INTRODUCTION TO BIODIESEL

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Whole Energy Fuels

- 2004: Plant built in NW WA
- 2005: WEF founded
- 2006: Large scale testing/distribution of biodiesel
Whole Energy Fuels

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- 2005: WEF founded
- 2006: Large scale testing/distribution of biodiesel
- 2007: Awarded CARB grant for Pacifica
- 2008: 25% of WA biodiesel from WEF
What is Biodiesel?

• An alternative to conventional #2 petroleum diesel
• Derived from many types of oil: canola, soy, mustard, used cooking oil, animal tallow, etc.
• Cleaner exhaust, with significant reductions in PM, SOx, CO, PAH’s
• Because it comes from plants, CO2 is approx 1/5th that of petroleum diesel
Comparison

BIODIESEL

- Non-volatile
- Gels around 32 F
- Strong solvent
- Lower emissions

PETROLEUM DIESEL

- Volatile
- Gels around 14 F
- Weak solvent
- Regular emissions

VERY SIMILAR!
Typical Oil to Biodiesel Reaction

OIL + METHANOL → BIODIESEL + GLYCERIN
Typical Oil to Biodiesel Reaction

- Biodiesel:
  - Recover remaining methanol
  - Mix with water to dissolve remaining catalyst
  - Evaporate dissolved water

- Glycerin:
  - Recover remaining methanol
Approx. Proportions

**Input**
- 55 Gal Vegetable Oil
- 10 Gal Methanol
- 6 Lbs Sodium Hydroxide

**Output**
- 55 Gal Biodiesel
- 5 Gal Glycerin
- 5 Gal Methanol
Notes on Products

• Biodiesel must meet ASTM standard 8751 to be called biodiesel (B100)
• If biodiesel is blended with petroleum diesel, mixture is called B20 (if 20% biodiesel)
• Glycerin is a common industrial product and can be sold
• EBMUD in Oakland purchases glycerin for use in its digesters
Typical Equipment
How big is a biodiesel plant?
How big is a biodiesel plant?
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## Comparison of Production

<table>
<thead>
<tr>
<th>Industrial</th>
<th>Home-brew</th>
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<tbody>
<tr>
<td>• Spill prevention and containment plans</td>
<td>• Under the radar – no permits</td>
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<td>• Fire code analysis to determine occupancy</td>
<td>• Sometimes poor handling practices</td>
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<td>• Sprinkler systems</td>
<td>• Methanol vapors create dangerous environment</td>
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<tr>
<td>• Ventilation</td>
<td>• Access/egress issues</td>
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<tr>
<td>• Compliance with codes and permitting agencies</td>
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Plant Fires

- Typically due to poor handling of methanol
Methanol

- The primary hazard in biodiesel production
- Liquid at room temperature, but volatile
- Flash point: 52 F
- Clear, transparent, slightly sweet odor
- Commonly used in hotrod cars, solvents, industrial applications
Other HazMat

• **Sodium or potassium hydroxide**
  typical catalyst – sometimes in methanol solution called methylate

• **Sulfuric acid** used for preparing oil and neutralizing sodium or potassium in bio/glycerin
Other Materials

- Vegetable oil
- Biodiesel
- Glycerin
Pre-Engineered Safety

• Double containment of Methanol and Methylate tanks and pipes
• Occupancy of process area H3, requiring Class 1 Division II electrical
• Process to take place in well ventilated space
• Sprinkler system and flammable gas detectors
• Tanks containing methanol should not be vented into the plant
Whole Energy Pacifica Plant

• Located next to Pacifica Wastewater Plant
• Biodiesel produced from used cooking oil
• Generator runs off biodiesel
• Recycled water used in process
• Plant emissions scrubbed through an existing soil scrubber
Whole Energy Pacifica Plant

• 4000 sq ft type V-B steel building
• Analysis of Fire Code determined the building should be half F1 and half H3
• 1 hr fire barrier
Whole Energy Pacifica Plant

• Steps to permitting:
  1) EIR provided to City under CEQA
     ✓ Traffic, visual and wildlife impact assessments
  2) Permit issued by BAAQMD
     ✓ Examination of plant emissions
  3) Permit issued by Coastal Commission
     ✓ Spill containment, other coastal issues
  4) Building permit for shell
     ✓ Structural, wind, seismic, geotech
  5) Building permit for interior (in process)
     📢 Plumbing, electrical, ventilation, site work, HazMat
Summary

- Industrial scale operations subject to scrutiny to ensure safe handling
- Home brewers using and heating methanol: clearly dangerous
Thank you!

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