Biodiesel Economics

Jon H. Van Gerpen
*Biological and Agricultural Engineering*
*University of Idaho, Moscow, ID, USA*

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Cost estimation- Three Questions

1. What does a biodiesel plant cost?
2. What will it cost you to produce the biodiesel?
3. How does your production cost relate to selling price?
Plant Cost- Buy

- Are you going to buy a turn-key plant from a technology provider such as Lurgi, REG, Crown, Superior Process, etc.?
  - Most expensive but quickest option.
  - If it is their first plant, you should expect a substantial discount.
Plant cost- Build Your Own

- Are you going to design and build your own plant?
  - Least expensive (maybe) but longest time due to need for development.
  - Should be able to take advantage of used or existing equipment.

- Some combination of these two options.
Add about 20% to cost due to rise in steel prices, 10/07
Biodiesel Plant Budget Installed Cost

Installed Cost ($)

Capacity in millions of gal/yr

$1./gal of annual capacity

Low FFA
10% FFA
30% FFA

Data based on estimates of Lurgi PSI

Superior Process Technologies
## Biodiesel Production Cost

(5 million gallon plant)

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit Cost</th>
<th>$/gal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil</td>
<td>$0.38/ lb</td>
<td>$2.85</td>
</tr>
<tr>
<td>Methanol</td>
<td>$1.15/ gal</td>
<td>$0.14</td>
</tr>
<tr>
<td>Catalyst (25% NaOCH₃)</td>
<td>$0.55/ lb</td>
<td>$0.08</td>
</tr>
<tr>
<td>Neutralizer (HCl)</td>
<td>$0.08/ lb</td>
<td>$0.01</td>
</tr>
<tr>
<td>Nat. gas + electricity</td>
<td>$9./ mmbtu, $0.05/ kwh</td>
<td>$0.02</td>
</tr>
<tr>
<td>Labor 1 shift, 5 people</td>
<td></td>
<td>$0.04</td>
</tr>
<tr>
<td>Depreciation/ interest 10 yr/ 6%</td>
<td></td>
<td>$0.15</td>
</tr>
<tr>
<td>Maintenance 3.8% of plant</td>
<td></td>
<td>$0.04</td>
</tr>
<tr>
<td>Admin. + overhead</td>
<td></td>
<td>$0.02</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td></td>
<td><strong>$3.35</strong></td>
</tr>
</tbody>
</table>

Note that the oil is 85% of production cost, infrastructure is only 5% of production cost. Production cost is $0.50/gal + oil.
## Biodiesel Retail cost

**Producer**
- **Production cost**: $3.35/gallon
- **Producer profit**: $0.00
- **Small producer tax credit**: -$0.10
- **CCC credit**: 0
- **Transportation**: $0.08
  - **Distributor purchase price**: $3.33

**Distributor/blender**
- **Purchase price**: $3.33/gallon
- **Excise tax credit**: -$1.00
- **Idaho+Federal tax**: $0.494
- **Freight**: $0.08
- **Blender profit**: $0.05
  - **Retailer purchase price**: $2.95

**Retailer**
- **Purchase price**: $2.95/gallon
- **Retailer mark-up**: $0.12
  - **Retail price (B100)**: $3.07

- Assumes CCC program expires in 2006.
- Assumes no credit for glycerin.

With current incentives, biodiesel should break even with diesel fuel when retail prices are above $3.07/gallon.
Oil Price

- Oil is difficult to find if you haven’t locked in a supply.
- If you are already a crusher, the internal transfer price is a business issue relating to where the profits should appear.
- If you are buying oil, expect to pay CBOT price plus freight ($0.01-0.03/lb).
- With recycled greases, collection and waste disposal costs mean the oil is not “free.”
Methanol prices

- The reaction consumes about 0.11 lb methanol per lb of biodiesel.
- \(0.11 \times 7.3\) lb/ gal = 0.80 lb methanol/ gal biodiesel
- \(0.80\) lb / 6.6 lb/ gal methanol = 0.12 gal methanol per gallon of biodiesel
- \(0.12\) gal x $1.15/ gal = $0.14/ gal biodiesel
- But remember we are using 100% excess methanol. Can we recover all of this? This depends on your plant design.
Methanex Monthly average price

Methanol price, $/gal

Slope = $0.12/yr

Catalyst

- **Using 2% sodium methylate solution (25%)**
  - If a lb of oil gives a lb of biodiesel and 1 gallon of biodiesel is 7.3 lb:
  - \( 7.3 \text{ lb/gallon} \times 0.02 \text{ lb cat/lb bio} \times $0.55/\text{lb cat} \)
  - \( = $0.08/\text{gallon biodiesel} \)

- **Using 1% sodium hydroxide**
  - \( 7.3 \text{ lb/gallon} \times 0.01 \text{ lb cat/lb bio} \times $0.42/\text{lb cat} \)
  - \( = $0.03/\text{gallon biodiesel} \)
Neutralizers and other production inputs

- Need to neutralize catalyst and split soaps. Typically use 1% HCl in water.
- Energy costs will depend on process but are usually small unless using high temperature processes (heterogeneous catalyst or supercritical).
Labor

- Estimate about 1 plant operator per million gallons.
- Half a manager per two employees. Try to leverage this with other businesses (soybean crushing, etc.)

For example:
- 2 employees @$30K, 0.5 manager @$50K
- $85K/ 2 million gallons = $0.04/ gallon
Depreciation- Expensing the Assets

- Land can’t be depreciated.
- Building might be 20 or 25 years.
- Equipment is typically 7 or 10 years.

- If a 10 million gallon, $9 million plant is depreciated over 10 years, this is $0.09/gallon.
Business Models

- **Large centralized plant**
  - Lower operating cost (main savings is labor and cost of capital)
  - More transportation cost

- **Small decentralized plant**
  - Higher operationing cost
  - Reduced transportation (It is quite feasible to make up for a $0.10/gallon penalty on the plant operating cost with lower transportation costs)
Business Models

- Most plants try to leverage local advantages such as building next to an existing crush plant.
  - Close proximity to oil
  - Can share marketing, management, lab facilities
- Might also locate close to petroleum distribution or close to meal market.
Business Models

- Tying up an oil supply is important to weather current industry shake-out.
- Suggested approach:
  - Start by buying and reselling biodiesel in your area.
  - Is the market there? Make sure you can sell the product before you invest in making it.