Introduction to Biodiesel

The 2007 New York State Biofuel Forum

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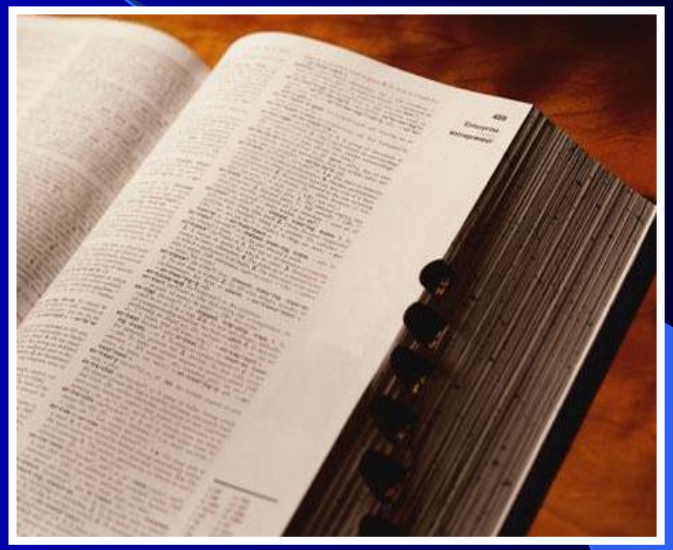
The Northeast Regional Biomass Program (NRBP) is pleased to be making this presentation today representing both the NRBP and the NBB. Through a cooperative agreement the two organizations are able to serve a wider audience and provide objective and reliable information on biodiesel in the Northeast sates.

Biodiesel – The Definition

- ✓ 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 6751-07a.



Biodiesel Production

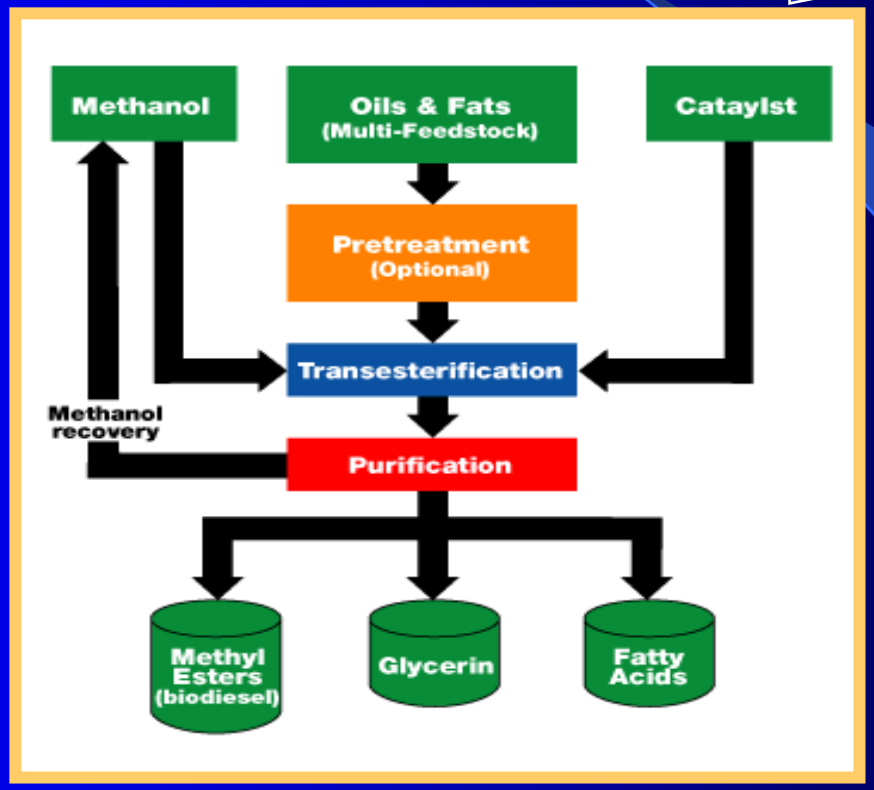
Transesterfication

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.)

Soybean, Yellow Grease, Tallow & Palm

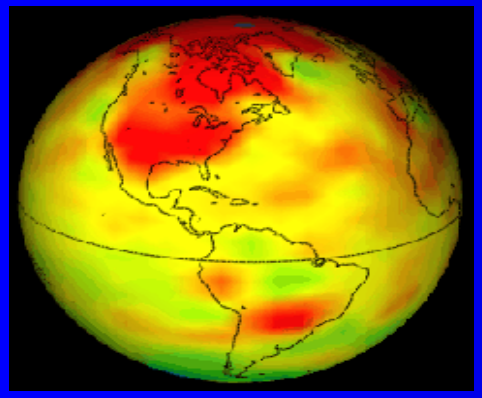
Methanol (The Alcohol) & Sodium or Potassium Hydroxide (The Catalyst)

Current Snapshot of Biodiesel

- Nearly all Biodiesel in the U.S. is made from soybean oil
- On-road use has been spurred by policy
- Diesel engine manufactures have been cautious but supportive
- Sales in 2007 are estimated to be near 400 million gallons
- Current production capacity is estimated to be nearly one billion gallons and expected to grow

Why Biodiesel?

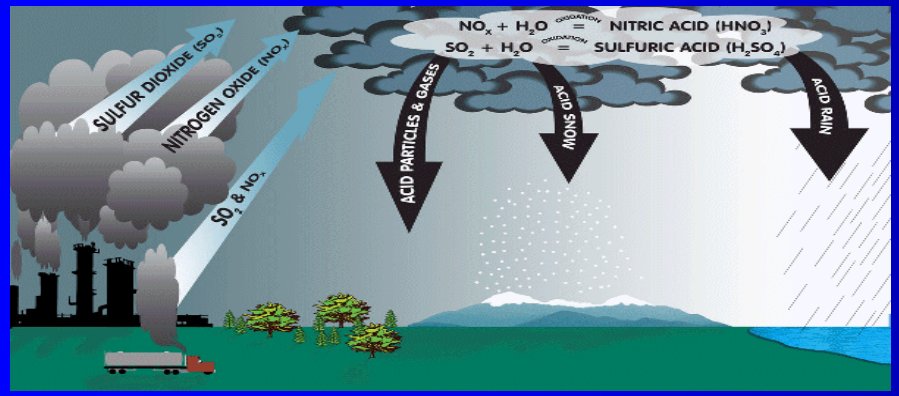
Global Warming



Particulate Emissions (PM 2.5)

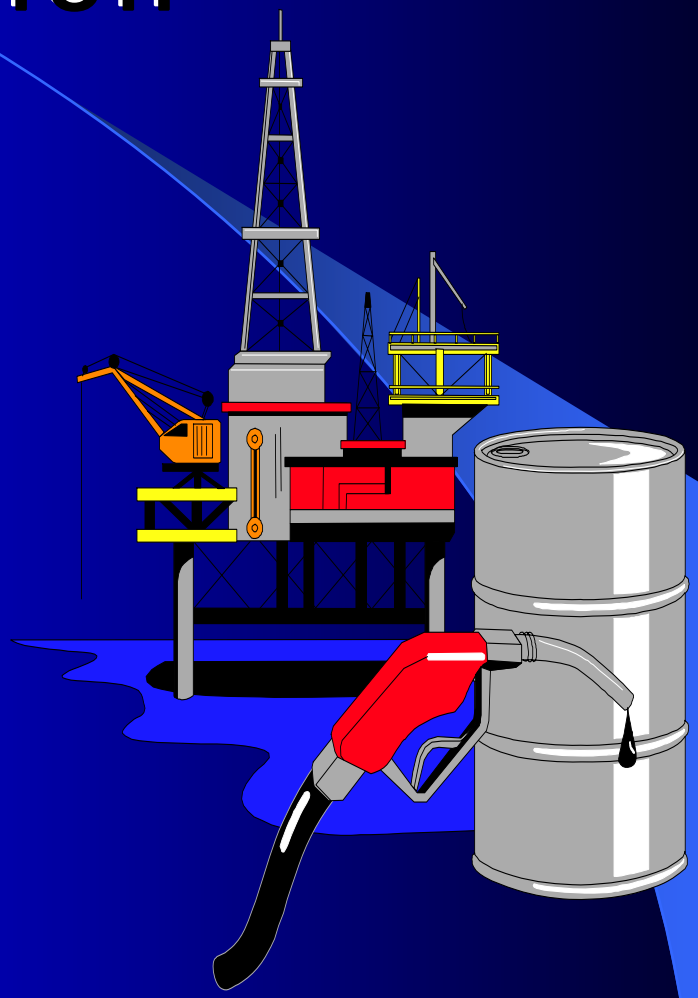
Smog

Acid Rain



U.S. Consumption & Production

- The U.S. **consumes** approximately **20.5** (MBD), projected to reach **22.5** (MBD)by **2010**.
- The U.S. currently **produces** an estimated **7.3** (MBD). This production has declined every year for the last **5** years and has only increased one year in the last **10**.
- The US currently **imports** an estimated **2.5** (MBD) from the Persian Gulf. The balance coming from other regions of the World.



Sources: Energy Information Administration

World Energy Consumption

- **84** million barrels of oil per day (MBD) was consumed in 2005.
- Projections indicate an increase of 2% to **85.6** (MBD) in 2006 and to **94.6** (MBD) by 2010.

Source: Energy Information Administration

The Benefits of Blending Biodiesel in Diesel Fuel

- Reduced tailpipe emissions
- Increased lubricity
- Reduced toxicity
- No major modifications required
- Reduced carbon emissions
- Domestic fuel

The Benefits of Blending Biodiesel in Heating Oil

- Reduced emissions and soot
- Reduced Greenhouse gases
- Reduce petroleum
- Potential to reduce maintenance and extend equipment life
- Regional production = Regional jobs
- New markets for agricultural commodities and waste grease

Energy Balance of Biodiesel

- The National Renewable Energy Laboratory and the U. S. Department of Energy have published "An Overview of Biodiesel and Petroleum Diesel Life Cycles" a wells to wheels analysis. That study gives biodiesel a 3.2 net energy.
- David Pimentel recently published a paper that puts the net energy for biodiesel from soybeans at less than one and lower than diesel.

Effect of Biodiesel on CO2 Emissions

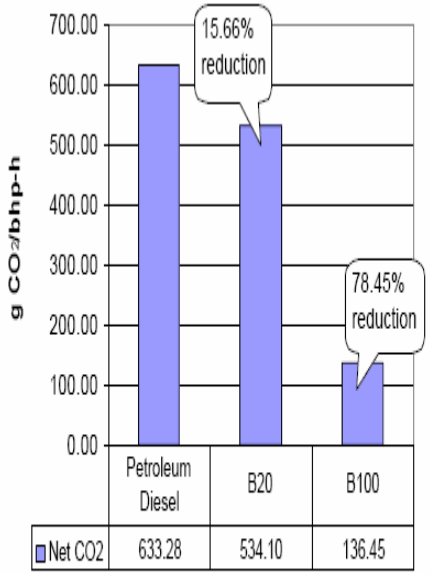


Figure 100: Comparison of Net CO_2 Life Cycle Emissions for Petroleum Diesel and Biodiesel Blends (g CO_2/bhp-h)

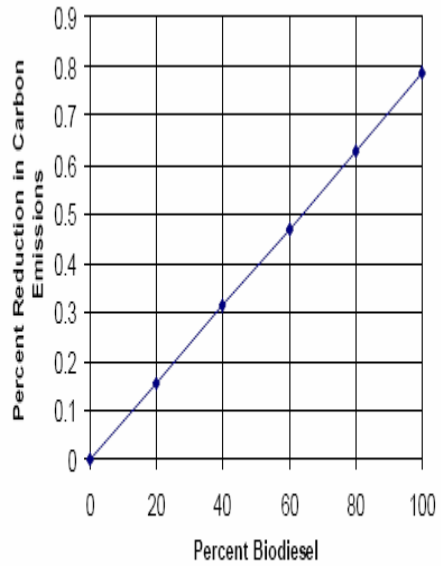


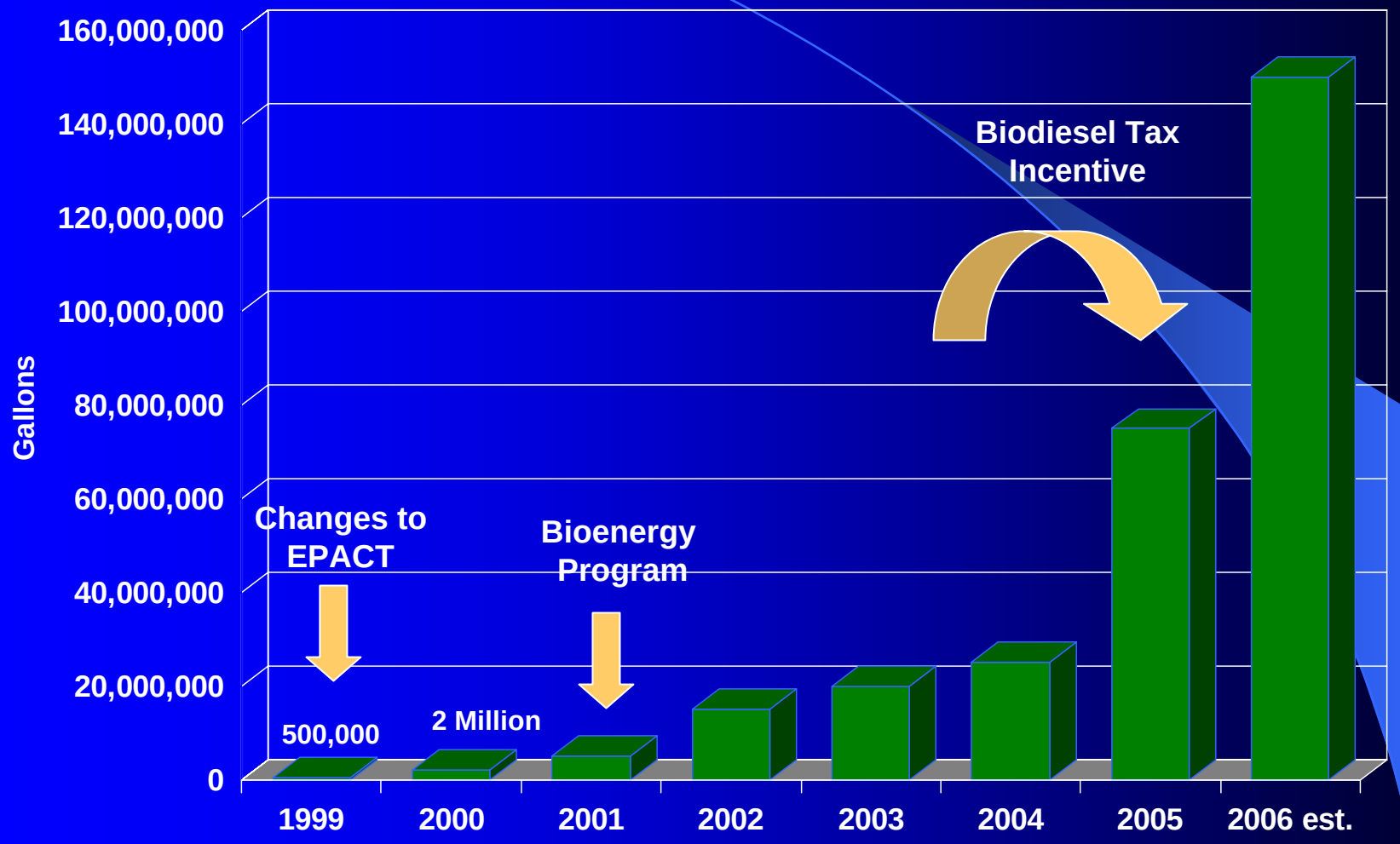
Figure 101: Effect of Biodiesel Blend Level on CO_2 Emissions

- B20 results in a 15.66% reduction in CO2
- B100 results in a 78.45% reduction in CO2
- The higher the blend, the higher the percent reduction as compared to petroleum diesel.

Job Creation Potential

- The projections for job creation are all over the chart ranging from 1 permanent job for a 500,000 gallon plant to projections for 6000 new jobs created with a 100 million gallon national market.
- What is clear is that distributed biodiesel production facilities would create good paying local jobs and hundreds of temporary construction jobs – what is also clear is that dollars spent on biodiesel will stay in the local and regional economy much longer than dollars spent on imported petroleum

US Biodiesel Demand



Policy Driven Demand

- Biodiesel Blender's Tax Credit
  - $1.00/gal agri-biodiesel
  - $0.50/gal recycled feedstock biodiesel
  - 12/31//08 Sunset Date, Extension?
- Renewable Fuels Standard
  - 7.5 m gallons 2012, ethanol/biodiesel
  - 1.5 credits for biodiesel
- Ultra Low Sulfur Diesel (ULSD) 15 ppm
  - Lubricity
- New Farm Bill
  - CCC Program for Biodiesel? 2008 and beyond

Biodiesel Tax Incentives

- Federal Tax law allows a blenders credit that is equal to $1 per gallon of biodiesel made from first use vegetable oil and animal fats known as agri-biodiesel. Biodiesel made from recycled oil and grease is allowed $.50 per gallon.
- The Federal Government also has passed a small producer credit, and the States of Maine, Pennsylvania, and Maryland have state incentives for in-state production of biodiesel.

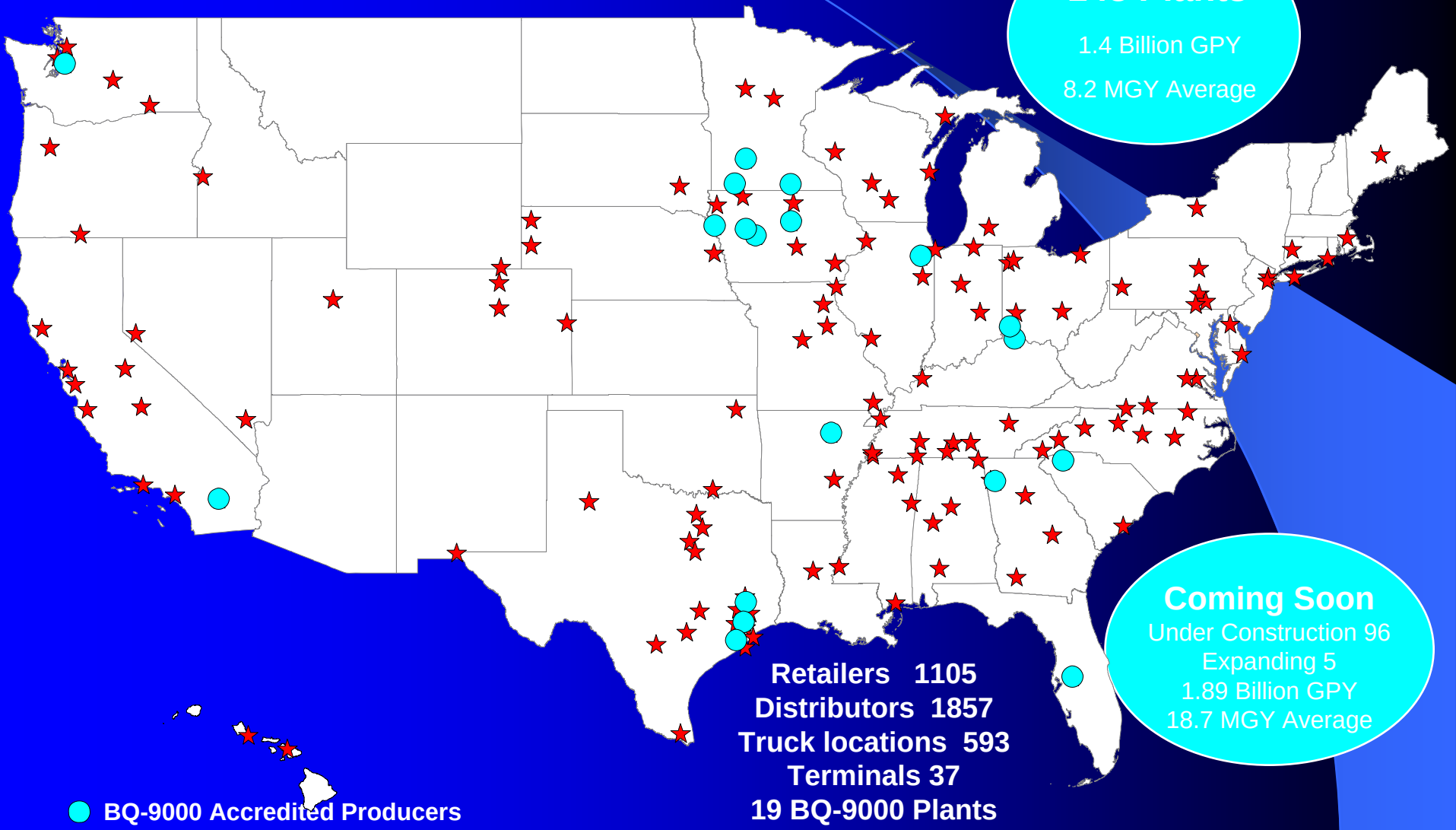
Northeast Market Trends

- Rapid rise in interest in biodiesel production
- Strong interest from heating oil suppliers
- Positive press
- Trend to small distributed production
- Red, White, and Blue appeal

Biodiesel's Positive Public Image is Fueling Infrastructure

- According to the National Biodiesel Board, the number of retail biodiesel fueling stations rose nearly 50 % in 2003 to 200. That number could double again by the end of 2005, and double again by the end of 2007.
- Retail stations are open in every Northeast state.
- Bulk storage is also increasing and the advent of biodiesel blending in heating oil will also help to aid the expansion of refueling stations.

Biodiesel Production



There are 18 accredited producers listed on the NBB web site
There are nearly 300 producers/marketers

http://www.biodiesel.org/buyingbiodiesel/

NOTE: Most of the companies are capable of supplying biodiesel anywhere in the country, and the proximity of your potential biodiesel usage in relation to a company's listed mailing address is not necessarily relevant to their supply logistics or price structure.

Balance Sheet

- Blends with distillate
- No modifications to engines
- Reduced toxics and particulates
- Very little sulfur
- Can be made from Ag crops and waste
- Provides opportunities for new business development
- Greenhouse gas reductions
- Gels at higher temperature than distillate fuel
- May increase NOx emissions in engines
- More expensive that diesel
- Stability and materials compatibility are unresolved issues
- Distribution infrastructure needs to be established

Biodiesel Market Challenges

- Quality Assurance
- Price stability
- Petroleum industry's willingness to incorporate biodiesel into the distillate pool
- Ability to be a reliable supplier – supply meet demand
- Resolving technical issues

ASTM D6751-07a

Property	ASTM Method	Limits	Units
Flash Point	93	130 min.	degree C
Water & Sediment	2709	0.05 max.	vol.%
Carbon Residue (100% sample)	4530	0.05 max.	wt. %
Sulfated Ash	874	0.02 max.	wt. %
Kin. Viscosity, 40C	445	1.9 - 6.0	mm^2/sec.
Sulfur S500	5453	0.05 max.	wt. %
S15	5453	15 max	ppm
Cetane	613	47 min.	
Cloud Point	2500	By Customer	degree C
Copper Corrosion	130	No. 3 max.	
Acid Number*	664	0.50 max.	mg KOH/g
Free Glycerin	6584	0.020	wt. %
Total Glycerin	6584	0.240	wt. %
Phosphorous	4951	10 max	ppm
Distillation, T90 AET	1160	360 max	degree C
Combined Na/K	EN 14538	5 PPM	ppm
Combined Ca/Mg	EN 14538	5 PPM	ppm
Oxidation Stability	EN 14112	3 min	hours
Workmanship	Free of undissolved water, sediment & suspended matter		

Bold = BQ-9000 "Critical Specification Testing

The BQ-9000

Advantage

- To **promote** the commercial success and public acceptance of biodiesel
- To help **guarantee** that biodiesel fuel is produced and maintained at ASTM D 6751 levels
- To **provide** a mechanism to track biodiesel in the distribution system, identifying biodiesel which meets ASTM standards.

Biodiesel Purchase Consideration

- Specify fuels that meet ASTM D 6751-06a
- Specify BQ-9000 Producer
- Customers should always test B100
- Ensure Biodiesel Supplier is registered with US EPA
- Biodiesel Producer require
  - On site laboratory
  - Liability Bond

What is BIOHEAT

- BIOHEAT is the industry-accepted term for any blend of pure biodiesel blended with conventional high or low sulfur home heating oil.

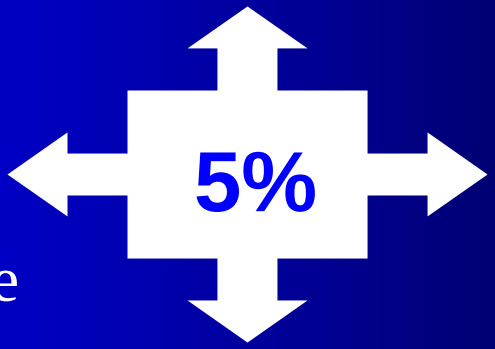
- The heating oil must meet its specification, ASTM D 396 and the biodiesel must meet ASTM D 6751, before blending them together

Exciting Times For

- Growing list of fuel dealers now selling **Bioheat® fuel (115+), registered with NORA to use trademark**
- Wholesale rack operations beginning to meet the demand for supply
- Industry group wrapping up UL Fact Finding Study, June & December 2007 ASTM press anticipated
- Biodiesel blenders credit, reduced the pricing disparity between middle distillates and biodiesel making it more attractive an option

Why 5%?

- Presents minimal stress to national biodiesel supply
- Potential operational snafu's minimized
- Consumers and dealers are keeping an eye on the value added proposition



A “5 in 5” Program

- Establish a new heating oil formulation in the region comprised of 95% low sulfur heating oil and 5% biodiesel in 5 years
- This will require regional cooperation and acceptance by the petroleum industry and the heating oil marketers
- A 5 in 5 program establishes a new market for over 300 million gallons of biodiesel