouse gases obtained by carbon sequestration. The purposes of the Registry are as follows:

- Encourage voluntary actions to reduce greenhouse gas emissions;
- Enable participants to voluntarily record carbon sequestrations made after January 1, 1990 or such other beginning dates as may be established by rule or regulation of the State Forestry Commission, in a consistent format that is certified;
- Ensure that sources in the State receive appropriate consideration for certified carbon sequestration results under any future federal or international regulatory regime relating to greenhouse gas emissions;
- Recognize, publicize and promote participants in the Registry; and
- Recruit broad participation in the process from all economic sectors and regions of the State.

This measure also provides for reporting procedures using standardized forms and software and sets up a record-keeping system maintained by the Superior Court clerks. While this legislation provides authorization for such a Registry, no appropriations were allocated specifically for this purpose. The Georgia Forestry Commission is identifying resources for the initial activities for implementing the Act.

Maryland's HB1308/SB 869, the *Renewable Energy Portfolio Standard and Credit Trading Act*, require the Public Service Commission to establish a Renewable Energy Portfolio Standard (REPS) that applies to retail electricity sales in the State beginning in 2006. Any electricity supplier must include a specified renewable energy as part of its portfolio of generating fuels for retail sales. Tier 1 renewable energy sources include solar, wind, qualifying biomass (excluding sawdust), methane, geothermal, ocean and fuel cells powered by other Tier 1 sources. Tier 2 renewable sources include hydroelectric power, the incineration of pultry litter and waste-to-energy. The PSC must establish a market-based renewable electricity trading system in which electricity suppliers can trade renewable energy credits with each other fulfill the energy portfolio standard.

These measures also establish a Maryland Renewable Energy Fund as a special, nonlapsing fund to encourage the development of generating resources for renewable energy. If retail electricity contains fewer kilowatt-hours from Tier 1 and 2 renewable sources than are required to comply with the standard for the year, the supplier must pay a compliance fee in the following year. In addition, these measures repeal provisions of the State's electricity restructuring law on maintenance of effort in procuring electricity from renewable sources, effective January 1, 2006.

In addition, ***Maryland*** legislators extended the *Environmental Surcharge* under HB 503. This bill extends the sunset date for the environmental surcharge imposed on electricity generated in the State from June 30, 2005 to June 30, 2010. Under current law an environmental surcharge per kilowatt hour of electric energy distributed in the State is required to be paid by all electric companies. The Maryland Energy Administration receives $250,000 from this fund to leverage federal dollars to promote energy efficiency and renewable energy.

The State of ***North Carolina*** enacted a HB 1636, *Tax Credits for Renewable Fuels.* This bill provides tax credits for dispensing and processing renewable fuels. A taxpayer that constructs and installs and places in service a qualified commercial facility for dispensing renewable fuel is allowed a credit equal to 15 percent of the cost to the taxpayer of constructing and installing the part of the dispensing facility that is directly and exclusively used for dispensing or storing renewable fuel. This act also provides a tax credit for a taxpayer that constructs and places in service a commercial facility for processing renewable fuel equal to 25 percent of the cost to the taxpayer of constructing and equipping the facility.

Oklahoma policy makers created a *Fuel Cell Initiative Task Force* under HB 2351. The Task Force will study and make recommendations regarding:

- the state of industry or of specific components of the industry, alternative programs to accelerate the commercial availability of fuel cells, including similar efforts by other states;
- programs considered to encourage the industry to locate manufacturing, system integration or related component parts or services to the State;
- the development of a statewide plan for the coordinated effort of the commercialization of fuel cell generation in the State, including the ongoing monitoring of the industry and communication with fuel cell manufacturers; and
- tax or other economic incentives.

The Task Force will make a report to the Governor, the President Pro Tempore of the Senate, the Speaker of the House of Representatives, and the appropriate committees of the State Senate and the Oklahoma House of Representatives by January 1, 2005. The Task Force will be created only if federal funds are obtained by the Oklahoma Department of Commerce for the expenses of the Task Force by May 31, 2004.

In addition, ***Oklahoma*** SJR 41 provides that it will be the goal of the State of Oklahoma to encourage dederal agencies, state agencies and all county and municipal governments to purchase Oklahoma Green Power or Oklahoma Green Tags, also know as Renewable Energy Credits, when available. Green Power in Oklahoma includes wind, sun, geothermal, biomass/bioenergy and hydroelectric power. The resolution further states that it will be the goal of the State to promote the use of renewable energy and encourage Oklahoma citizens to consider utilizing renewable energy sources in their homes and businesses.

State legislators in ***Tennessee*** enacted the *Agricultural Ethanol Production Act of 2004* under HB 3067. The Act makes appropriations for the period of July 1, 2004, through June 30, 2005 for the purpose of funding incentive payments for the production of ethanol and of funding the administration of the Act. By February 1, 2005, the Comptroller of the Treasury must transmit to the Commerce, Labor and Agriculture Committee of the Senate and the Commerce Committee of the House of Representatives a report that:

- Reviews the use of alternative fuels such as biodiesel and gasohol as a means to enhance consumption of Tennessee agricultural products;
- Includes an explanation of any practical, technical and scientific benefits for using biodiesel and gasohol in reducing air pollutants and emissions;
- Includes an explanation of the effects of biodiesel and gasohol on contemporary motor vehicle engines;
- Includes an analysis and recommendations concerning how to facilitate industries that would manufacture, produce and distribute biodiesel and gasohol in Tennessee; and
- Includes a plan for using any available funds for implementing a program for the encouragement of the production, distribution and use of biodiesel and gasohol and the cost benefits of such plan.

During the next quarter of this project, SSEB will compile all the information to complete this task. The findings under this task will result in a separate report that serves as a deliverable under this cooperative agreement.

<u>Task 3: Southern States Biobased Alliance Meeting</u>
A joint meeting of the Southern States Biobased Alliance and the Southeast Biomass State and Regional Partnership (Partnership) was held on July 29-30, 2004, in Orlando, Florida. Two purposes of the meeting were to kick off the new Partnership and, in the spirit of cooperation and collaboration, initiate development of a joint Action Plan.

During the brainstorming session, the group arrived at a consensus on identifying a number of regional level projects. The regional steering committee and Alliance members discussed their ideas for the most productive regional activities in terms of furthering the development and application of bioenergy technologies. It was noted that previous activities that have been the most productive have been those that have had the greatest level of participation from state elected government officials, state agency heads, and their respective staffs. Therefore the group decided to focus on this audience with proposed activities.

The following is a summary of the activities identified:

- Develop an educational/marketing package that would cover the basics of bioenergy including the benefits and address key questions. The packet would contain generic information and state-specific information for the respective state where it would be distributed.

- Assemble a "Biomass Outreach Tool Kit" for conducting one-day workshops for state officials to use as a way to promote rural economic development, including jobs creation (especially in the forestry and agriculture sectors) and increasing tax revenues. A generic state template program agenda would be developed, but SSEB would work with individual states to customize the program, as a state might desire.
- Update the existing computerized biomass facility database using input from the respective states to identify missing or incorrect information.
- Expand the "biomass exchange" website, developed and operated by Alabama, to connect biomass suppliers with biomass users in the region.
- Arrange and conduct tours of biomass facilities representative of those of interest to a specific state.
- Develop and implement an expanded media outreach plan with future funding if available to target broader audiences such as the general public.

A small group of state representatives volunteered to participate in a task force that would lead in the drafting of materials and plans for the proposed activities. We envision that draft materials for the tool kit would be ready for presentation to the full group at the next meeting, tentatively scheduled for sometime in November 2004.

Task 4 Activities

As stated in the project proposal, the overall objective of Task 4 is to provide market development assistance to the Brazilian biodiesel market by assisting with an evaluation of the economic viability of producing biodiesel. Specifically, the following aspects will be addressed in the pre-feasibility study:

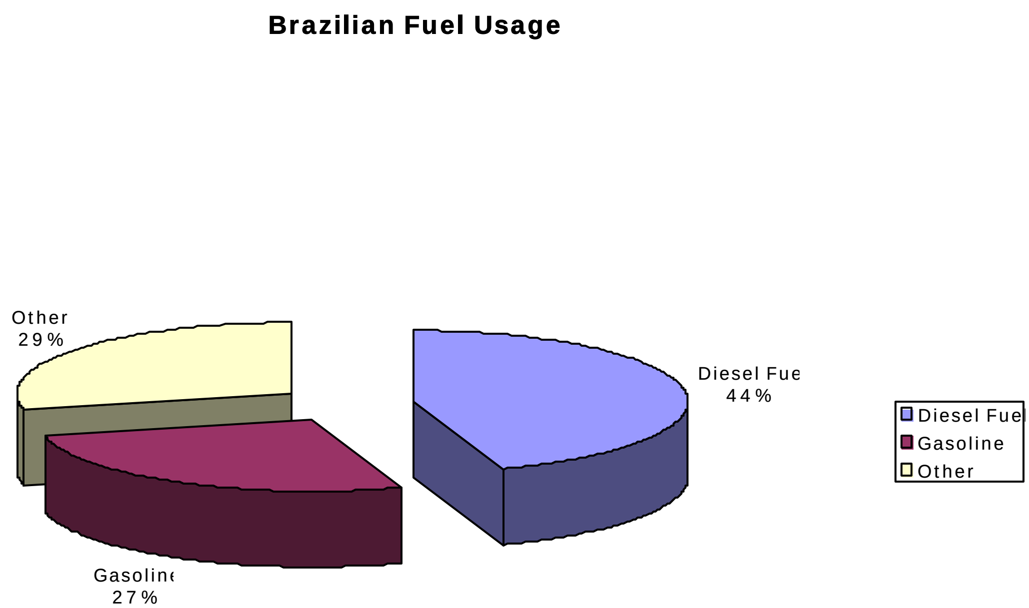
- Feedstock Assessment
- Technology Evaluation
- Brazilian Market Segmentation (opportunities & barriers)
- Evaluation of Petroleum Distribution Channels
- Market Drivers & Demand Potential
- Evaluation of Economic Viability
- Factors to Consider and Recommendations

Activity during the time period of July 1st to September 30th concentrated on completion of sections of the pre-feasibility study. A draft of several of the sections completed follows (some sections were completed in previous efforts and submitted in previous quarterly reports):

Diesel Consumption in Brazil

Diesel is a very important fuel in the Brazilian economy; accounting for approximately 44% of total fuel use. In 2002, almost 10 billion gallons of diesel fuel were consumed of the 22 billion gallons of total fuel use. Diesel usage is the largest single component of the fuel picture.

Figure 1



There are 13 refineries in Brazil that produce diesel fuel; however these facilities cannot meet Brazil's appetite for diesel. In recent history, Brazil has imported 16 to 18% of their diesel fuel needs. As a result, more than a billion US dollars left their economy each year. In 2003, imports dropped to a little more than a billion gallons, almost 40% less than in the previous year. This decrease appears to hold true for 2004 as well.

Diesel imports, however, still represent a large balance of trade issue for Brazil and in 2003 almost $800 million dollars were "exported" to other countries.

Table 1. Brazilian diesel fuel imports, 2000-2003

Diesel Fuel Imports	
Year	*(gallons)*
2000	1,532,428,189
2001	1,739,651,878
2002	1,682,749,768
2003	1,008,704,290

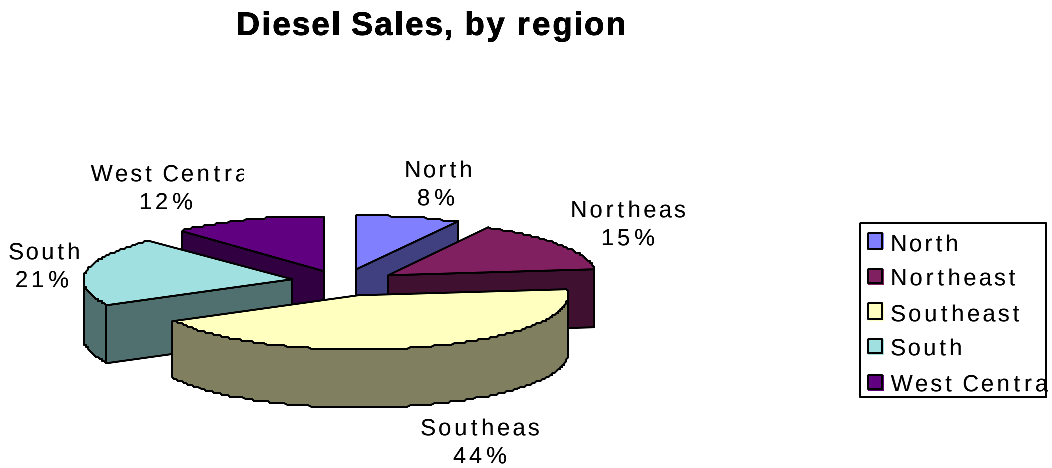
Diesel fuel is refined in 8 states, however most production (65%) is concentrated south along the coast from the states of Rio de Janeiro to Rio Grande de Sul. Relative to this pre-feasibility study the interesting question is, "Where is diesel fuel refined, compared to geographic regions that are consuming large quantities of diesel fuel or are increasing the amount of diesel fuel consumed from year to year?"

Table 2. Brazilian refinery production of diesel fuel

Diesel Fuel Production (2000-03), by State				
	2000	2001	2002	2003
		gallons		
Amazonas	182,688,147	239,615,363	256,225,178	244,196,370
Bahia	575,199,923	743,799,249	778,833,740	827,367,419
Ceara	1,984,460	4,513,907	4,145,651	1,655,038
Minas Gerais	729,286,960	745,789,521	742,902,121	785,965,327
Parana	1,205,311,696	1,338,579,601	1,332,541,157	1,331,654,068
Rio de Janeiro	695,875,077	671,772,753	708,786,640	702,247,833
Rio Grande de Sul	788,119,309	796,235,522	804,306,937	787,175,067
Sao Paulo	3,979,980,481	4,234,668,971	4,174,817,370	4,436,597,557
Totals	8,158,446,053	8,774,974,887	8,802,558,793	9,116,858,679

Diesel fuel consumption is concentrated in the South and Southeast of Brazil as depicted in Figure 2 that follows. The most significant growth in diesel fuel consumption has been in the West Central agricultural regions where consumption grew by almost 5% between 2001 and 2002.

Figure 2. Diesel fuel consumption in 2002, by region.



In Brazil, diesel fuel is used for agriculture, public transportation, the military and freight transportation. Usage in diesel passenger cars is prohibited. These facts highlight both the need for alternative fuels for heavy-duty applications, as well as the potential benefits to the Brazilian economy. Especially given current exchange rates, domestic production of a diesel fuel alternative will have beneficial impacts on the Brazilian economy.

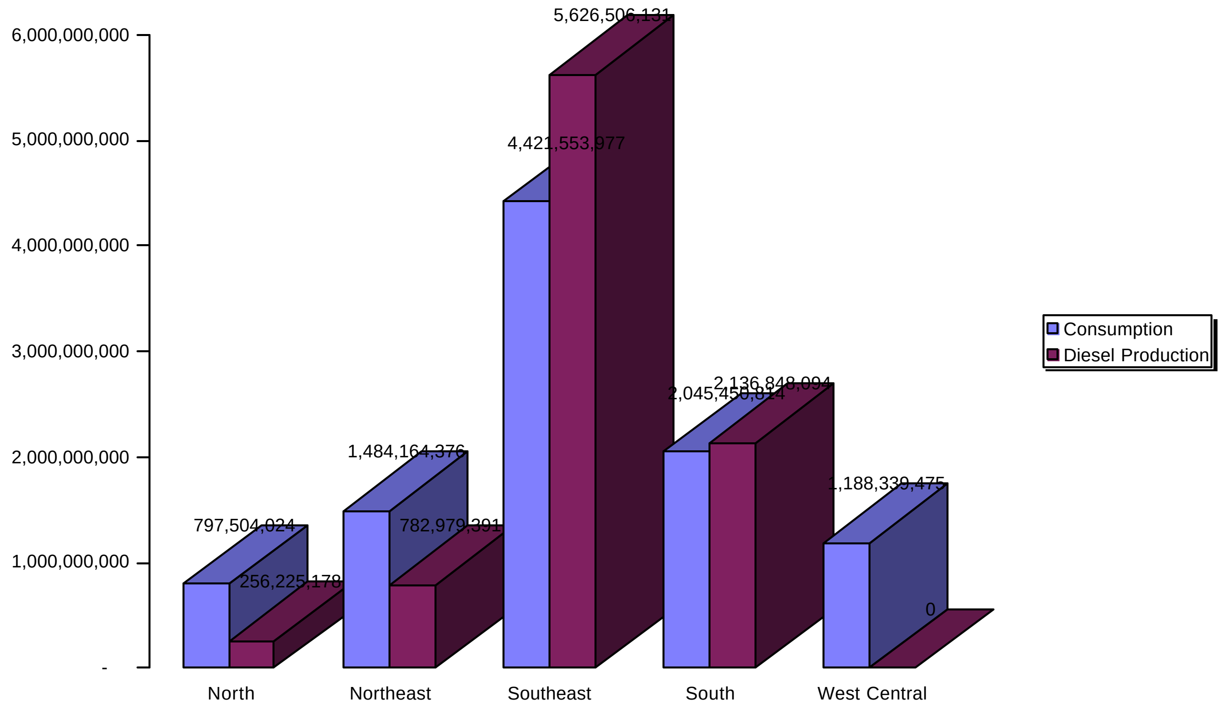
As a side note of interest, there are two grades of diesel fuel in Brazil, Interior Fuel (B) and Metropolitan diesel fuel (D). Metropolitan diesel fuel contains less sulfur (maximum of 500 ppm) than Interior fuel. Due to enforcement issues, the National Petroleum Agency implemented a red dye program in 2004. Non-conformity dropped from 8% to approximately 3.5% by May 2004.

Based on data from the National Petroleum Agency, the following points can be made:

- Diesel fuel consumption is concentrated in the South of Brazil.
- Diesel fuel production is also concentrated in the South and along the Eastern Coast of Brazil.
- The most significant growth, however, in consumption is in the Interior of Brazil in the West Central Region.

Therefore, how does the production of diesel fuel relate to consumption? Figure 3 demonstrates the one region with the most significant growth in diesel consumption also represents a state without diesel fuel production.

Figure 3. 2002 Diesel fuel production and consumption in Brazil, by region.



As will be documented in later sections, the West Central Region is a major agricultural region with significant oilseed (soy) production.

The reader may also be interested in estimated demand for biodiesel if national policy were implemented that called for a 2% by volume blend of biodiesel. Based on ANP statistics, almost 200 million gallons of biodiesel would be required nationwide to implement a B2 blend. Table 3 documents biodiesel needs by region.

Table 3. Estimated biodiesel demand for a federal B2 policy.

	Diesel Consumption	Biodiesel for "B2"	Soybeans Required
	gallons		*bushels*
North	797,504,024	15,950,080	11,392,915
Northeast	1,484,164,376	29,683,288	21,202,348
Southeast	4,421,553,977	88,431,080	63,165,057
South	2,045,450,814	40,909,016	29,220,726
West Central	1,188,339,475	23,766,789	16,976,278
Total	9,937,012,666	198,740,253	141,957,324

The following are important elements for the reader to understand relative to the previous section on diesel demand:

- Brazil "runs" on diesel fuel.
- Brazil imports refined diesel fuel (10% in 2003) and the economy would benefit from a new industry.
- Most of the diesel fuel is refined along the Southern coast
- Most of the diesel fuel consumption is in the South and Southeast regions.
- Diesel fuel consumption is increasing in the West Central region, where little refining capacity exists.
- A B2 national policy would require almost 200 million gallons of biodiesel.
- Purely from a supply/demand standpoint, the interior states of Brazil would benefit from biodiesel production.
- Two types of diesel fuel are marketed in Brazil and one type, Metropolitan, has a sulfur cap. It is possible that Metropolitan diesel fuel may benefit from lubricity additives.
- The Brazilian National Petroleum Agency has shown the tendency to enforce their programs (red dye program for sulfur types). This fact indicates that efforts will need to be undertaken to ensure blend levels throughout the distribution system.

Fuel Distribution System

In 1993, other companies, besides Petrobras, were allowed to distribute fuel. In addition, other companies can now refine oil. However, more than 90% of the fuel is still refined by Petrobras. Iparanga and (one other company) each have refineries. There is a slight difference between the US and Brazilian distribution system. The Brazilian petroleum industry has terminals located around each refinery. Each company has their own set of tanks. From their terminal, they distribute products to customers by trucks. Sometimes, but not often, their customer is a "downstream blender."

The Brazilian infrastructure does have some longer pipelines (such as a typical pipeline company in the US), but it appears that these pipelines are owned by Petrobras and the terminal on the other end is owned by Petrobras. Companies are allowed to have remote bulk terminals, but only if they have a terminal operation located at the refinery. Some refineries allow pick-up by truck, however others only send their products away by pipeline (small and large).

Distributors are not allowed to own retail stations, however many do own these stations, but they are established under a different company. Also, there are other arrangements such as small distributors leasing/renting tank space from distribution companies such as Occidental.

Taxes are collected at the refinery, except for alcohol. Taxes on sugar cane alcohol are collected at the terminal where it is blended. Petroleum either comes from the refinery or it is imported. If imported, it is delivered by truck and the taxes are paid by the importer. Alcohol is delivered by truck.

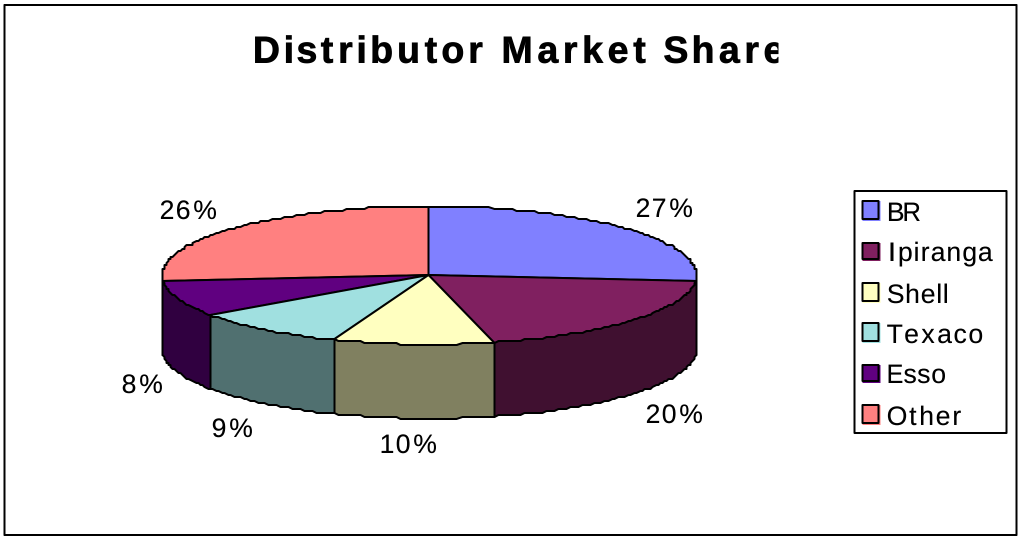
Quality control at a typical blending facility is as follows: Each day, three samples of each type of fuel sold are pulled randomly. A sample from each incoming alcohol load or petroleum fuel is pulled and tested. Each load of gas/alcohol mix is sampled for blend level before it leaves. The blend level test takes about 2 minutes and a 1% deviation that is allowed.

Several distribution companies believe if biodiesel is blended into the diesel fuel pool, it would occur at the terminal like alcohol. Therefore, it raises the importance of two items; a) enforcement of blend levels and b) having a "quick & dirty" test for blend percentage.

The CR_5 ration of petroleum distribution in Brazil is 73.5%. Thus the top 5 distributors have 73.5% of the market share. 161 firms make up the final 26.5% of the petroleum distribution business (see Appendix A). The top two firms, Petrobras and Ipiranga, also have refinery capacity in Brazil.

If Brazil pursues a national policy of 2% inclusion in all of the diesel fuel pool, distribution may be easier to implement because a significant market share is held by two companies. Capital costs and enforcement can be large issues, and are minimized in this situation.

Figure 4. Market share of petroleum distributors, 2002.



Brazil Biodiesel Specifications

The Brazilian National Petroleum Agency (ANP) is responsible for creating and implementing fuel specifications. Similar to the United States, ANP is developing a B100 specification for use as a blend stock. The primary difference is that the current U.S. specification (ASTM D6751) allows for blending up to 20% by volume. The Brazilian specification will allow blending up to 2% by volume.

ANP's effort has resulted in a workable specification for Brazil. Details of the specification are in Appendix B.

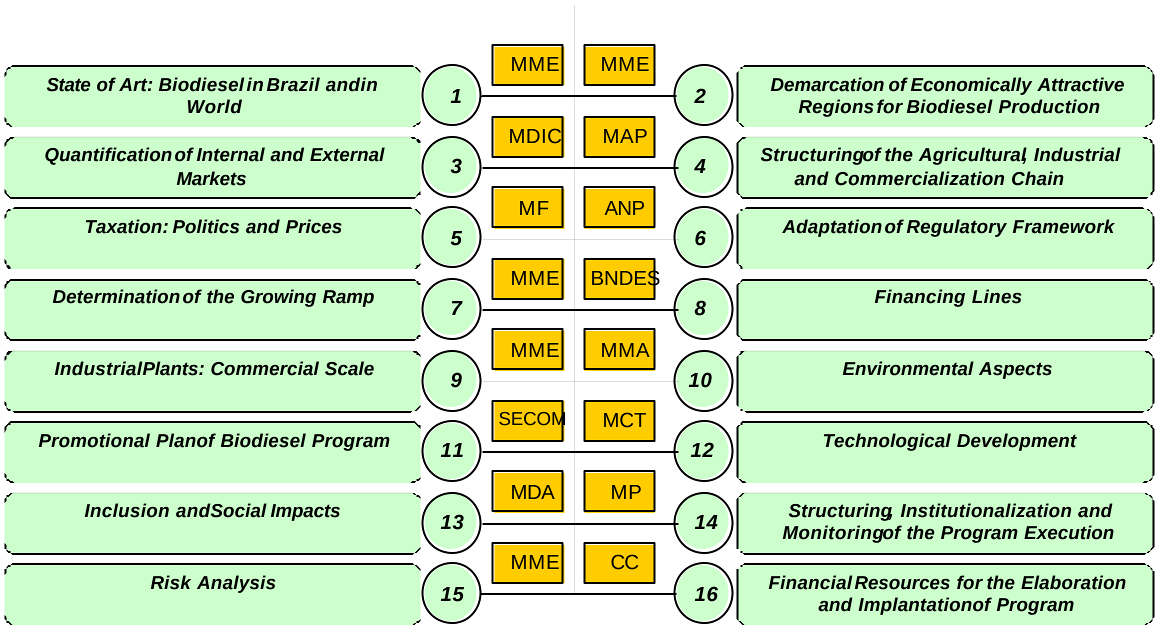
Brazilian Federal Policy Relative to Biodiesel

The federal biodiesel report that was prepared by the Interministerial Working Group was finalized in December 2003. This ministry working group was created after the Presidential decree by President Lula on July 2, 2003. The decree was after the signing of the memorandum of understanding between the U.S. and Brazil in June 2003.

The challenge given to the working group was to:

> "Implant a sustainable project, regarding price, quality and supply guarantee of BIODIESEL, produced from different oilseeds, in different economical activity regions, climate, depending on the region, not favorable for foodstuff cultivation, generating incomes, fighting social exclusion and poverty."

This charge is important as it points to feedstock preference and how the Brazilian government may try to direction production geographically. The working group had sixteen topics they addressed:



Source: MME

Conclusions from this report (as reported by ANP) are:

- Adopt social inclusion and regional development
- North and Northeastern with different treatment (poor regions and with potential possibilities to insert in biodiesel market)
- Not to prevail technological routes, feedstocks, agricultural production scales and regions
- To authorize officially the biodiesel use in national level (Responsible: MME)
- To carry out additional tests for biodiesel use in blendings or pure in vehicle and stationary engine (fuel for urban transport, agriculture maschinery and electricity generation) (Responsible: MME/MCT)
- To establish agreement between Brazilian Government and other countries in which produce biodiesel (France, Germany, US and Argentine) (Responsible: MME, MCT and MDIC)

Source: ANP Presentation

In April 2004, after a working group meeting, the following main points were announced to the public:

- Authorize the use nationwide of biodiesel blending (B2)
- Develop mechanisms seeking the social inclusion in the production of biodiesel
- Definition of the taxation model incident in the biodiesel chain
- Market segmentation and its priorities for the use of biodiesel

Source: ANP Presentation

As an outcome of the report, the Brazilian Government is pursuing a national program of biodiesel inclusion at the 2%, by volume, level. According to official releases, Brazil's mines and energy ministry plan to announce regulations for the use of biodiesel as an additive to diesel by November. MME minister Dilma Rousseff has stated,

> "We still don't know whether to make the addition of biodiesel to diesel obligatory or optional, but it will likely be increased in different steps."

Meetings with various firms and agencies have indicated the national program would begin with B2 blends and then consider ramping up to B5. See Appendix C for the policy released by MME in September, 2004.

Potential Demand Drivers

As discussed in previous sections, the use of low level blends of biodiesel for lubricity purposes could become more important as sulfur levels in Metropolitan diesel fuel decrease. In addition, the federal government will look to other attributes of biodiesel as justification for a national biodiesel program. The section below documents relevant biodiesel attributes.

Enhanced Lubricity

All diesel fuel injection equipment has some reliance on diesel fuel as a lubricant. Wear due to excessive friction, resulting in shortened life of diesel injection pumps and injectors, has sometimes been attributed to lack of lubricity in the fuel. For many years, the lubricity of the diesel fuel was sufficient to provide the protection needed to maintain adequate performance. Recent changes in the composition of diesel fuel, primarily the need to reduce the sulfur level, have inadvertently caused the removal of some of the compounds that provide lubricity to the fuel. This has, in turn, given rise to concerns that today's diesel fuels do not have sufficient lubricity to protect certain fuel injection equipment. According to Mr. Paul Henderson, Chairman of the Society of Automotive Engineers (SAE) diesel fuel injection equipment standards committee, there have been numerous examples from the field where lack of lubricity in the fuel has caused premature equipment breakdown and in some cases, catastrophic failures. This problem will be more dramatic as EPA moves to further reduce the sulfur levels in petrodiesel fuel.

The lubricity of diesel fuel can vary dramatically. It is dependent on a wide variety of factors, which include the crude oil source from which the fuel was produced, the refining processes used to produce the fuel, how the fuel has been handled throughout the distribution chain and the inclusion of lubricity enhancing additives whether alone or in a package with other performance enhancing additives. Typically, Number 1 diesel fuel (commonly referred to as kerosene), which is used in colder climates, has poorer lubricity than Number 2 diesel fuel.

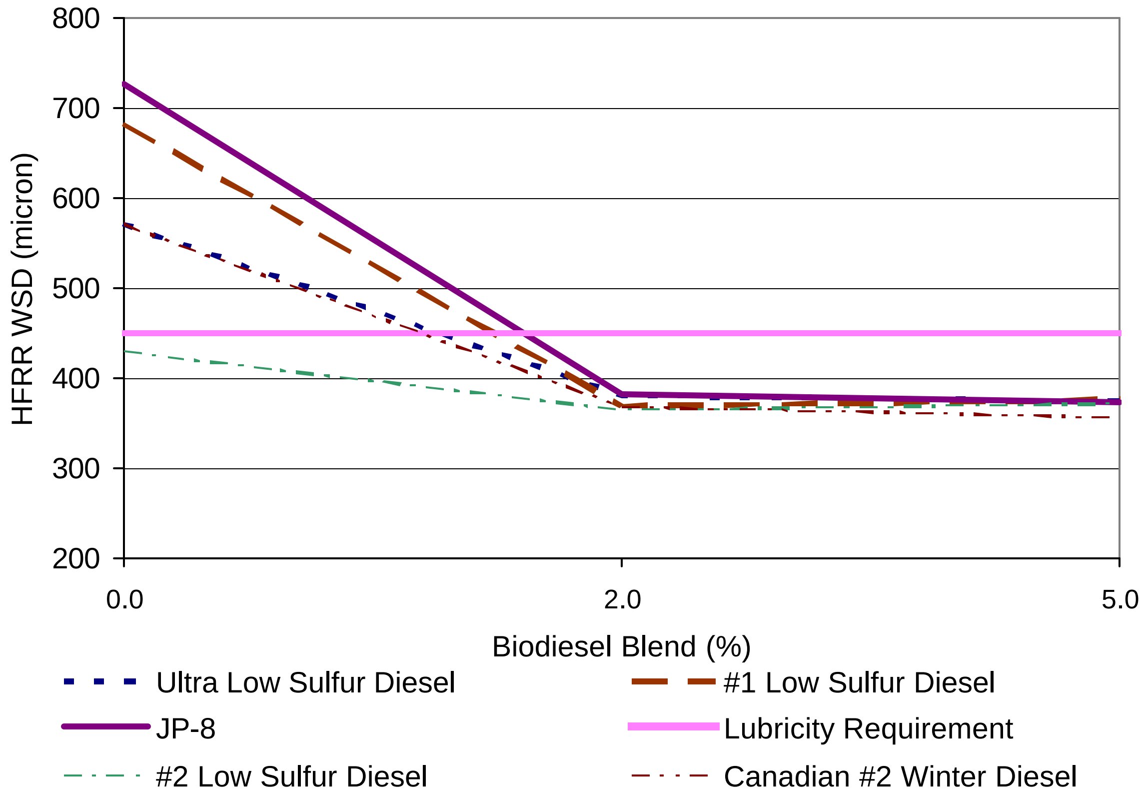
A 1998 review paper on fuel lubricity worldwide (SAE 982567) showed that diesel fuel in the US and Canada is some of the poorest lubricity fuel found in the entire world. Of the 27 countries surveyed, only Canada, Switzerland, Poland and Taiwan had poorer lubricity fuel than the US. Almost 50% of the US fuel was found to be insufficient to meet the recommended specifications.

The two most popular bench test methods for measuring lubricity are the Ball on Cylinder Lubricity Evaluator (BOCLE) and the High Frequency Reciprocating Rig (HFRR). The BOCLE is commonly used to evaluate the lubricity of fuels or fuel blends but does a poor job of characterizing the lubricity of fuels containing lubricity additives, while the HFRR is commonly used for both the neat fuels and with fuels containing small amounts of lubricity enhancing additives. The Fuel Injection Equipment (FIE) manufacturers have adopted the use of the HFRR (ISO 12156-2:1998), and recommend that all diesel fuel meet a limit of 460 micron maximum Wear Scar Diameter (WSD).[1] For the HFRR, a lower wear scar indicates better lubricity.

In 2001, Stanadyne, in cooperation with the National Biodiesel Board, completed a series of lubricity tests (see figure below). Convention diesel fuel (#2) was tested, as well as problem diesel fuels such as #1, Canadian #2, military JP-8 fuel, and new ultra low sulfur diesel fuel with less than 15 ppm sulfur. The results indicate that the inclusion of 2% biodiesel into any conventional diesel fuel will be sufficient to address the lubricity concerns that diesel engine companies and diesel fuel injection equipment companies have with these existing diesel fuels. Inclusion of 2% biodiesel is desirable for two reasons. First, it would eliminate the inherent variability associated with the use of other additives and whether sufficient additive was used to make the fuel fully lubricious. Second, we consider biodiesel a fuel or a fuel component--not an additive. It is possible to burn pure biodiesel in conventional diesel engines. Thus, if more biodiesel is added than required to increase lubricity, there will not be the adverse consequences that might be seen if other lubricity additives are dosed at too high a level.

[1] Delphi Diesel Systems, Stanadyne Automotive Corp., Denso Corporation, and Robert Bosch GmbH, "Fuels for Diesel Engines—Diesel Fuel Injection Equipment Manufacturers Common Position Statement", Issued June, 2000.

Figure 5. Lubricity Testing of Various Biodiesel Treat Rates In a Variety of Diesel Fuels Using an HFRR Test



The poor lubricity of diesel fuel and the superior lubricity of biodiesel make this an extremely promising market for biodiesel, even with today's diesel fuel.

Emissions Benefits

Biodiesel exhaust is safer for people to breathe than diesel fuel and is the only alternative fuel to voluntarily perform EPA Tier I testing to quantify emission characteristics as required by Section 211(b) of the Clean Air Act Amendments. Biodiesel and biodiesel blends generate reductions in all of the regulated emissions except NOx. This NO_x increase can be effectively eliminated with the use of normal mechanical remediation techniques (e.g. catalysts or engine timing changes). Research also documents the fact that the ozone forming potential of the hydrocarbon emissions of pure biodiesel is nearly 50% less than that of petroleum diesel fuel. Pure biodiesel does not contain sulfur and therefore reduces the sulfur dioxide exhaust from diesel engines to virtually zero. Recently, an EPA study reviewing relevant biodiesel emission research confirmed that biodiesel provides emissions benefits.[2]

[2] U.S. Environmental Protection Agency, Assessment and Standards Division Office of Transportation and Air Quality, A Comprehensive Analysis of Biodiesel Impacts on Exhaust Emissions: Draft Technical Report, EPA420-P-02-001, October 2002.

Biodiesel also reduces other carcinogenic air toxics important to society today. Research conducted in the United States showed biodiesel emissions have decreased levels of all target polycyclic aromatic hydrocarbon (PAH) and nitrited polycyclic aromatic hydrocarbon (nPAH) compounds, as compared to petroleum diesel exhaust.[3] PAH and nPAH compounds have been identified as potential cancer causing compounds. Targeted PAH compounds were reduced by 75% to 85%, with the exception of benzo(a)anthracene, which was reduced by roughly 50%. Target nPAH compounds were also reduced dramatically with biodiesel, with 2-nitrofluorene and 1-nitropyrene reduced by 90%, and the rest of the nPAH compounds reduced to only trace levels. All of these reductions are due to the fact the biodiesel contains no aromatic compounds.

Biodiesel can help address several of the concerns related to the global effects of climate change as well as help meet the national goals for the net reduction of atmospheric carbon. As a renewable fuel derived from organic materials, biodiesel and biodiesel blends reduce the net amount of carbon dioxide in the biosphere. A U.S. study has found that biodiesel production and use, in comparison to petroleum diesel, produces 78.5% less CO_2 emissions.[4] Carbon dioxide is "taken up" by the annual production of crops such as soybeans and then released when vegetable oil based biodiesel is combusted.

Table 4: Average Biodiesel Emissions Compared To Conventional Diesel[5]

Emission Type	**B100**	**B20**
Regulated		
Total Unburned Hydrocarbons	-67%	-20%
Carbon Monoxide	-48%	-12%
Particulate Matter	-47%	-12%
Nox	+10%	+2%
Non-Regulated		
Sulfates	-100%	-20%*
PAH (Polycyclic Aromatic Hydrocarbons)**	-80%	-13%
nPAH (nitrated PAH's)**	-90%	-50%***
Ozone potential of speciated HC	-50%	-10%

* Estimated from B100 result

[3] Chris Sharp, Characterization of Biodiesel Exhaust Emissions for EPA 211(b), (San Antonio: Southwest Research Institute, January 1998).
[4] John Sheehan, James Camobreco, James Duffield, Michael Graboski and Housein Shapouri, Life Cycle Inventory of Biodiesel and Petroleum Diesel for Use in an Urban Bus (Golden: National Renewable Energy Laboratory, May 1998), NTIS, BF886002.
[5] National Biodiesel Board, "Biodiesel Emissions Fact Sheet".

** Average reduction across all compounds measured
*** 2-nitroflourine results were within test method variability

Energy Balance

The energy balance for renewable fuels is defined as the amount of energy required to produce the fuel compared to the amount of energy released by the fuel when it is burned. One of the potential disadvantages of some renewable fuels is their low energy balance. If the energy balance is low, then it could possibly take more energy to produce the fuel than would be released when it is burned, resulting in merely a transfer of energy from one form to another without increasing the overall energy available to society.

Biodiesel has an extremely positive energy balance and this has been verified by a joint independent study of the U.S. Departments of Agriculture and Energy.[6] In the study, the most conservative approach was used, beginning with bare ground and ending with finished biodiesel produced from soybeans. The results from this study indicated that for every one unit of energy needed to produce biodiesel, 3.2 units of energy are gained while diesel is 0.83 to 1. This is the highest energy balance of any liquid fuel.

The USDA and DOE life cycle analysis represents the energy balance from an average production scenario. However, if a biodiesel plant has access to alternative energy sources such as waste wood fuel, the energy balance may be slightly higher.

Biodegradability

Biodiesel also has desirable degradation attributes. Studies conducted at the University of Idaho tested the biodegradability of biodiesel in the aquatic environment by the CO_2 evolution method and gas chromatography (GC) and compared the results with regular diesel.[7] According to the University of Idaho's report, under aerobic conditions and nutrient supply (N, P), microorganisms will metabolize a substance to two final products, CO_2 and water. Therefore, CO_2 is presumed to be the prevalent indicator of organic substance breakdown. If the substrate is the only carbon source, the amount of CO_2 evolved will be proportional to the carbons consumed by microorganisms from the test substrate. Thus, the percentage of CO_2 evolution is proportional to the percentage of substrate degradation.

The maximum percent CO_2 evolution from several samples of biodiesel produced from various feedstocks were 85.54% - 88.49% in 28 days, the same as that of dextrose, indicating there is no difference in their biodegradability. Yet, the CO_2 evolution from the diesel flasks was only 26.24%. It should be noted that biodiesel blends degrade faster than D2, for example B20 biodiesel degrades twice as fast as D2. This illustrates that even at a small blend level biodiesel has a synergistic effect. Simply stated, neat biodiesel degrades as fast as dextrose (a test sugar) and a B20 blend will degrade twice as fast as petroleum based diesel fuel.

[6] Ibid
[7] Zhang, X., C.L. Peterson, D. Reece., G. Moller and R. Haws. 1995. "Biodegradability of biodiesel in the aquatic environment." ASAE Paper No. 956742. St. Joseph, MI: ASAE.

Toxicity

Impact on human health represents a significant criterion as to the suitability of a fuel for commercial applications. Health effects can be measured in terms of toxicity to the human body as well as health impacts due to exhaust emissions. Tests conducted by WIL Research Laboratories investigated the acute oral toxicity of B100 in a single-dose study on rats.[8] The test material (B20) was administered once orally via gastric intubation to a single group of five male and five female fasted albino rats at a dose level of 5000 mg/kg.

There were no deaths, remarkable body weight changes or gross necropsy findings during the study. Clinical observations noted that with the exception of hair loss on one specimen, all animals appeared normal by day 8 or earlier and throughout the remainder of the study. Therefore, the LD_{50} (the LD_{50} number means that 50 percent of the rats have died and 50 percent were still alive) of B100 was found to be greater than 5000 mg/kg when administered once orally via gastric intubation to fasted male and female albino rats.

The acute dermal toxicity of B100 was evaluated in a single dose study involving rabbits.[9] The test material was administered once dermally at a dose of 2000 mg/kg to the clipped, intact skin of five male and five female albino rabbits for a 24-hour period under semi-occlusive dressing. There were no deaths, test material related clinical findings, body weight changes or gross necropsy findings. With the exception of two animals having very slight erythema, all dermal irritation completely subsided by day 14 or earlier.

The LD_{50} of biodiesel was found to be greater than 2000 mg/kg when administered by the previous methods. In addition, the 2000 mg/kg dose level was found to be a No Observable Effect Level (NOEL) for systemic toxicity under the conditions of this study.

Feedstocks

Feedstocks make up a lion's share of the production costs for methyl esters. Animal fats and vegetable oils generally account for between 65% and 75% of the overall cost of producing a gallon of biodiesel. Meanwhile the other components, usually an alcohol source and a base catalyst comprise an additional 4% - 6% of production costs.

Fats and oils used in biodiesel production come from a variety of plant and animal sources. Even though these feedstocks are generally interchangeable in the production process, their physical and molecular structures can impact the handling and quality characteristics of the methyl esters. Below are some of the fats and oils that are either being used or could be used in biodiesel production.

[8] "Acute Oral Toxicity Study of 100% REE in Albino Rats" (Ashland, OH: WIL Research Laboratories, 1996) WIL-275003. Study sponsored by the University of Idaho Agricultural Engineering Department.
[9] "Acute Dermal Toxicity Study of 100% REE in Albino Rabbits" (Ashland, OH: WIL Research Laboratories, 1996) WIL-275004.

Figure 6. Feedstocks available in Brazil, by region.

The choice of the biodiesel feedstock is dependent upon many factors but the leading determinants are usually cost, quality, finished product impact and the reliability of supply. Cost is probably the single most important determinant of feedstock choice. However, quality of the fat or oil as determined primarily by the level of free fatty acids (FFA), water and solids, and the ability of the chosen technology to deal with lower cost, lower quality raw materials may override the feedstock cost difference in some instances. Lastly, reliability of supply, as this industry grows, will become increasingly important although in the developing market this factor has generally been overlooked. Soybean oil was the primary oil source that was to be examined by this pre-feasibility study.

Table 5 details fats and oils production in Brazil in 2002. In addition, Table 5 outlines the potential biodiesel production from those feedstocks. The reader must note that sufficient soybeans are raised to generate soybean oil to meet the B2 proposed national policy, however this would force the diversion of soybean oil from present uses. This fact emphases the need for additional feedstock participation in a Brazilian biodiesel market if the B2 policy is pursued beyond soybean oil.

Table 5. Fats and oils production, 2002

	2002 Production (thousand metric tons)				Potential Biodiese
Vegtable Oil	**Grain**	**%**	**Oil**	**%**	**(gallons)**
Soybean	51,000	96.2	4,927	90.6	1,447,881,067
Cotton	1,520	2.9	193	3.5	56,716,267
Palm	N/A	0	118	2.2	34,676,267
Sunflower	168	0.3	56	1	16,456,533
Peanut	127	0.2	28	0.05	8,228,267
Caster	72	0.1	41	0.8	12,048,533
Canola	55	0.1	17	0.3	4,995,733
Other	53	0.1	13	0.2	3,820,267
TOTALS	**52,995**	**100**	**5,451**	**100**	1,601,867,200

In addition, there are another set of relevant facts that must be considered. Table 6 documents the soybean crush capacity as cited by ABIOVE. ABIOVE represents oilseed crushers in Brazil. Although ABIOVE and ANP data differs slightly, both sources estimate that a 2% national policy would require approximately 200 million gallons of biodiesel

Total crush capacity was estimated by ABIOVE to be 6,950 million metric tons, or approximately 2 billion gallons. Therefore, sufficient crush capacity exists in Brazil to implement a B2 national policy. Furthermore, sufficient crush capacity exists in all five regions to supply a 2% blend for the existing diesel fuel demand in those respective regions.

Table 6. Oilseed crush capacity.

Region	**Diesel Consumption**	**Vegetable Oil Crush Capacity**	**Biodiesel Demand (B2)**	**Biodiesel Demand (B2)**
		million metric tons		***gallons***
South	6.836	3.400	0.137	40,177,451
Southeast	15.028	1.300	0.301	88,324,565
Westcentral	3.899	1.700	0.078	22,915,723
Northeast	5.120	0.400	0.102	30,091,947
North	2.717	0.150	0.054	15,968,715
TOTAL	33.600	6.950	0.672	197,478,400

Source: ABIOVE

Comparison of Selected Oils and Fats

Inedible tallow and grease may also represent a significant biodiesel feedstock source. Definitions of some of the quality characteristics of fats and oils are included below.

Table 7. Common Values for Soybean Oil and Yellow Grease

Measurement	Crude Soybean Oil	Yellow Grease
Titer	20 – 22	36 – 42
Free Fatty Acids	0.25 - 0.50	5 – 15
MIU	1.0 - 1.8	2 – 4
Iodine Value	120 – 140	58 – 79
AOM stability, hours	40 – 45	20

Titer is the solidification point of the fat in degrees Centigrade, and is a rough measure of the saturation level of the fat. The higher the titer the more saturated the fat.

FFA is the amount of free fatty acids contained in the product. Fats and oils are compounds containing three fatty acids each chemically connected to an oxygen on a glycerine molecule. Consequently, compounds with this structure are called triglycerides. Free fatty acids are those structures that are no longer connected to the glycerine. They are a degradation product and a measure of the quality of the fat. A high quality fat has a low FFA level.

MIU stands for moisture, insolubles, and unsaponifiables. It is a measure of the remaining compounds in the fat that are not fatty acids or triglycerides. It is also a measure of quality, as is the color. The lower the MIU level the higher the quality of the fat.

Iodine value refers to the grams of iodine taken up by 100 grams of fat. It is a measure of degree of saturation of fatty acids.

AOM Stability is a measure of the stability of the fat. Oxygen is a constant threat to the stability and potential rancidity of all fats. When oxidation occurs, peroxides are formed. Peroxidation reactions lead to the formation of various by-products. The first of these being free radicals, which are responsible for the bad odor and unpleasant taste of rancid fats and oils.

The quality of yellow grease is much lower than soybean oil, as evidenced in the table above by the high level of free fatty acids and MIU and the low AOM stability. Soybean oil also has a higher degree of unsaturation compared to yellow grease, as shown in the table below. This explains the difference in iodine value (a measure of the amount of unsaturation) and the resulting titer (solidification point of the oil in degrees F). A higher degree of unsaturation (double or triple bonds) gives a higher iodine value and a lower titer.

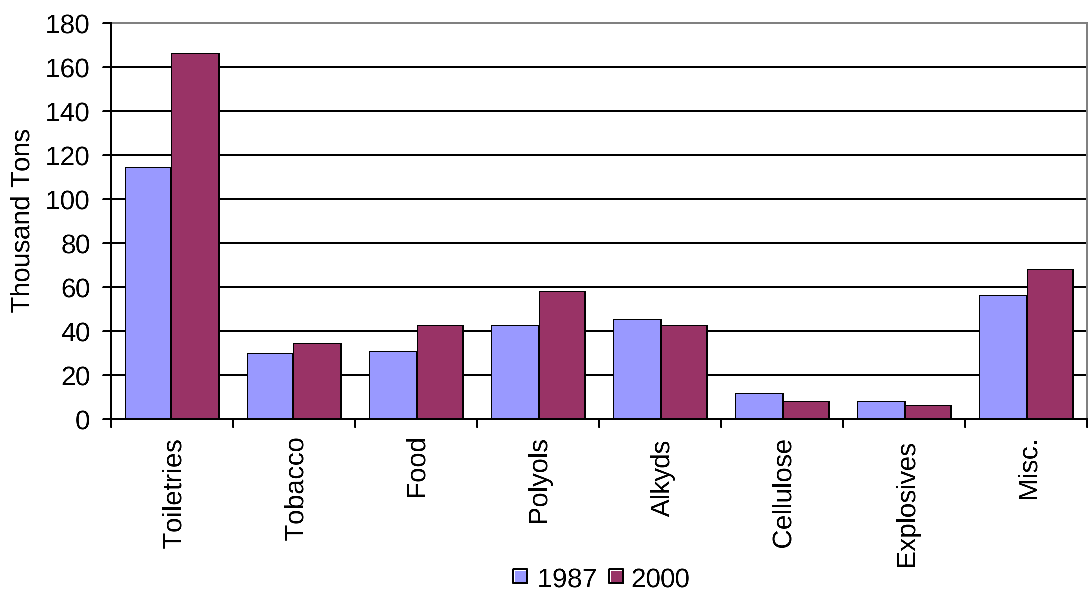
Glycerine

The primary co-product of biodiesel production is glycerine. As indicated in the description of the biodiesel process, when the methanol reacts with the oil (triglyceride), in the presence of the catalyst, the methyl ester is formed as well as glycerine. Glycerine is an extremely versatile material and is used in numerous applications as both an intermediate material and an end-product in itself.

Currently there is more than 560 million pounds per year of refined glycerine consumed in the U.S, with approximately 400 million pounds refined domestically and 160 million pounds imported. The world-wide market for refined glycerine is more than 1.7 billion pounds per year. Glycerine growth patterns typically follow the general national economic indicators. Thus, in high economic growth periods demand for glycerine can increase considerably. Likewise, in slower times the demand can be sluggish.

There are over 1,500 known applications for glycerine including use as an ingredient in cosmetics, personal healthcare products, drugs, food products, and the like as illustrated in the table below. As an intermediate it is used in the production of a range of chemicals by reacting the material with other reagents to produce the desired product.

Figure 7. Major Uses of Glycerine



Glycerine has typically been produced as a co-product from the processing of fats and oils to manufacture fatty acids and soaps. In addition, a second source has been the production of synthetic glycerine, manufactured from various organic raw material inputs, similar in concept to petrochemical product manufacture. These two sources are typically referred to as natural (from fats, oils, etc.), and synthetic. From a chemical standpoint, with refined glycerine it is extremely difficult to tell the difference between the two sources, however, there is some market segmentation that has developed as a result of the glycerine source.

There is additional differentiation in the source of the natural glycerine for various markets. A particular grade of glycerine, referred to as Kosher, can only have acceptable vegetable oils as it origin. Glycerine, resulting from feeds such as beef tallow and yellow grease, is not acceptable for this standard. The Kosher market typically has historically commanded a slight pricing premium since the sources for the glycerine are restricted.

Within the past several years, however, further product differentiation has developed in the natural material origin side of the glycerine supply. As indicated, the two major natural categories were initially Kosher and non-Kosher (or tallow) USP. With the advent of concerns, especially in Europe, over the potential for animal by-products as a means of transmitting disease, e.g. mad cow disease, there has been a differentiation between non-Kosher materials as to source, i.e. vegetable or animal fat. While minor at this point, there has, in recent times, been a slight premium for vegetable origin, non-Kosher glycerine compared to that derived from animal fats. This factor becomes slightly more important in soft glycerine markets when supply of crude is plentiful.

Regardless of origin, i.e. tallow, vegetable oils, etc., most of the glycerine marketed in the U.S. today is manufactured to meet the purity standards set forth in the United States Pharmacopeia (USP). There are strict analytical requirements for this material, and since the product may go into various consumer goods, it is essential that the manufacturer establish an effective Good Manufacturing Practices (or GMP) program that insures product purity and consistency. Administration and control of such a program on an on-going basis requires technical expertise and support, and is an additional cost factor when considering the economics of glycerine.

There is a minor amount of glycerine marketed as a technical grade product wherein the purity requirements are not as restrictive and control of the process can be somewhat less than that associated with the USP material. Even with this lower restriction, the purity of technical material is typically in the range of the USP products, and as indicated, the niche markets for these materials are limited. In general, they can be served with “off-spec” materials from the normal USP manufacturing process.

Conventional Glycerine Refining Considerations

The production of synthetic glycerine is a unique chemical process, and not directly related to the manufacturing techniques used for processing natural origin feedstocks (or crude glycerine), such as those originating from vegetable oils or animal fats. Thus, this overview will focus on the current approach used with natural feeds.

A major factor in the processing approach is the origin of the crude glycerine that is to be refined. As indicated, there are several sources of crude glycerine, and each has its own unique characteristics. It is also important to note that so-called integrated manufacturers, i.e. those that are producing other fatty acid or ester products, do the majority of the glycerine refined in the U.S. today. Some larger soap manufacturers also have integrated glycerine refining capability.

A primary source of crude glycerine is as a by-product of the manufacturer of fatty acids from vegetable oils or animal fats. In the fatty acid production process, the feed oil or fat is reacted with water in a high pressure, high temperature system, wherein the oil or fat is converted to a fatty acid and a weak glycerine solution. This technique is referred to as "fat splitting". The weak glycerine is separated from the fatty acid.

This weak glycerine solution, commonly referred to as "sweet water", due to its sweet taste, is relatively weak and contains some level of entrained and dissolved fatty acid. It will also have an odor, and may contain minor levels of dissolved inorganic impurities. In order to be acceptable to an outside refiner, the solution is evaporated to remove the majority of the contained water, then stored and shipped as a nominal 88% glycerine. At this stage in the glycerine processing chain, the glycerine is referred to as crude, or sometimes "full crude". Considerable trading is done with glycerine materials, thus general industry nomenclature has evolved over the years. From a desirability standpoint, to a glycerine refiner, this is the most acceptable crude, since it is relatively low in impurities.

A second major source of crude is that derived in the manufacture of soap products from oils and fats. During the course of the soap production, a by-product glycerine is produced that is also relatively weak, and contains not only dissolved or entrained fatty acid or soap materials but also has a significant level of dissolved salt in the solution. Due to the salt content, this material is commonly referred to as "soap lye crude". Some evaporation of the solution may be carried out at the soap manufacturer's operation (to produce an 80% material) and possibly reject a portion of the salt, but the end crude material will still contain higher levels of salt impurities that that originating from the fat splitting operations.

Finally, a more recent source of crude glycerine has been that produced as a by-product of the biodiesel industry, which is the subject of this discussion. Biodiesel crude typically contains the highest level of organic and inorganic impurities, e.g. dissolved esters, fatty acid soaps, potassium or sodium salts, etc. It is the least desirable of the crude materials due to the need for more extensive processing in the pretreatment and refining steps.

In the conventional glycerine refining processes, i.e. those that have developed around the processing of fat splitter and, to some extent soap lye materials, the crude glycerine solution is initially treated with additional chemicals to remove any dissolved fatty acids or soaps, and to prepare the solution for the next stage of processing. Depending on the concentration of the crude, the material may next be processed in a conventional evaporation system, operating at atmospheric pressure, to remove additional water.

The concentrated glycerine is then processed in a higher temperature, high vacuum distillation unit. A number of equipment configurations have been used to carry out this portion of the process, but in essence, the glycerin in the concentrated, treated crude is evaporated, or distilled, from the solution, then the glycerin vapor condensed to recover a purer glycerine solution. Again, a variety of methods have been used to carry out the condensation step so as to minimize the co-condensation of certain impurities that invariably carry over with the glycerine vapor.

The condensed glycerine solution is further treated to remove traces of residual fatty acids, esters, or other organics that may impart color, odor, or taste to the glycerine. Typical methods for this "post-treatment" step may include activated clay addition and filtration, similar to that used in the treatment of vegetable oils for edible uses; powdered activated carbon addition, followed by filtration; and/or treatment in activated carbon columns, commonly used for trace organic removal from a range of industrial and food chemicals. Each refiner typically develops its own particular, and preferred, approach to the various processing steps, and there is no "one way" to carry out this process.

Product Opportunities

In the production of biodiesel about 10%, by weight, of the input triglyceride feedstock will become co-product glycerine (100% basis). From a practical design consideration, about 0.70 to 0.72 pounds of glycerine (100% basis) is recoverable from a biodiesel operation.

Storage Considerations

Depending on the amount of crude produced and cost associated with storage, there could be some advantages to storing crude material for later sale. Conventional producers are known to have significant storage capabilities, especially for refined products, thus the concept is certainly valid.

As seen from the price history, however, storage would need to be evaluated from a relatively long term perspective, i.e. multiple months, since the price variations are typically not on a short term (i.e. daily or weekly) cycle. For example, from mid-2001 until spring 2002, there was a period of about 10 months of low pricing. For the biodiesel producer operating at a rate of about 5 MM gpy, and producing a nominal 50% glycerine material, the storage required for this period of time would be on the order of 600,000 gallons of glycerine solution. Storage can be leased, but the lease costs can, in some cases, consume any potential gain. Such choices need to be carefully assessed.

Technology Assessment

When evaluating the potential of any biodiesel operation one of the key factors is the choice of production technology and/or production techniques used in the manufacturing of the fuel. While biodiesel is a relatively new fuel, the production of methyl esters is not. Methyl esters have been produced by the oleochemical industry for many years as intermediates for the production of soaps and other derivatives with relatively high value compared to its use as a fuel. The purpose for this section of the feasibility study is to:

- provide the reader with an overview of the options for the production of methyl esters and the factors to consider when choosing a technology;
- provide an overview of the companies that offer biodiesel technology, either as a complete plant or as a process technology package; and

While further detailed engineering and analysis will be necessary prior to the installation of an actual facility, the information provided in this section, combined with the rest of this report, will allow an interested party to make an informed determination as to the potential attractiveness of the project.

Biodiesel Production

There are three basic avenues of commercial significance to the production of biodiesel (mono-alkyl esters) from naturally occurring vegetable oils and fats (also known as triglycerides (TG)).[10] As indicated, mono-alkyl esters are made for other purposes, besides biodiesel, such as intermediates for industrial chemicals, consumer products and the like, thus there is a significant amount of know-how relative to these materials. Much of the current biodiesel technology is based on the "simplification" of the conventional ester production techniques so as to allow for the manufacture of a more "commodity-like" material. The primary approaches to the manufacture of these materials include:

- Reaction of the TG with an alcohol, using a base catalyst
- Reaction of the TG with an alcohol, using a strong acid catalyst
- Conversion of the TG to its fatty acids, and a subsequent reaction of the fatty acids with an alcohol using a strong acid catalyst

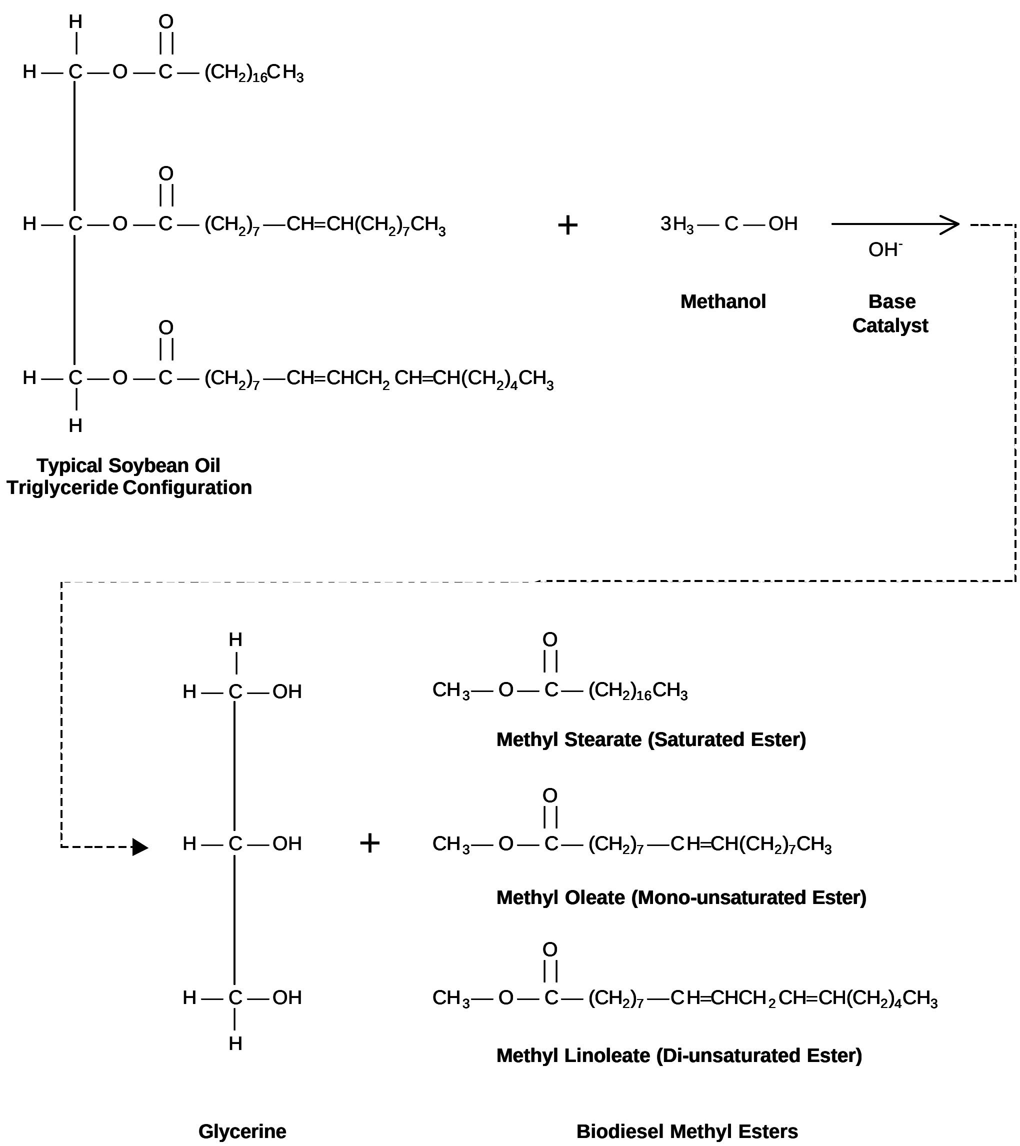
Almost all of the mono-alkyl esters of commercial significance (especially biodiesel) are produced using the base catalyzed reaction of the TG with methanol. Use of acid catalysis is typically limited to the conversion of the fatty acid fraction in high free fatty acid (FFA) feeds, or to treat intermediate high fatty acid/ester streams that can form in the acidification of the crude glycerine bottoms, produced as a co-product of the transesterification reaction. For the feedstock under consideration, i.e. soybean oil, the most cost effective avenue is the base catalyzed reaction of the TG for the following reasons:

[10] For the remainder of this section we will use the term TG as a generic term to represent any naturally occurring vegetable oil or animal fat.

- It is a low temperature (150 F or less), low pressure chemical process
- It yields high conversion (98%) with minimal side reactions
- No exotic materials of construction are needed

The chemical reaction is illustrated below. Stoichiometrically, 100 pounds of TG are reacted with 10 pounds of alcohol in the presence of a base catalyst to produce 10 pounds of glycerine and 100 pounds of mono-alkyl esters or biodiesel. In practice, an excess of alcohol is used in the reaction to assist in quick and complete conversion of the TG to the esters, and the excess alcohol is later recovered for reuse. All reactants must be essentially free from water. The catalyst is usually sodium methoxide, sodium hydroxide, or potassium hydroxide that has already been mixed with the alcohol.

Figure 8. Illustration of Base Catalyzed Reaction of Triglycerides with Methanol

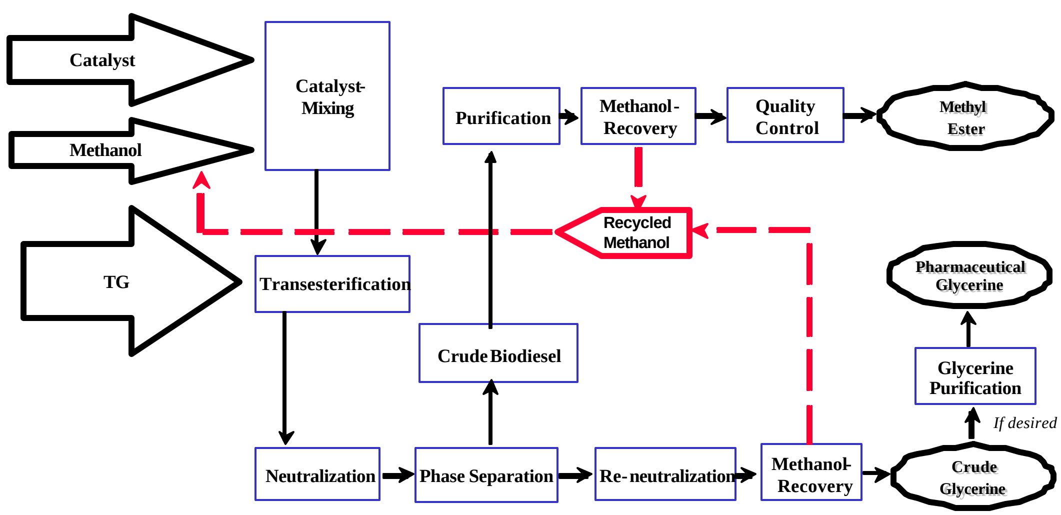


While the ASTM specification for biodiesel permits the use of a variety of alcohols for the production of biodiesel, methanol is currently the main alcohol used commercially for the production of biodiesel. There have been discussions regarding the use of ethanol, but to date the use of this alcohol (for biodiesel) is insignificant. Major reasons why methanol is the current alcohol of choice include:

- Methanol is less expensive than ethanol
- Ethanol is a larger molecule than methanol and it is incrementally more difficult to get the reaction to go to completion, requiring longer reaction times or higher temperatures
- It is more difficult to recycle the excess ethanol due to its azeotrope with water at the 95% concentration.
- Since ethanol has a higher molecular weight than methanol, and is more expensive on a unit cost basis, the overall impact is to increase the production cost for biodiesel, (since the equivalent contained weight of the ethyl molecule is greater than methanol).

For these reasons, this technology-related discussion will focus on the base catalyzed reaction of the TG with methanol. A simplified process concept for the production of biodiesel from soy oil and methanol is shown below.

Figure 9. Flowchart of the Biodiesel Production Process



Biodiesel Technology Providers

This reaction has been studied for years in the oleochemical industry. Long time industry stalwarts like Procter and Gamble have methyl ester patents dating as far back as 1950. Although many patents have been issued over the years, very few have been issued recently and there is very little about ester processing that is not already considered in the public domain. Most of the current capacity for producing methyl esters lies within these existing oleochemical companies as captive capacity, i.e. capacity that is used almost entirely within the company for the production of other chemicals and products. This capacity was built using largely internal company engineering resources and staff with very little information about the finer details of construction and plant operation being available to the public or available for purchase.

With the recent inception of the biodiesel industry, however, the number of engineering and technology firms with expertise in biodiesel technology and production has increased. In addition, some entrepreneurial biodiesel companies, low on capital funds or attempting to expand their revenue potential, have attempted to offer technology packages or build facilities without the benefit of professional engineers or scientists because the technology appears relatively simple at first glance.

While the production of biodiesel is fairly simple it is still a chemical reaction; one using a SARA 313 Class hazardous flammable chemical (methanol) and it must be treated as such. The 'design it yourself' option is not recommended simply due to the fact that the process engineering/design represents a relatively small percentage of the overall cost of the project. . In addition, while designing a plant in-house may appear to save some money up front it usually doesn't. Experience indicates that unless a company has personnel on staff with experience in building and or operating biodiesel plants, hiring an engineering or technology firm with previous biodiesel experience will outweigh the small increase in up front investment required. In addition, it will probably improve the reliability and safety of the plant as well as reduce the down time and start-up troubleshooting.

Biodiesel processes are now available from several companies overseas, primarily because the European market for biodiesel is more mature than that in the U.S. However, there are a growing number of U.S. companies offering biodiesel technology. There are several companies who claim to have 'new' biodiesel production technologies, most of which are simply re-inventions or re-applications of existing technology and many that are largely unproven.

Information was obtained from a number of companies that offered biodiesel technology. For purposes of this study, however, only those that had demonstrated experience in the design and construction of biodiesel plants were included in the specific technology summaries. A summary of the companies is found below.

Axens, North America, Inc.

Axens N.A. is a wholly owned subsidiary of Axens (formerly Institut Franrais du Petrole located in Ruiel Malmaison Cedex, France. The corporation has offices in every continent. Axens corporate vision is to become the recognized leader in products and services for the refining and petrochemicals industry worldwide. The corporation's R&D facilities are large and extensive. All areas of hydrocarbon-related activity are covered at Axens, from petroleum exploration through automotive engine development.

This set of tools was put to the test when Axens developed a joint venture with the French company SOFIPROTEOL to conduct an intensive program to develop a process specifically designed to convert vegetable oils to a marketable diesel fuel equivalent. The "ESTERFIP" process was the result. This meant not just using Axens' research and development laboratory and pilot plant activities, but considerable work with government agencies, agricultural organizations, petroleum refiners, by- product markets and automobile manufacturers as well.

The 40,000 metric ton (12 million gallon) per year plant built for the ROBBE Company at Compiegne, France, is the outcome of this combined effort. The process is an automated batching process with no liquid waste stream.

Axens N. A. will provide plant designs for from 3.0 to 36.4 million gallons/year of biodiesel. They can provide turnkey plants and start-up training anywhere in the world with the help of a design and construct engineering company.

Ballestra S.p.A.

Since beginning operation in 1960 as a subsidiary of De Smet, Ballestra, now independent, has become recognized as a world leader in engineering and construction in the field of oleochemistry. The company has designed, engineered and constructed over 1000 detergent plants in 120 countries in various parts of the world. It has offices in 22 countries and employs more than 150 engineers and full time consultants world wide. The Ballestra Group includes major investments/holdings in eight partner corporations in Europe, Asia and the Americas. In Italy, Ballestra has built a continuous methyl ester production facility, with the esters being further processed into detergents for Colgate-Palmolive with a capacity of 500 kg/h (1.2 MM gal/yr) and options for saponification or sulfonation.

Ballestra's movement into the non-detergent methyl ester market started in 1988 with a pilot plant, leading to a contract with the Italian company Estereco in Citta di Castello for a Biodiesel plant with a capacity of 18,200 gal/day (6.0 MM gal/yr).

Ballestra provides a continuous transesterification process using a sodium methoxide catalyst dissolved in methanol and typical reaction conditions (50°C and 7.5 psi). Clean oils must be fed to the Ballestra process. The reaction is carried out step wise in a series of three continuously stirred reactors. Conventional gravity settling is used to separate most of the glycerine from the ester phase. Methanol is flashing the ester phase followed by two water washing/centrifuging steps and then the biodiesel is flash dried. Excess methanol is also flashed off the glycerine phase, combined with the methanol flashed off the ester phase, distilled in a conventional reflux still and returned to the process. The glycerine produced is refined and bleached. Ballestra offers glycerin distillation as a value added process.

Crown Iron Works Company

Established in 1878, Crown Iron Works is the largest supplier of oilseed extraction and refining plants and equipment in North America. With over 500 installations worldwide, Crown offers a wide range of services including complete extraction and processing plants. A very large number of these installations are repeat business with the largest names in the oilseed industry worldwide.

This year, Crown Iron Works announced the offering of enhanced continuous and batch methyl ester production processes for the production of biodiesel, tailored to the specific requirements and markets of the customer. The continuous process is a two-stage reaction system followed by ester washing, drying and methanol recovery. The glycerine is acidulated, evaporated and can be sold as 78 to 80 % crude glycerine. Crown assisted West Central Soy with the design of their 38,500 gal/day plant in Ralston, Iowa.

Their batch process is designed for smaller scale and/or multi-feedstock capability. There are several reactor options for the methyl ester formation and the ester wash step. In conjunction with a methyl ester facility, Crown offers a complete line of glycerine recovery equipment capable of producing 99.7% USP glycerol Crown also offers technology and design assistance to enhance existing ester plants that will minimize investment costs while increasing production.

Energea Umwelttechnologie GmbH

Energea is a relative young company headquartered in Wien, Austria. The company is primarily focused on second-generation biodiesel production technology resulting in a manufacturing process technology they have multiple international patents approved or pending. Their CTER (Continuous Trans Esterification Reactor) process has optimized and accelerated the transesterification reaction to get high conversion of multiple animal and vegetable base feed stocks in the matter of minutes. The CTER process was piloted in 1999 and they are currently commissioning a 12MM gal/year plant located near Vienna.

Energea designs, engineers, and builds their methyl ester processing equipment into shippable modules at their contractor's shop in Austria. Their customers only have to provide civil work, utilities, raw material and product storage. They claim that their process technology costs less to fabricate due to the controlled construction environment and cost less to field install due to the modular design of each operating modular system. The modular biodiesel plant can be operating in less than 12 months from the time the customer agrees to purchase. Energea also offers a biodiesel-electric generator option that will supply all the electrical power to run the process while consuming 1.9% of the biodiesel produced.

The oil feed stocks must be degummed and dry but can handle oils with fatty acids as high as 5.0% with the addition of their pre-esterification and pre-transesterification modules. The CTER system has zero waste water discharge and near zero methanol emissions due to the design of the water wash module and methanol distillation module. All water in the process is completely recycled.

Lurgi PSI, Inc.

Founded in 1974 as PSI, located in Memphis, Tennessee, Lurgi PSI, Inc, became a fully owned subsidiary of Lurgi AG of Frankfort, Germany, in 1998. This well-known German engineering company with activities all over the world is a subsidiary company of mg Technologies, the engineering division of Metallgesellschaft. Lurgi PSI Inc. is part of the Lurgi Life Sciences Technologies.

Lurgi's methyl ester experience began in 1884, with the construction and start-up of a Malaysian methyl ester plant using the acid catalyzed esterification process technology. The plant produces methyl esters from palm kernel oil fatty acids with a capacity of 95 tons (29M gal.)/day. The esterification reaction system requires greater capital to build due to the higher operating temperatures (300°C) and pressures (400 psi) required to get 98.5% conversation of the fatty acids to methyl esters.

In 1993 Lurgi designed and built a transesterification plant in Indonesia to produce distilled methyl esters made from coconut and palm kernel oil with a capacity of 240 ton (72M gallon) per day. Lurgi's continuous 2-reactor transesterification process works with normal pressure with temperatures between 35°C and 75ºC using a sodium methoxide catalyst. This design has become the standard for the company and several have been built in Europe

Currently Lurgi's smallest standard biodiesel plant design produces 60 tons (18M gal)/day. Their latest plant to be commissioned was a turnkey 90 M gal/day facility built in Marl, Germany. This is the same size on production facility that SSPC has agreed to purchase. Lurgi PSI, Inc, signed a Memorandum of Agreement with Southern States Power Company in February 2002, for the construction of 30 MM gallon per year biodiesel plant to be built at a green field site in Riverside, California.

West Central Soy (dba Renewable Energies Group)

West Central Soy, the manufacturing division of West Central Cooperative is in the commissioning phase of their 36M gallon per day biodiesel plant in Ralston, Iowa. West Central entered the methyl ester market in 1996 after they stated up a self-designed batching process. As their sales markets grew, management realized that by re-engineered their original batching operation into a continuous manufacturing process they could increase the plant's capacity with out building an entirely new plant.

West Central has team up with their design company, Crown Iron Works, and their building contractor, Todd & Sargent, to build turnkey biodiesel plants at their customers' site. They also offer training services and other raw material purchasing and product sales services to their customers. Their process design is a continuous 12 MM gal/year transesterification process that can be start-up ready in 12 months. At this point, the company has no intention of supplying sizes other than 12 MM gal/year and believes this to be a competitive advantage. The process is currently designed for soybean oil with a maximum free fatty acid level of 0.1%, but the company is looking into higher FFA levels.

Conclusion

Beyond the potential economic development benefits, states gain the opportunity to strengthen and integrate the work of energy, agriculture, forestry, environmental and other state agencies. Where issues are the same among several states, strategies can be developed to address these issues without regard to state borders. Examples include the development of similar legislative actions, working with the private sector with multi-state locations, and multi-state training and outreach to economize resources.

Notably, several southern states have long-standing policies and programs that support the use of bioenergy. Therefore, some states have a more developed bioenergy economy than others. However, all states in the southern region have significant biomass resources. SSEB will report these findings in the final report.

In the previous reporting period, results from the "Bioenergy and Biobased Policy Survey" revealed that public awareness and education of policy incentives are lacking in the private sector. One of the most surprising results was the lack of awareness of existing state and federal incentives and programs. Of the federal programs, responders were more familiar with the U.S. Department of Agriculture programs. Consequently, these incentives are not being optimized to expand the bioenergy and biobased products industry and markets. When the incentives are utilized, the efforts seem to be focused in specific geographic areas and/or regions. As a result, outreach efforts are even more critical if the benefits of using biomass are to be realized.

During the 2004 state legislative session, SSEB member states enacted policies and implemented programs that support the use of biomass and biobased products. In the next reporting period, a compilation of these policies, incentives and programs will discuss how states are incentivizing the use and production of bioenergy. In addition, federal policies and programs are necessary to promote further development of bioenergy. Certainly, future expansion is highly dependent upon public awareness and education particularly as bioenergy offers increased opportunities for rural development

Under Task 4, the U.S.-Brazil Biodiesel Pilot Project, continued analysis and specific application is needed of business risks to design approaches to overcome key risks and barriers to financing. Raising investment sources and options is a top priority for the Ministry of Mines and Energy in Brazil.

Current biodiesel production in Brazil is limited to small commerical or research production facilities. There are more than 10 known such facilities. These facilities range from 3,000 liter per day plants to 130,000 liter per day plants. Multiple types of feedstocks are utilized (from soybeans to castor to nabo) and both methyl and ethyl routes are utilized.

Petrobras has a large research program that includes biodiesel and has announced their intention to produce 2,300 barrels of biodiesel per day by 2010. This announcement is part of their 2010 strategic plan. The Petrobras research program, as previously noted in progress reports, is working with castor beans as the primary feedstock. Castor fits the criteria from the government report of being a non-edible crop and having the capability of being produced in impoverished regions of Brazil (most notably the Northeast). Petrobras is also working on a new technology that would start with the castor seed (not the oil) and utilize local ethanol instead of methanol.

The Brazilian Government is pursuing a national program of biodiesel inclusion at the 2%, by volume, level. According to official releases, Brazil's Mines and Energy Ministry plans to announce regulations for the use of biodiesel as an additive to diesel by November 2004. However, Brazilian Government officials are determining if the additive should be optional or obligatory

The economic model results section is being drafted. Please contact Alan Weber at aweber@marciv.com for additional details or questions.

References

Southern States Energy Board Energy and Environment Digest 2004, September 2004.

Appendix A
Brazilian Petroleum Distributors

Distributors	(%)	Distributors	(%)
Total (166 distributors)	**100.0000**		
BR	26.3867	Premium	0.0437
Ipiranga	19.6994	Cacel	0.0436
Shell	9.7720	Megapetro	0.0428
Texaco	9.3869	Liderpetro	0.0419
Esso	8.2799	Cruzeiro do Sul	0.0416
Agip	3.3672	Petronac	0.0413
Ale	1.6870	Álamo	0.0406
Petrosul	1.5659	Mister Oil	0.0380
Sabbá	1.5184	Jatobá	0.0352
Total	1.2579	Temape	0.0329
Repsol YPF	1.0607	Gpetro	0.0328
Aster	1.0328	Glória	0.0313
Satélite	0.9392	Ocidental	0.0311
Fic	0.6793	Energy	0.0297
Manchester	0.6033	Monte Carmelo	0.0282
Flag	0.5175	Contatto	0.0275
Simarelli	0.4582	Panamérica	0.0254
Petro Amazon	0.4358	Walendowsky	0.0253
SP	0.3964	Petromotor	0.0252
Taurus	0.3894	Sauro	0.0245
Idaza	0.3884	Atem's	0.0228
TM	0.3647	CDC	0.0223
Federal	0.3241	Star	0.0205
Potencial	0.3032	Manguary	0.0202
Latina	0.3009	Petronova	0.0194
Wal	0.2710	Centro Sul	0.0190
Larco	0.2633	Sulpetro	0.0188
S. Distribuidora	0.2519	Buffalo	0.0184
Dislub	0.2492	Ubinan	0.0183
Zema	0.2470	Noroeste	0.0172
American Lub	0.2415	Equatorial	0.0169
DNP	0.2322	Petropar	0.0167
Macom	0.2313	Alcom	0.0163
Ello	0.2105	Pelikano	0.0162
Triângulo	0.2093	Jumbo	0.0153
Petroálcool	0.2062	Exxel	0.0143
Novoeste	0.2029	American	0.0143
Charrua	0.1915	Oil Petro	0.0140
Extensão	0.1882	Bardan	0.0131
CJ	0.1826	Caomé	0.0123

Ciapetro	0.1823	Real Minas	0.0115
Dark Oil	0.1771	Euro	0.0113
Asadiesel	0.1622	Minas Oil	0.0104
Granel	0.1622	Agecom	0.0092
Saara	0.1598	Art Petro	0.0071
Polipetro	0.1560	Ambro	0.0069
UBP	0.1503	Sulandre	0.0068
Brasoil	0.1474	LM	0.0063
Ciax	0.1404	Cosan	0.0059
Rio Branco	0.1375	Real	0.0056
Small	0.1336	Jacar	0.0055
TA	0.1297	Montes Claros	0.0049
Estrada	0.1231	Golfo	0.0049
Chebabe	0.1185	Petroleum	0.0048
Rede Brasil	0.1106	Floralco	0.0047
Fórmula	0.1094	Ouropetro	0.0043
Petrobahia	0.1082	Transo	0.0034
Soll	0.1074	Isabella	0.0033
Frannell	0.1041	Prix	0.0030
Tabocão	0.1038	TR	0.0026
Mercoil	0.1022	Ticpetro	0.0024
Ecológica	0.0989	Millenium	0.0023
Dibrape	0.0970	Asa Delta	0.0018
Terra	0.0962	Gianpetro	0.0018
Petroserra	0.0950	Uberlândia	0.0015
Pontual	0.0850	Arco	0.0015
Tower	0.0805	Mercosul	0.0010
Mega Union	0.0790	Titan	0.0009
Storage	0.0752	JPJ	0.0009
Visual	0.0752	Titanic	0.0007
Rejaile	0.0704	Petronossa	0.0007
Express	0.0681	Arnopetro	0.0006
Americanoil	0.0652	Petro-Garças	0.0006
Torrão	0.0609	Petromarte	0.0004
Hora	0.0595	Master	0.0004
Watt	0.0592	Onyx	0.0003
Oásis	0.0524	Jetgas	0.0002
Safra	0.0508	Nascar	0.0002
Petrofer	0.0499	Caribean	0.0002
Equador	0.0494	Tecab	0.0001
Dalçoquio	0.0484	Águia	0.0001
Petromil	0.0472	Global	0.0001
Minas	0.0469		

Source ANP/SAB

Appendix B
Biodiesel Specification

CARACTERÍSTICA	UNIDADE	LIMITE	MÉTODO		
			ABNT NBR	ASTM D	ISO
Aspecto	-	LII (3)	-	-	-
Massa específica a 20ºC	kg/m3	Anotar (5)	7148, 14065	1298, 4052	- , -
Viscosidade Cinemática a 40°C,	mm2/s	Anotar (1)	10441	445	EN ISO 3104
Água e sedimentos, máx.	% volume	0,050	-	2709	-
Ponto de fulgor, mín.	°C	100,0	14598 -	93 -	-ISO/CD 3679
Destilação; 90% vol. Recuperado, máx.	°C	360 (4)	-	1160	-
Resíduo de carbono dos 10% finais da destilação, máx.	% massa	0,10	--	4530, 189	EN ISO 10370, -
Cinzas sulfatadas, máx.	% massa	0,020	9842 -	874 4294	ISO 3987
Enxofre total, máx.	% massa	0,05	-	5453 -	- EN ISO 14596
Sódio + Potássio, máx	mg/kg	10	--	--	EN 14108 EN 14109
Corrosividade ao cobre, 3h a 50 °C, máx.	-	1	14359	130	EN ISO 2160
Número de Cetano, mín.	-	45	-	613	EN ISO 5165
Ponto de entupimento de filtro a frio, máx.	°C	(2)	14747	6371	
Índice de acidez, máx.	mg KOH/g	0,80	14448 -	664 -	-EN 14104 (6)
Glicerina livre, máx.	%massa	0,02	- - -	6584 (6) (7) - -	- EN 14105 (6) (7) EN 14106 (6) (7)
Glicerina total, máx.	%massa	0,38	--	6584 (6) (7) -	-EN 14105 (6) (7)
Monoglicerídeos, máx.	% massa	1,00	--	6584 (6) (7) -	-EN 14105 (6) (7)

Diglicerídeos, máx.	% massa	0,25	--	6584 (6) (7) -	-EN 14105 (6) (7)
Triglicerídeos, máx.	% massa	0,25	--	6584 (6) (7) -	-EN 14105 (6) (7)
Metanol ou Etanol, máx.	% massa	0,5	-	-	EN 14110 (6)
Estabilidade à oxidação a 110°C, mín	h	6	-	-	EN 14112 (6)

Nota:
(1) A mistura óleo diesel/biodiesel utilizada deverá obedecer aos limites estabelecidos para viscosidade a 40°C constantes
da especificação vigente da ANP de óleo diesel automotivo.
(2) A mistura óleo diesel/biodiesel utilizada deverá obedecer aos limites estabelecidos para ponto de entupimento de filtro
a frio constantes da especificação vigente da ANP de óleo diesel automotivo.
(3) LII – Límpido e isento de impurezas.
(4) Temperatura equivalente na pressão atmosférica.
(5) A mistura óleo diesel/biodiesel utilizada deverá obedecer aos limites estabelecidos para massa específica a 20°C
constantes da especificação vigente da ANP de óleo diesel automotivo.
(6) Os métodos referenciados demandam validação para as oleaginosas nacionais e rota de produção etílica.
(7) Não aplicáveis para as análises de mono-, di-, triglicerídeos, glicerina livre e glicerina total para dendê, côco e mamona.

Appendix C

MEDIDA PROVISÓRIA Nº 214, DE 13.9.2004 - DOU 14.9.2004

Altera dispositivos das Leis nºs 9.478, de 6 de agosto de 1997, e 9.847, de 26 de outubro de 1999.

O PRESIDENTE DA REPÚBLICA, no uso da atribuição que lhe confere o art. 62 da Constituição adota a seguinte Medida Provisória, com força de lei:

Art. 1º. Os arts. 6º. e 8º. da Lei nº 9.478, de 6 de agosto de 1997, passam a vigorar com a seguinte redação:

"Art. 6º. ....

XXIV - Biodiesel: combustível para motores a combustão interna com ignição por compressão, renovável e biodegradável, derivado de óleos vegetais ou de gorduras animais, que possa substituir parcial ou totalmente o óleo diesel de origem fóssil." (NR)

"Art. 8º. A ANP terá como finalidade promover a regulação, a contratação e a fiscalização das atividades econômicas integrantes da indústria do petróleo e dos combustíveis renováveis, cabendo-lhe:

....

XVI - regular e autorizar as atividades relacionadas com a produção, estocagem, distribuição e revenda de biodiesel, fiscalizando-as diretamente ou mediante convênios com outros órgãos da União, Estados, Distrito Federal ou Municípios." (NR)

Art. 2º. O § 1º. do art. 1º da Lei nº 9.847, de 26 de outubro de 1999, passa a vigorar com a seguinte redação:

"§ 1º O abastecimento nacional de combustíveis é considerado de utilidade pública e abrange as seguintes atividades:

I - produção, importação, exportação, refino, beneficiamento, tratamento, processamento, transporte, transferência, armazenagem, estocagem, distribuição, revenda e comercialização de petróleo, seus derivados básicos e produtos, gás natural e condensado;

II - produção, importação, exportação, armazenagem, estocagem, distribuição, revenda, e comercialização de biodiesel; e

III - distribuição, revenda e comercialização de álcool etílico combustível." (NR)

Art. 3º. Esta Medida Provisória entra em vigor na data de sua publicação.

Brasília, 13 de setembro de 2004; 183º da Independência e 116º da República.

LUIZ INÁCIO LULA DA SILVA

Dilma Vana Rousseff