

Dept. of Public Safety  
Spring 2008 Career Development

## BIODIESEL 101

CT Biodiesel/Bioheat Association

## CT Biodiesel/Bioheat Association

- Representing producers, marketers and affiliates
- Primary objectives
  - Establishing state incentives for the production and use of biodiesel in CT
  - Ensuring product quality
  - Outreach and education

## What is *biodiesel*?

Biodiesel is a cleaner burning, domestic and renewable fuel that can be produced from virgin or recycled vegetable oil and animal fat.

*Biodiesel, n*—a fuel comprised of mono-alkyl esters of long chain fatty acids derived from vegetable oils or animal fats, designated B100, and meeting the requirements of ASTM D 6751.

## How is biodiesel made?

Biodiesel is refined from vegetable oils through a fairly simple chemical reaction called *transesterification*.

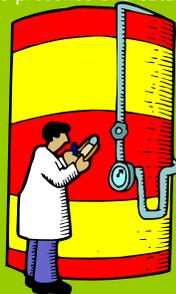
- Vegetable oils primarily consist of triglycerides; three carbon chains connected by a glycerin molecule.
- In the reaction process, an alcohol (methanol or ethanol) is used with a catalyst (potassium or sodium hydroxide) to separate the glycerin molecule from the carbon chains.
- The fatty acid alkyl esters, the chemical name for biodiesel, is then separated from the co-product glycerol.
- The long carbon chains in biodiesel have a very similar profile to petroleum middle distillates.

## How is biodiesel made?

In the presence of a catalyst

Combining

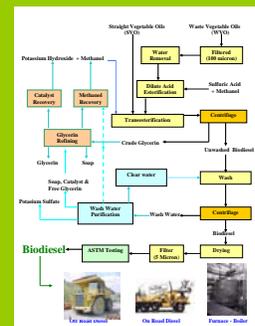
Vegetable Oil  
or  
Animal Fat  
(100 lbs.)  
+  
Methanol or  
Ethanol  
(10 lbs.)



Yields

Biodiesel  
(100 lbs.)  
+  
Glycerine  
(10 lbs.)

## How is biodiesel made?



## How is biodiesel used?

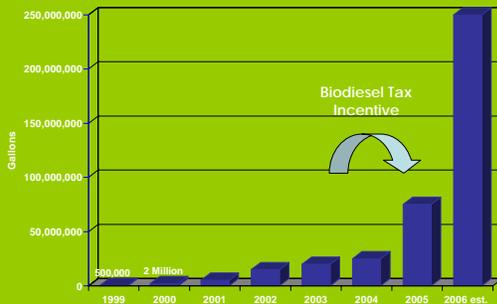
- Diesel engines
  - On-highway
  - Off-highway
- Oil-burning furnaces
- Easily blends with petroleum products



## Who is using biodiesel today?

- All branches of the U.S. military – including **U.S. Coast Guard Academy**; USPS; DOA; GSA
- State fleets - including **Connecticut DOT**, New Jersey DOT, Missouri DOT
- Municipal fleets - including **New Haven, Cheshire, Glastonbury, Sharon and Salisbury, CT**; City of Keene, NH; Clark County Public Works Department, Vancouver, WA; City of St. Louis, MO; Hennepin County, MN; Arlington County, VA
- School bus fleets, including **Glastonbury, CT**, Warwick Public Schools, RI; Chicago School Transit, IL; Medford School District, NJ; Deer Valley School District, AZ; St. Johns Public Schools, MI
- Private fleets, including Alcoa, Florida Power & Light Company, Clif Bar, L.L. Bean, New Belgium Brewery, Fetzer Vineyards, Jones Soda Co., Georgia Power
- U.S. National Parks, including Yellowstone and Channel Islands
- Marine vessels, including Western Prince Whale & Wildlife Tours, Seattle, WA

## U.S. Biodiesel Demand



## Connecticut Incentives

- **Biodiesel Production Grant**
  - One-time grants for the initial purchase of or retrofit of production facilities and equipment not to exceed either \$3 million dollars or 25% of the equipment or construction cost.
- A qualified biodiesel producer will be eligible for up to 60 monthly grants up to a total grant per fiscal year equal to:
  - 1) \$0.30 per gallon for the first five million gallons of biodiesel
  - 2) \$0.20 per gallon for the second five million gallons of biodiesel
  - 3) \$0.10 per gallon for the third five million gallons of biodiesel

## Connecticut Incentives

- **Distribution Grant**
  - Up to \$50,000 per distributor/site will be available for the actual costs of creating storage and distribution capacity for biodiesel.
- **Biofuels Support**
  - DECD is to provide funding to Connecticut institutions of higher education or research for agricultural research to promote biofuel production from agricultural products, algae and waste grease, as well as biofuel quality testing.

## Key attributes

- **Biodegradable**
  - Straight biodiesel (B100) biodegrades as fast as sugar, and even accelerates the biodegradability of petrodiesel, thus minimizing the environmental impact of fuel spills. Classified as a non-hazardous material.
- **Non-toxic**
  - Straight biodiesel (B100) is less toxic than table salt and irritates skin less than ordinary hand soap.

## Key attributes, cont'd

- Cleaner burning
  - B100 reduces CO<sub>2</sub> emissions by up to 78% (16% in a B20 blend) [plant-based feedstock = closed CO<sub>2</sub> loop]
  - substantially reduces unburned hydrocarbons, carbon monoxide, and particulate matter, thus reducing the localized formation of smog
  - dramatically reduces polycyclic aromatic hydrocarbons (PAH) and nitrated polycyclic aromatic hydrocarbons (nPAH), which have been identified as potential cancer causing compounds

## Key attributes, cont'd

- essentially eliminates emissions of sulfur oxides and sulfates (20% reduction in a B20 blend), thus reducing major components of acid rain.
- Renewable
  - A transportation fuel that, in essence, extracts solar energy and carbon stores from plants through a simple process of refining the plants' oil. The plant oil (feedstock) is harvested from crops that are grown year after year.

## Positive energy balance

- Independent studies show that for every one unit of fossil energy put into the production of biodiesel, the yield is 3.2 units of energy out. This is the highest energy balance of any transportation fuel today.
- Ethanol: 1.2
- Diesel: .8

## Energy Security

- Surging national, regional and local interest in energy independence
  - 1.6 billion gallons of CT's 3.1 billion gallon annual petroleum demand is imported
  - 1 billion gallons of these imports originate outside the Western hemisphere
  - 320 million gallons originate from the Persian Gulf region (\$530M)