Rainbow Valley Farm
Biodiesel

Bill Mordasky
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Rainbow Valley Biodiesel was made possible through a grant from the Vermont Sustainable Jobs Fund, the office of Senator Patrick Leahy, and the Department of Energy.
Project Conception and Design

- System efficiency
- As completely automated as possible
- Completely dynamic to respond to crop conditions
- Ability to process large amounts of crop
- Utilize equipment left over from dairy operations
Conception and Design cont’

- Conscious of environmental concerns
- Tailor the system specifically for soybeans
- Keep cost as low as possible
System efficiency

- Presses are run by diesel motor
- Almost no reliance on electricity
- Heat for biodiesel reaction from glycerin
System Automation

- All grain is moved through the system by hydraulic powered augers with flow control valves
- Fluid level control circuit on oil barrel
- Auto shutoff switches
- Level control switches on meal removal auger
Dynamic System Control

- Hydraulic flow control valves
High Volume

- 250 tons of crop storage
- 60 tons of meal storage
- 9000 gallons of oil/fuel storage
- 2 8-ton presses
- Automatic system
Used/leftover Equipment
Low Cost

- Renovating existing building
- All augers came from dairy system
- Electric motors
- Water heater
- Used milking equipment
- Used grain bins
- Custom metal work
- HDPE Tanks
Environmental Concerns

- Building constructed with 7 inch concrete wall for more than %100 containment
- Glycerin burner
Tailored for Soybeans

- Crop water jacket pre-heater
- Presses set up in series
- Meal exhaust post heater
Problems

- Pre-heater not hot enough
- Moisture in meal bin
- Meal bridging
- Market
Solutions

- Build a pre-heat hopper where grain will have more time in contact with heat before press
- Install vent fan in bin
- Install vertical auger in bin
- Pellet mill?
Crop Water Jacket Pre-heater
Looking up at giant magnet
MK GLYCERIN BURNER Specifications

**Fuel**
Raw glycerin with viscosity no greater than 220 centistokes (equivalent to 20w oil) @ 70 degrees F (21 degrees C)
Starting mixture: Glycerin + 5-10% combustion enhancer (methyl alcohol). Time on starting mix is approximately one minute, depending on combustion chamber and operating conditions.

**Compressed air**
- Glycerin burner: 90 psi min., 150 psi max.
- Water purge Assy: 100 psi

**Capacity**
- **Beckett AF burner**
  - Firing rate: 1.3 - 1.5 GPH (5.7-13.2 l/h)
  - Input glycerin: 150,000 - 300,000 BTU/hr. (44-88 kW)
  - Input vegetable oil: 420,000 BTU/hr. (123 kW/h)
  - Input waste oil: 500,000 BTU/hr. (146 kW/h)
  - Input #2 fuel oil: 320,000 BTU/hr. (94 kW/h)

  *The Beckett CF burner is used when higher BTU output is required*

**Glycerin Burner**
- Power supply: 120 VAC/60 Hz single phase
- 220 VAC/50 Hz
- Operating load: 5.8 amps. max.
- Motor: 1/7 – 1/5 HP 3450 RPM
- Ignition: Continuous duty-intermittent

**Starting Mixture Pump**
- Outlet pressure: 120 PSI – 300 PSI
- Motor: 1/7 – 1/5 HP 3450 RPM
- Power supply: 120 VAC/60 Hz.
- Operating load: 5.8 amps. max

**Dimensions**
- Height: 11 1/2” (29 cm)
- Width: 12 7/8” (32.6 cm)
- Depth (chassis only): 6 9/16” (16.9 cm)
- Air tube: 4” (10.16 cm) diameter, 7” (17.78 cm) length
<table>
<thead>
<tr>
<th>Soybean Biofuel Cost Analysis</th>
<th>Cost Per Gallon of Biodiesel</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Price/Quantities List</strong></td>
<td></td>
</tr>
<tr>
<td>Soybeans ($/Bu)</td>
<td>$11.48</td>
</tr>
<tr>
<td>Soy Meal Break Even Target</td>
<td>$312.58</td>
</tr>
<tr>
<td>Soybean Meal ($/ton)</td>
<td>$300.00</td>
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<tr>
<td>Off Road Fuel ($/Gal)</td>
<td>$2.60</td>
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<tr>
<td>Average Fuel Usage (Gal/Ton)</td>
<td>5</td>
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<tr>
<td>Methanol ($/Gal)</td>
<td>$3.50</td>
</tr>
<tr>
<td>Average Oil Extract (Gal/Ton)</td>
<td>25</td>
</tr>
<tr>
<td>Average Weight of Soy-meal bi-product (lbs/ton)</td>
<td>1825</td>
</tr>
<tr>
<td>Oil to Methanol Ratio (#parts Oil to 1 part methanol)</td>
<td>5.0</td>
</tr>
<tr>
<td>Cost To Sell Soybeans per ton</td>
<td>$26.10</td>
</tr>
<tr>
<td>Glycerin Biproduct</td>
<td>5.0</td>
</tr>
</tbody>
</table>

**Comparison between 1 ton of Soybeans**

- Non-processed and Processed

<table>
<thead>
<tr>
<th>Sale Price of bulk soybeans ($/ton)</th>
<th>$285.23</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value of Soybean Biofuel</td>
<td>$34.50</td>
</tr>
<tr>
<td>Value of Glycerin</td>
<td>$9.14</td>
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<tr>
<td>Sale price of Soybean Meal</td>
<td>$273.75</td>
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</tbody>
</table>

**Total:** $317.39

Email Mark Mordasky