Feasibility Study for Commercial Production of Biodiesel in the Treasure Valley of Idaho

Presented by
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Consultant respectively
University of Idaho
Biodiesel As An Alternative to Diesel Fuel

• Invention of the Diesel Engine 1897

• Alternative Fuels
  – Environmental Concerns
  – Energy Shortages
Objectives

• Local sources of feedstocks
  • Oil
  • Alcohol
  • Catalyst

• Identify Marketing Options
  • Fuel
  • Glycerin
  • Meal

• Biodiesel Plant site Requirements

• Constraints for Biodiesel Plant
  • Economic
  • Environmental
  • Policy
  • EPA Fuel Certification
Biodiesel Technology

- Multiple technologies
- Commercial processes to produce an ASTM standard Biodiesel may be proprietary
- Any processor must anticipate the analytical requirements to assure ASTM standard compatibility
Greater Treasure Valley Area

9 Counties (2001)
- Ada - 312,337
- Boise - 7,011
- Canyon - 139,821
- Elmore - 29,157
- Gem - 15,482
- Owyhee - 11,008
- Ada - 312,337
- Boise - 7,011
- Canyon - 139,821
- Elmore - 29,157
- Gem - 15,482
- Owyhee - 11,008
- Washington - 9,956
- Malheur County, Oregon - 31,456
- Total - 577,096

Courtesy Idaho Power Data
Study Area

• The study considers only feedstocks available within the 9 county area and markets within the 9 county area.
  – Feedstocks outside the area might be preempted by a biodiesel plant in that area.
  – Markets outside the study area would be competitive markets with other biodiesel producers
Study Area

• This area has and is experiencing rapid growth which should be considered when developing a business plan for a potential biodiesel plant
  – In the past 6 years, daily traffic volumes on I-84 linking Ada and Canyon counties increased nearly 50%
  – Recent population projections for Ada and Canyon counties indicate an increase of an additional 25% from 1998 to 2005.
Biodiesel Feedstocks
Biodiesel Feedstocks

• Virgin Oils
  – Rapeseed, canola, yellow mustard crops
  – Other specialty oil seed crops
    • safflower
    • sunflower
    • other

• Used Oil from restaurants and deli’s
• Used Oil from processing plants
• Tallow
Biodiesel Feedstocks

• Used Oil from restaurants and deli’s
  – Estimate 1.1 gallons per day per person (NREI)
    • 555,000 @ 1.1 gal/person/yr = 600,000 gal
  – Survey of current renders
    • = 1 million gal/yr - Collection area > TV
  – Challenge
    • estimate the percentage that can be obtained for biodiesel use
    • current renders are reluctant to give up current customers to supply a new, and uncertain market such as biodiesel -- cash talks
    • Setting up a system to collect these oils would be expensive and competitive
Biodiesel Feedstocks

- Used Oil from processing plants
  - information is proprietary
  - Biodiesel plant must negotiate individually
  - possibly 0-3 million pounds
  - supply not certain because of different products and re-use strategies
  - processing plant goal is to not have waste grease
    - High quality feedstock < 3% FFA
Biodiesel Feedstocks

• Tallow
  – large supply
  – one meat processing plant recently closed
  – recent changes in livestock feed regulations prohibit this product from being used for feed
  – one of the most abundant sources of oil available in the Treasure Valley
  – Our estimate - 56 million pounds
  – current renders are reluctant to give up current customers to supply a new, and uncertain market such as biodiesel
    • may be negotiable
Biodiesel Feedstocks

• Current renders are reluctant to transfer oil from current customers to supply a new, and uncertain market such as biodiesel – everything is negotiable

• Starting a new oil recovery business
  – Duplicating current services
  – Define significant investment
    • Trucks
    • Tanks
    • Labor
    • Containment
Biodiesel Feedstock
Virgin Oils

• Winter rapeseed
• Winter canola
• Mustard
• Alternative Oil Seed Crops
  – Sunflower
  – Safflower
  – Soybeans
• Other
Cropland Issues

• 8 or 12 year Crop Rotations
• Harvested acres - 800,000 harvested vs 1.1 million acres planted
• Yield estimate
  – 2200# seed/A (irrigated)
  – 40% oil content
• Oil yield: 105 gal/acre
Oil Seed Production

• Information is lacking on horticultural practices to optimize oil production in the Treasure Valley
• State average yield of canola is 1100 #/acre (54 gal/acre)
• Production under irrigation could be 2-2.5 times higher – 100-125 gallon/acre
• Winter rapeseed and winter canola are reportedly the highest oil yielding crops recommended for Idaho
• Safflower and sunflower are also potential oilseed crops that have been grown successfully in Idaho. Reported yields are 1200 #/acre on dryland to as much as 3000 #/acre under irrigation
Idaho Ag Ruling Pertaining to the Production of Brassica’s

- To control diseases of the Brassica genus particularly blackleg
- to protect genetically developed varieties
- to protect the vegetable seed industry in southwest Idaho
Idaho Ag Ruling Pertaining to the Production of Brassica’s

• Administrative districts within the study area
  – District IV - all land within the boundaries of Ada, Canyon, Gem, Owyhee (north of Murphy), and Payette
  – District V - All lands within the boundaries of Elmore, Owyhee (south of Murphy) and Washington
Idaho Ag Ruling Pertaining to the Production of Brassica’s

• District IV - No rapeseed of either variety may be planted in District VI.

• District V - Only edible types of rapeseed may be planted, exceptions
  – Person planting industrial types can obtain written approval from all farmers bordering the fields to be planted
  – Must be at least one mile from a field planted to edible rapeseed
Oregon Ag Ruling Pertaining to the Production of Brassica’s

• Oregon ag rule pertaining to production of Brassica is under revision. The revision is to address the concept of growing large areas for the production of oil for biodiesel.

• The proposed revisions protect the established seed producing areas which includes the Treasure Valley
Oregon Ag Ruling Pertaining to the Production of Brassica’s

• Seed Producing Areas
  – Prohibits Brassica crops grown for oil production. Keeps the current 3-mile separation distance for canola/rape grown for seed.
  – Allows canola/rape if crop not allowed to flower.

• Non-seed areas:
  – Brassica crops grown for oil allowed
  – no separation between fields
  – no recording requirement
  – Same disease control measures are required
Oregon Ag Ruling Pertaining to the Production of Brassica’s

- Seed Producing Areas: retains current disease control measures including:
  - use of certified seed and testing/treatment for blackleg
  - not be grown in the same field more than one year in four
  - location of canola fields be recorded at the appropriate OSU extension office.
  - Retain transportation security requirements, sealed containers
Oregon Ag Ruling Pertaining to the Production of Brassica’s

- Non-seed areas:
  - Brassica crops grown for oil allowed
  - no separation between fields
  - no recording requirement
  - Same disease control measures are required
Alternative Oil Seed Crops

• Soybeans
  – Commercial varieties not adapted to cool night time temperatures & low humidity in Treasure Valley
  – OSU Malheur Experiment Station developing varieties adapted to the local climate
    • Some have yields -40-60 bu/A
    • Soybeans: oil content -17 to 19%
Alternative Oil Seed Crops

- Sunflower
  - Native North American plant
  - Food for North American Indians before colonization
  - Grown in Treasure Valley
  - Uses row crop equipment
  - Birds reduce yields
  - Heads are difficult to dry
  - Deep rooted plant
Alternative Oil Seed Crops

• Safflower
  – currently raised for birdseed at 12-14 and oil at 8-10 cents per pound, current production in southeastern Idaho 20,000 A, there are fields in Washington county.
  – Responds to hot dry conditions during flowering
  – Yield estimates- 2200 lb/A with 40% oil (Irrigated)
    – Dryland - 40 to 60% of irrigated
  – production 105 gallons per acre
Rotations Suggested for the Treasure Valley

<table>
<thead>
<tr>
<th>Rotation</th>
<th>8 year</th>
<th>12 year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crops*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grain</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>Alfalfa seed (3 yr)</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Potatoes/sugarbeets</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>Corn</td>
<td>25</td>
<td>0</td>
</tr>
<tr>
<td>Dry beans/ onions</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Mint (4yr)</td>
<td>0</td>
<td>25</td>
</tr>
</tbody>
</table>

* Data is % of crop land available
## Greater Treasure Valley Agricultural Area

<table>
<thead>
<tr>
<th></th>
<th>Total Acres</th>
<th>Crop Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ada</td>
<td>675,416</td>
<td>89,540</td>
</tr>
<tr>
<td>Boise</td>
<td>1,217,670</td>
<td>6,956</td>
</tr>
<tr>
<td>Canyon</td>
<td>377,721</td>
<td>235,077</td>
</tr>
<tr>
<td>Elmore</td>
<td>1,970,551</td>
<td>126,529</td>
</tr>
<tr>
<td>Gem</td>
<td>360,435</td>
<td>47,908</td>
</tr>
<tr>
<td>Payette</td>
<td>261,704</td>
<td>57,969</td>
</tr>
<tr>
<td>Owyhee</td>
<td>4,915,493</td>
<td>157,795</td>
</tr>
<tr>
<td>Washington</td>
<td>932,138</td>
<td>107,423</td>
</tr>
<tr>
<td>Malheur County, Oregon</td>
<td>6,329,706</td>
<td>278,780</td>
</tr>
</tbody>
</table>

- Total: 17,040,334 acres, 1,107,977 crop acres
Biodiesel Feedstocks
Rapeseed and/or Canola

Pessimistic
Oilseeds Crop Acreage at 8% - 12 year Rotation

• Total Cropland, 
  Harvested acres 809,557
• Acres for oilseeds 64,765*
• Oil production based 
  105 gallons per acre 6.8 million gal
  State Average yield 3.5 million gal

*Requires modification of ag order
Biodiesel Feedstocks
Rapeseed and/or Canola

Optimistic
Oilseeds Crop Acreage at 15% - 8 year Rotation

- Cropland, acres 1,107,977
- Cropland available at 15%, acres 166,197*
- Oil production based
  on 105 gallons per acre 17.5 million gal
  State Average Yield 9.0 million gal

*Requires modification of ag order
## Feedstock Production Summary
(Millions of Gallons)

<table>
<thead>
<tr>
<th>Feedstock Source</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Oil from Crops</strong></td>
<td>1.35 to 17.4</td>
</tr>
<tr>
<td>(25,000 to 166,000 acres at 54 to 105 gallons per acre)</td>
<td></td>
</tr>
<tr>
<td><strong>Oil from Waste Grease</strong></td>
<td>0.3 to 0.5</td>
</tr>
<tr>
<td>(50% of current collection)</td>
<td></td>
</tr>
<tr>
<td><strong>Oil from Processing Plants</strong></td>
<td>0.2</td>
</tr>
<tr>
<td>(50% of estimated 3 million pounds)</td>
<td></td>
</tr>
<tr>
<td><strong>Oil from Tallow</strong></td>
<td>3.7</td>
</tr>
<tr>
<td>(50% of current 56 million pounds)</td>
<td></td>
</tr>
<tr>
<td><strong>Total Estimated Supply</strong></td>
<td>5.5 to 21.8</td>
</tr>
</tbody>
</table>
Biodiesel Market

- Potential customers
  - EPAC
    - State Fleets
      - DOT
      - National guard
    - Federal Fleets
      - Forest service
      - BLM
      - BREC
    - Utilities
      - Idaho Power
      - Intermountain Gas
  - Others
    - Public Transportation
    - Sanitation Companies
    - Boise City
    - Counties
    - School buses
    - Public
Diesel Consumption (gallons)
Data from Idaho Tax Commission

Idaho

246 million On-road

375 million Total
Diesel Consumption

- 38% of the Idaho motor vehicles in the study area
- 42% of the Idaho population in the study area

Based on the above, this study used 40% of the diesel consumption in Idaho in the Treasure Valley and added an equivalent amount per person for Malheur County
# Biodiesel Market
(millions of gallons)

<table>
<thead>
<tr>
<th></th>
<th>Treasure Valley</th>
<th>@20%*</th>
<th>@5%*</th>
</tr>
</thead>
<tbody>
<tr>
<td>On-road Diesel</td>
<td>110</td>
<td>22</td>
<td>6</td>
</tr>
<tr>
<td>Total Diesel</td>
<td>166</td>
<td>33</td>
<td>8</td>
</tr>
</tbody>
</table>

*Blend ratio of biodiesel:diesel
Byproduct Utilization
Meal Market

Meal Uses:
- Livestock feed
- Boiler Fuel
- Pesticide
- Disposal problem
# Byproduct Utilization

## Meal

Safflower meal utilization

<table>
<thead>
<tr>
<th>Biodiesel plant capacity (million gal)</th>
<th>Meal (ton)</th>
<th>Dairy cows required*</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td>3,333</td>
<td>3,653</td>
</tr>
<tr>
<td>1</td>
<td>6,667</td>
<td>7,306</td>
</tr>
<tr>
<td>4</td>
<td>26,667</td>
<td>29,224</td>
</tr>
<tr>
<td>12</td>
<td>80,000</td>
<td>87,671</td>
</tr>
<tr>
<td>18</td>
<td>120,000</td>
<td>131,507</td>
</tr>
</tbody>
</table>

* assumes 5 lb. of meal included in ration
Byproduct Utilization

• Calves, Cattle, Cows in study area*

  – 620,000 Southwest
  – 215,000 Malheur County Oregon
  835,000 Total

*2004 Idaho Agricultural Statistics
<table>
<thead>
<tr>
<th>1999-2001 average</th>
<th>Wheat</th>
<th>Barley</th>
<th>Corn</th>
<th>Oats</th>
<th>Other*</th>
<th>Total Grains</th>
<th>Protein Meal*</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>CANADA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beef Cattle</td>
<td>145</td>
<td>3,396</td>
<td>768</td>
<td>1,554</td>
<td>579</td>
<td>6,442</td>
<td>349</td>
<td>6,791</td>
</tr>
<tr>
<td>Dairy Cattle</td>
<td>116</td>
<td>952</td>
<td>1,824</td>
<td>60</td>
<td>344</td>
<td>3,295</td>
<td>471</td>
<td>3,765</td>
</tr>
<tr>
<td>Hogs</td>
<td>818</td>
<td>2,001</td>
<td>3,676</td>
<td>30</td>
<td>304</td>
<td>6,829</td>
<td>1,396</td>
<td>8,225</td>
</tr>
<tr>
<td>Chickens</td>
<td>402</td>
<td>179</td>
<td>836</td>
<td>0</td>
<td>40</td>
<td>1,456</td>
<td>391</td>
<td>1,847</td>
</tr>
<tr>
<td>Layers</td>
<td>274</td>
<td>0</td>
<td>250</td>
<td>0</td>
<td>43</td>
<td>566</td>
<td>133</td>
<td>699</td>
</tr>
<tr>
<td>Turkeys</td>
<td>100</td>
<td>0</td>
<td>131</td>
<td>0</td>
<td>11</td>
<td>243</td>
<td>81</td>
<td>324</td>
</tr>
<tr>
<td>Horses</td>
<td>0</td>
<td>71</td>
<td>22</td>
<td>178</td>
<td>13</td>
<td>285</td>
<td>27</td>
<td>312</td>
</tr>
<tr>
<td>Sheep/Lambs</td>
<td>1</td>
<td>34</td>
<td>7</td>
<td>7</td>
<td>4</td>
<td>53</td>
<td>3</td>
<td>56</td>
</tr>
<tr>
<td>Total</td>
<td>1,857</td>
<td>6,632</td>
<td>7,514</td>
<td>1,829</td>
<td>1,337</td>
<td>19,169</td>
<td>2,851</td>
<td>22,019</td>
</tr>
</tbody>
</table>
## Byproduct Utilization

### Meal Value

<table>
<thead>
<tr>
<th></th>
<th>Suitable for feed</th>
<th>Protein (%)</th>
<th>Value ($/ton)#</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safflower</td>
<td>yes</td>
<td>25</td>
<td>$120</td>
</tr>
<tr>
<td>Sunflower</td>
<td>yes</td>
<td>50</td>
<td>$239</td>
</tr>
<tr>
<td>yellow mustard</td>
<td>*</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Canola</td>
<td>*</td>
<td>36</td>
<td>$172</td>
</tr>
<tr>
<td>Rapeseed</td>
<td>*</td>
<td>36</td>
<td>$172</td>
</tr>
</tbody>
</table>

*depends on glucosinolate content

#Current price of 47% protein soy meal is $225 per ton
Byproduct Utilization
Glycerine Market

Glycerol Uses:
- Livestock feed
- Boiler Fuel
- Raw material for cosmetics, food, etc.
- Disposal problem

Glycerol Value:
- USP Grade - $0.40 per pound
- Unpurified glycerol may be a disposal problem
Glycerol Production and Use

<table>
<thead>
<tr>
<th></th>
<th>U. S.</th>
<th>Europe</th>
<th>Japan</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual capacity</td>
<td>169</td>
<td>315</td>
<td>59</td>
<td>543</td>
</tr>
<tr>
<td>Production</td>
<td>159</td>
<td>247</td>
<td>53</td>
<td>459</td>
</tr>
<tr>
<td>Consumption</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personal/oral care products</td>
<td>75</td>
<td>46</td>
<td>15.5</td>
<td>136.5</td>
</tr>
<tr>
<td>Drugs/Pharmaceuticals</td>
<td>14</td>
<td>24</td>
<td>23</td>
<td>61</td>
</tr>
<tr>
<td>Foods/beverages</td>
<td>42</td>
<td>27</td>
<td></td>
<td>69</td>
</tr>
<tr>
<td>Polyether polyols</td>
<td>17</td>
<td>33</td>
<td>6</td>
<td>56</td>
</tr>
<tr>
<td>Tobacco</td>
<td>22</td>
<td>15</td>
<td>5</td>
<td>42</td>
</tr>
<tr>
<td>Alkyd resins</td>
<td>6</td>
<td>17</td>
<td>7.5</td>
<td>30.5</td>
</tr>
<tr>
<td>Other</td>
<td>13</td>
<td>79</td>
<td>29</td>
<td>121</td>
</tr>
</tbody>
</table>

Table 5 – Production, Consumption, and Uses of Glycerol, 2001 (in thousands of tonnes; source: Chemical Economics Handbook)
# Byproduct Utilization

## Glycerin

Glycerin as a ration component

<table>
<thead>
<tr>
<th>Biodiesel plant capacity (million gal)</th>
<th>Glycerin (million lb)</th>
<th>Dairy cows required*</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td>0.37</td>
<td>1,027</td>
</tr>
<tr>
<td>1</td>
<td>0.75</td>
<td>2,055</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>8,219</td>
</tr>
<tr>
<td>12</td>
<td>9</td>
<td>24,658</td>
</tr>
<tr>
<td>18</td>
<td>13.5</td>
<td>36,986</td>
</tr>
</tbody>
</table>

*Assumes 1# per day

Traces of methanol not acceptable
<table>
<thead>
<tr>
<th></th>
<th>Yellow Grease Only 0.5</th>
<th>YG + Tallow 4</th>
<th>64,765 Acres @ 2200 #/acre 11</th>
<th>157,500 Acres @ 2200 #/acre 21</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feedstock</td>
<td>$375</td>
<td>$3,725</td>
<td>$17,500</td>
<td>$37,300</td>
</tr>
<tr>
<td>Methanol</td>
<td>$56</td>
<td>$450</td>
<td>$1,236</td>
<td>$2,360</td>
</tr>
<tr>
<td>Catalyst</td>
<td>$36</td>
<td>$292</td>
<td>$802</td>
<td>$1,530</td>
</tr>
<tr>
<td>FFA</td>
<td>$50</td>
<td>$400</td>
<td>$400</td>
<td>$400</td>
</tr>
<tr>
<td>Freight</td>
<td>$25</td>
<td>$200</td>
<td>$550</td>
<td>$1050</td>
</tr>
<tr>
<td>Crushing</td>
<td>---</td>
<td>---</td>
<td>$1,425</td>
<td>$3,465</td>
</tr>
<tr>
<td>Total Cost</td>
<td>$693</td>
<td>$6067</td>
<td>$26,500</td>
<td>$55,500</td>
</tr>
<tr>
<td>Cost - $/gal</td>
<td>$1.39</td>
<td>$1.52</td>
<td>$2.41</td>
<td>$2.64</td>
</tr>
<tr>
<td>Plant Size (Million Gallons Per Year) vs. Income in Thousands of $</td>
<td>Yellow Grease Only 0.5</td>
<td>YG + Tallow 4</td>
<td>64,765 Acres @ 2200#/acre 11</td>
<td>157,500 Acres @ 2200#/acre 21</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Biodiesel</td>
<td>$1,100</td>
<td>$8,800</td>
<td>$24,180</td>
<td>$46,200</td>
</tr>
<tr>
<td>Glycerol</td>
<td>$28</td>
<td>$220</td>
<td>$604</td>
<td>$1,155</td>
</tr>
<tr>
<td>Meal</td>
<td>0</td>
<td>0</td>
<td>$5,628</td>
<td>$13,700</td>
</tr>
<tr>
<td>Total</td>
<td>$1127</td>
<td>$9,020</td>
<td>$30,400</td>
<td>$61,045</td>
</tr>
<tr>
<td>Income, $/gal</td>
<td>$2.26</td>
<td>$2.26</td>
<td>$2.77</td>
<td>$2.91</td>
</tr>
<tr>
<td>Profit, $/gal**</td>
<td>$0.87</td>
<td>$0.74</td>
<td>$0.35</td>
<td>$0.26</td>
</tr>
</tbody>
</table>

** No program incentives considered and fob plant
Summary: Plant Size (Million Gallons Per Year) vs. Cost, Income and Profit

<table>
<thead>
<tr>
<th></th>
<th>Yellow Grease Only 0.5</th>
<th>YG + Tallow 4</th>
<th>YG + T + 64,765 Acres @ 2200 #/acre 11</th>
<th>YG + T + 157,500 Acres @ 2200 #/acre 21</th>
</tr>
</thead>
<tbody>
<tr>
<td>Income, $/gal</td>
<td>$2.26</td>
<td>$2.26</td>
<td>$2.77</td>
<td>$2.91</td>
</tr>
<tr>
<td>Cost - $/gal</td>
<td>$1.39</td>
<td>$1.52</td>
<td>$2.41</td>
<td>$2.64</td>
</tr>
<tr>
<td>Profit, $/gal**</td>
<td>$0.87</td>
<td>$0.74</td>
<td>$0.35</td>
<td>$0.26</td>
</tr>
</tbody>
</table>

** No program incentives considered and fob plant
# Plant Size Assumptions*

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oilseeds</td>
<td>$0.097 cents/pound</td>
</tr>
<tr>
<td>Methanol</td>
<td>$0.104 per gallon</td>
</tr>
<tr>
<td>Catalyst</td>
<td>$0.073 per gallon</td>
</tr>
<tr>
<td>High FFA Processing</td>
<td>$0.06 per gallon</td>
</tr>
<tr>
<td>Freight</td>
<td>$0.05 per gallon</td>
</tr>
<tr>
<td>Crushing and Filtering</td>
<td>$50.00 per ton</td>
</tr>
<tr>
<td>Cost of Plant Operation</td>
<td>$0.20 per gallon up to $0.30 per gallon for the smaller plant</td>
</tr>
</tbody>
</table>

*Reference: Building a Successful Biodiesel Business

Actual numbers for a particular plant may vary from data used.
## Plant Size Assumptions* (cont’d)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Biodiesel Selling Price</strong></td>
<td><strong>$2.20 per gallon</strong></td>
</tr>
<tr>
<td><strong>Glycerol value</strong></td>
<td><strong>$0.05 per pound</strong></td>
</tr>
<tr>
<td><strong>Meal Value</strong></td>
<td><strong>$125.00 per ton</strong></td>
</tr>
</tbody>
</table>

*Reference: Building a Successful Biodiesel Business
Actual numbers for a particular plant may vary from data used.
Plant Site Location

- Location will be size dependent
- Small plants will have more potential locations
- Large plants will be constrained by transportation vectors
- Large plants will need oil seed crushing capability (not in scope of study)
Processing Plant
Requirements

Utilities

– Electricity
– Water
– Natural gas
– Waste water treatment
– Storm water run off
## Processing Plant Capital Costs

<table>
<thead>
<tr>
<th>Annual Production (Million Gal)</th>
<th>Capital Cost $/gal</th>
</tr>
</thead>
<tbody>
<tr>
<td>.5</td>
<td>2.00</td>
</tr>
<tr>
<td>1.0</td>
<td>2.00</td>
</tr>
<tr>
<td>5.0</td>
<td>1.25</td>
</tr>
<tr>
<td>10.0</td>
<td>1.00</td>
</tr>
</tbody>
</table>
Plant Site Location

Idaho Northern & Pacific Rail line
Plant Site Location

Union Pacific Main rail line
Processing Plant Requirements

• Zoning requirements
  – Biorefinery (processing)-Industrial M1,M2
  – Individuals- Conditional use permit

• Counties
  – Limited industrial zones
  – Application for rezoning
Processing Plant Requirements

• Permits (Various permits depending on business size and location)*
  – Resource Conservation Recovery Act (RCRA)
  – Comprehensive Environmental Response Compensation and Liability Act (CERCA)
  – Emergency Planning and Community Right to Know Act (EPCRA)
  – Clean Water Act
    • Safe Drinking Water Act
  – Toxic Substances Control Act (TSCA)
  – Clean Air Act (CAA)
  – Oil Pollution Control Act

* Reference: Building a Successful Biodiesel Business, 2005
Project Summary

• Potential for a Biodiesel Plant in Treasure Valley
• Potential Biodiesel demand- 6 to 33 million gal
• Sufficient cattle for meal utilization
• Variety of feedstocks:
  • Used oil
  • Tallow
  • Oil seed crops
Potential Biodiesel production: 0.5 to 21 million gal
New market for oil seed crops in Treasure Valley
Project Summary: Constraints

- Ag order limits brassica production
- Previous history with used oil for Biodiesel
- Horticultural information for growing oil seed crops in study area
- No oil seed crush plant
- Limited uses for glycerol
- Market acceptance by major oil companies
- Permitting
Sponsors

• Idaho Department of Water Resources Energy Division

• University of Idaho
  – College of Engineering
  – Department of Biological and Agricultural Engineering
  – NIATT
Questions

The End