Update to the Board on Biodiesel Use in California

June 2005
Overview

• Background
• Production and Distribution
• Emissions
• Costs and Incentives
• Fuel Issues
• Recent Activities
• Goals
• Next Steps
Background
Diesel and Gasoline in CA

- Fuel consumption in 2004
  - Diesel: 2.9 billion gallons
  - Gasoline: 15.9 billion gallons
- Growth rate of diesel higher than gasoline from 1990-2004
  - Diesel 60%
  - Gasoline 20%
Governor’s Executive Order Establishes Aggressive Greenhouse Gas Emission (GHG) Targets

• By 2010: reduce GHG emissions to 2000 levels
Biodiesel Greenhouse Gas Benefits

• Based on lifecycle analysis
  – 1 gallon of diesel produces 28 lbs of CO$_2$
  – 1 gallon of B100 produces 6 lbs of CO$_2$ emissions

• Reduces greenhouse gas emissions
  – Biodiesel could displace about 1% of diesel fuel and reduce CO2 emissions by 300,000 tons
Other Biodiesel Benefits

• Reduces PM and toxic emissions
• Biodiesel can be used with no engine modification
What is Biodiesel?

• Made by reacting oils or fats and alcohol to form biodiesel
• Glycerol by-product

Transesterification

Animal fat or vegetable oil (Fatty acid) → Alcohol (methanol) → Catalyst (NaOH) → Biodiesel (Ester) → Glycerol
Biodiesel and Biodiesel Blends

• B100 refers to pure 100% biodiesel
• Biodiesel blends are noted as BXX
  – Example: B20 is 20% biodiesel, 80% diesel
Can Biodiesel be Used in CA?

Yes if:

• Meets ARB diesel regulations for sulfur and aromatics

• Meets Division of Measurement Standards specifications
  – Limits retail sales to B20 or less
  – B100 can be used in non retail or with a fuel variance
Users of Biodiesel in California

- **Federal government:** several military and national park installations
- **Municipalities:** City of Berkeley; Alameda Co.
- **Utilities:** PG&E; SoCal Edison; SDG&E
- **Private companies:** Fetzer Winery; Thanksgiving Coffee Co.; JR Cardenas Construction
- **Individuals:** Fuel cooperatives; card lock stations

Biodiesel Production and Distribution
Potential Annual Biodiesel Volume Based on Available Feedstocks

Volume of B100 in 2001 (millions gal/yr)

- 2001 US potential annual capacity 1.6 billion gallons
- Greases, animal fats, vegetable oils

CA Biodiesel Facilities

- 4 Production Facilities
- 29 Distributors
- 23 Retail Outlets

Photo courtesy Russ Teall
Biodiesel Production Capacity in California

• Current capacity
  – 2005 16 million gallons/year*
  – Represents 1/2 percent of CA diesel production

*Email Fred Wellons
Emissions
Emission Studies

- US EPA Tier I Study
- Montreal Biobus Study
- Recent NREL Studies
# Biodiesel Emission Impacts

<table>
<thead>
<tr>
<th>Emission Type</th>
<th>B20</th>
<th>B100</th>
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<tbody>
<tr>
<td>HC</td>
<td>-21%</td>
<td>-67%</td>
</tr>
<tr>
<td>PM</td>
<td>-10%</td>
<td>-48%</td>
</tr>
<tr>
<td>CO</td>
<td>-11%</td>
<td>-48%</td>
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<tr>
<td>NOx</td>
<td>+2%</td>
<td>+10%</td>
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</table>
Toxics

• Generally toxics decrease
  – US EPA Draft showed a 15% reduction of volatile toxic emissions
  – Tier 1 significant reductions of PAHs, formaldehyde and acetaldehyde, and VOC toxics
  – Biodiesel and biodiesel blends reduce emissions of PM, a toxic air contaminant.
Costs and Incentives
## Cost Breakdown Based on Feedstocks

<table>
<thead>
<tr>
<th></th>
<th>Soy</th>
<th>Rclyl grease</th>
<th>Diesel</th>
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<tbody>
<tr>
<td>Feedstock</td>
<td>$2.22</td>
<td>$1.09</td>
<td>$1.31</td>
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<tr>
<td>Processing</td>
<td>$0.47</td>
<td>$0.47</td>
<td>$0.46</td>
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<tr>
<td>Est Prod Costs</td>
<td>$2.69</td>
<td>$1.56</td>
<td>$1.77</td>
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</table>

Glycerol sales reduces biodiesel cost by $.15 per gallon

Diesel cost do not include distribution cost and taxes

Source: Biodiesel estimates from NREL, diesel estimates from EIA and CEC
Credit and Incentive Programs

• Production Level: Incentive funds
• Blenders Level: Biodiesel Tax Credit
  – $1.00/gal credit for animal fats and vegetable oil biodiesel
  – $0.50/gal credit for recycled grease-biodiesel
Fuel Issues
Compatibility with Verified Diesel PM Controls

• Compatibility demonstration of B20 underway
  – Would allow verified devices to use B20
Acceptance of Biodiesel

• Engine and vehicle manufacturers concern
  – B5 approved
  – Engine warranty Issues

• Distributors
  – Blending and contamination issues

• End-user
  – Lower energy content than diesel
  – Durability and performance

• Need fuel specifications for B100 and blends
  – Fuel stability specifications
  – Need for fuel blending level test method
Recent Activities
ASTM Specifications

• ASTM D6751 establishes fuel specifications for B100 as a blending component of diesel fuel
  – Goal: Consistent quality of biodiesel blending component
  – No ASTM specifications for finished biodiesel blends or B100 as a fuel
ASTM Ongoing Efforts

• Modification of D975 diesel fuel standard to include biodiesel up to B5
• Development of new ASTM standard for B20
• Update B100 blendstock specifications
ARB Biodiesel Workgroup

• Established in 2004 to assist the ARB in determining the need to develop biodiesel specifications
• First meeting held in March 2004
• Second meeting held in June 2005
Coordination with the California Energy Commission

- Biodiesel considered a renewable fuel
- Supports energy diversity
- Determine biodiesel market feasibility
- Assess air quality impacts
Goals

- Incorporate B20 in Diesel Retrofit Program to take advantage of its benefits
- Resolve NOx issues
- Address acceptability issues
Next Steps

- Continue to work with ASTM, CEC, and industry to resolve remaining issues