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Biodiesel Plant Investment—Making the Correct Decisions

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Biodiesel Plant Investment—Making the Correct Decisions

Presented by:
Leland Tong
Steve Howell

Goals and Objectives

• IBFG Background
• Quick Biodiesel 101
• Understand the critical elements to consider when investing in a biodiesel plant
  – Detailed discussion on specific topics such as demand, policy, feedstock supply, and technology
• Provide a venue to ask specific questions relating to plant investment

Overall Purpose of IBFG

• Provide the most accurate, up-to-date, detailed, independent information on biodiesel and the biodiesel industry
• Provide Information you need to make an intelligent decision on a biodiesel plant….

IBFG Services Overview

• Biodiesel Feasibility Studies and Business Plans
  – Site Selection
  – Technology Selection
  – Economic Analysis
  – Market and Legislative Analysis
• Critical Review and Due Diligence of Feasibility and Business Plans
  – Client Sponsored
  – Lender Sponsored
Biodiesel Defined

• Biodiesel, n. -- a fuel comprised of mono-alkyl esters of long chain fatty acids derived from vegetable oils or animal fats, designated B100, and meeting the requirements of ASTM D 6751.

• Biodiesel blend, n. -- a blend of biodiesel fuel meeting ASTM D 6751 with petroleum-based diesel fuel designated BXX, where XX is the volume percent of biodiesel.

Biodiesel Raw Materials

<table>
<thead>
<tr>
<th>Oil or Fat</th>
<th>Alcohol</th>
<th>Catalyst</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soybean</td>
<td>Methanol</td>
<td>Sodium hydroxide</td>
</tr>
<tr>
<td>Corn</td>
<td>Ethanol</td>
<td>Potassium hydroxide</td>
</tr>
<tr>
<td>Canola</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cottonseed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sunflower</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beef tallow</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pork lard</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Used cooking oils</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The Biodiesel Reaction

In the presence of a catalyst

Combining

Vegetable Oil or Animal Fat (100 lbs.)
+ Methanol or Ethanol (10 lbs.)

Yields

Biodiesel (100 lbs.)
+ Glycerine (10 lbs.)
Biodiesel Physical Properties

- High Cetane
  - (>50 vs. 42)
- Flash Point
  - (260° F vs. 150° F)
- Virtually Zero Sulfur
  - Meets 2006 ULSD rule
- No Aromatic Content
- Superior Lubricity
- Integrates into existing petroleum infrastructure

B5 Performance Properties

- B5 has Similar Performance to Petrodiesel:
  - Torque
  - Horsepower
  - Mileage
  - Range
  - BTU Content

Environmental Attributes

- Energy Balance - for every one unit of energy needed to produce biodiesel, 3.2 units of energy are gained.
- Biodegradable and Non-Toxic - Tests sponsored by the United States Department of Agriculture confirm that biodiesel is safer than diesel and biodegrades as fast as dextrose, a test sugar.
- Greenhouse Gases – A 78% life cycle decrease in CO2 according to a USDA and DOE study.

Cleaner Emissions

<table>
<thead>
<tr>
<th>Emission Type</th>
<th>B100</th>
<th>B20</th>
<th>B2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Unburned Hydrocarbons</td>
<td>-67%</td>
<td>-20%</td>
<td>-2.2%</td>
</tr>
<tr>
<td>Carbon Monoxide</td>
<td>-48%</td>
<td>-12%</td>
<td>-1.3%</td>
</tr>
<tr>
<td>Particulate Matter</td>
<td>-47%</td>
<td>-12%</td>
<td>-1.3%</td>
</tr>
<tr>
<td>Oxides of Nitrogen (NOx)</td>
<td>+10%</td>
<td>+2%</td>
<td>+.2%</td>
</tr>
</tbody>
</table>
Biodiesel Health Properties

- Reduces particulate emissions
- Reduces targeted compounds thought to cause cancer: PAH, nPAH
- Biodiesel blends did not generate any unexpected new hydrocarbon species
- Significantly reduces the mutagenicity of exhaust in both the gaseous and particulate phases

Enhanced Lubricity

- Equipment benefits
  - Superior lubricity
  - B2 has up to 66% more lubricity than #2 Diesel
- EPA requires sulfur reduction in 2006
- No overdosing concerns

Cold Flow Properties

- Biodiesel (B100) freezes faster than most petrodiesel
- Untreated B20 freezes about 2-10°F faster than petrodiesel, depending on:
  - the cold flow properties of the biodiesel
  - the cold flow properties of the petrodiesel
- B2 differences are imperceptible
- Traditional cold weather options for diesel work well with biodiesel and blends
  - Blend with kerosene, use of additives
  - Block and filter heaters
  - In-door vehicle storage

Goals of Handbook

- Guide those wishing to build a biodiesel plant
- Serve as a reference tool for key considerations and important questions to ask and answer
- Provide an overview of the biodiesel plant development process
Key Considerations

- Biodiesel Demand
- Legislation and Regulatory Issues
- Feedstock Supply
- Distribution
- Industry Capacity and Competition
- Technology Selection
- Financing

US Distillate Fuel Uses

- On-Highway: 58%
- Residential: 11%
- Commercial, 6%
- Industrial, 4%
- Oil Company, 1%
- Farm, 5%
- Electric Utility, 2%
- Railroad, 5%
- Vessel bunkering, 4%

US Total distillate consumption 2003: 60.2 billion gallons

NE Distillate Fuel Uses

- On-Highway: 60%
- Vessel bunkering: 2.5%
- Railroad: 0.5%
- Electric Utility: 0.5%
- Farm: 28.8%
- Off-highway: 13.2%
- Residential: 0.5%
- Commercial: 1.3%
- Industrial: 0.5%

US Total distillate consumption 2003: 634.8 Million gallons
How is Biodiesel being Used?

- As a neat fuel (B100)
- As a blending stock with petrodiesel (B20)
  - Federal, state, and alternative fuel providers
  - EPAct and Executive Order Compliance
  - Emissions Reductions
- In low levels with petrodiesel (B2)
  - Lubricity and Ultra Low Sulfur Diesel Fuel
  - Agriculture supporting its own product
  - Terminal locations primarily throughout the Midwest

Regulated Fleets

- Almost all Federal Agencies with a diesel Fleet use biodiesel
  - Marine Corps
  - Air Force
  - Postal Service
  - Dept. of Interior
  - NASA
- EPACT and E.O. compliance

Strong Growth in Farm Use

- More than 1000 petroleum distributors now offer biodiesel to farmers
- 30% of farmers use biodiesel according to USB research
  - Up from 23%
**On-Highway Market**

- Largest market for diesel except in the Northeast
  - B2 in all on-highway diesel would require over 740 million gallons of B100 annually
- Extremely Cost Sensitive
- Market Needs
  - Education
  - Infrastructure
  - Incentives

**Legislation and Regulatory Issues**

**Biodiesel Tax Credit**

- Credit taken at the blender level
  - Enables biodiesel blends to be marketed more competitive to diesel fuel
  - Available for blends up to B99.9
- Structured to benefit all consumers (taxable and tax exempt markets)
  - Also including heating oil
  - B100 sales; income tax only
- Expires December 31, 2008
  - Implied investment risk

**How will it affect price?**

- DTN’s Alt Fuels Index on 8/18/05:
  - No. 2 diesel: $1.92/gal.
  - B100: $2.76/gal.
  - The tax incentive could lower the price of B20 by 20 cents
- Informal analysis: Given current crude oil prices, we could see a substantial increase in demand after the incentive has been fully implemented.
Additional Federal Initiatives

- Renewable Fuels Standard
  - 7.5 billion gallon requirement by 2012 included in the House version of the Energy Bill
  - Available to both ethanol and biodiesel
  - Refiners will need determine what combination or choice makes economic and logistical sense

CCC Bioenergy Program

- Program originally funded at $150,000,000 per year through FY2006.
  - FY 2005 funded at $100 million, FY 2006 could be $60 million
- Available to both ethanol and biodiesel plants.
- No one producer can receive more than 5% of the program funding ($7.5 million).
- Payments are based upon soybean prices in the county the plant is located in.
- Prorate factor has consistently been below 1.0 for last two years
  - 76.975%, 62.792%, 55.852%, 57.623%, 39.62% respectively
- This CCC Bioenergy payments program will not be continued past 2006

State Policy—Biodiesel

- Remains critical to the industry.
- States are increasingly taking proactive steps to implement policies to enhance the use of biofuels.
  - 2004 130 biodiesel related bills 27 passed.
    • (30% increase over 2003)
  - 2005 44 biodiesel related bills 18 states.

State Biodiesel Initiatives
Feedstock Supply

Key Feedstock Issues

- Quality
- Price
- Consistency of Supply

2003 US Fats & Oils Production

Biodiesel: U.S. Looking Forward

- Current Potential: 1.7 Billion gal/year
  - Displaces 5.5% of national on-hwy. demand.

- Near-Term Potential: (2015): 3.5 Billion gal/year
  - Displaces 6.8% of national on-hwy. demand.

- Long-Term Potential: (2030): 10 Billion gal/year


Total US Market: 30.3 billion lbs/yr
Distribution

Infrastructure

- Fuel available through direct shipment or from over 1,000 petroleum distributors nationwide
- About 400 public retail filling stations nationwide
- Movement towards biodiesel at the terminal

Distribution Outlets (August 05)

Retail Outlets (August 05)
Biodiesel Capacity (Current Competitors)

- In 1996, there were two registered biodiesel suppliers.
- In 2005, there are more than 39 companies who have invested millions of private dollars into the development of the biodiesel manufacturing plants and industry development activities.

Production Locations (August 05)

Proposed Plants (August 05)
Biodiesel Technology

Biodiesel Production Process

Biodiesel Plant Project Schedule

Critical Risk Factors

- Legislation
- Feedstock Market Swings
- Diesel Fuel Market Swings
- New Biodiesel Markets
Summary

• Biodiesel is an exciting new industry
• Many opportunities are available
• As are many pitfalls

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