Biofuels industry development in New York City and the Mid-Hudson

Khin Mar Cho, John Nettleton

Cornell University Cooperative Extension, New York, USA - kc458@cornell.edu

Abstract: *Biofuels used for transport and space heating offer significant environmental and economic benefits as a green niche fuel capable of production throughout the Northeast United States. Biodiesel (BD) is a clean burning alternative fuel, produced from domestic, renewable sources of vegetable or animal fats and oils. BD contains no petroleum, but it can be blended at any level with petroleum diesel to create a BD blend. BD is simple to use, biodegradable, nontoxic, and essentially free of sulfur and cancer causing polycyclic hydrocarbon and aromatics. Biodiesel use is particularly beneficial given the region's reliance on heating oil. The advantages of biodiesel over methanol/ethanol follow from its positive caloric value and the inherent efficiencies of diesel over internal combustion engines. Biodiesel can be blended with existing heating oil without replacing boilers or changing over burners. The main purpose of the paper is to share the potential savings and environmental benefits of biodiesel use as a heating fuel in New York City apartment buildings and potential biofuels industry development in New York State. A fuel dealer in Newburgh, New York has been delivering to more than 100 homes for three heating seasons, and Brookhaven National Lab researchers have tested Teddy Roosevelt's Sagamore Hill National Park Service site for several seasons. Schildwatcher Oil, a pioneering Bronx fuel oil dealer has been delivering B20 (20% biodiesel blended with 80% petroleum diesel) to all Upper Manhattan, Bronx and Westchester customers since fall 2006, and Metro Fuel Oil in Brooklyn is now providing B20 to buildings in Brooklyn and Manhattan under a demonstration project with Cornell Cooperative Extension, the Superintendents Technical Association and Brookhaven. Tri-State Biodiesel is the New York City-based environmentally-driven fuel company that started to produce clean, renewable biodiesel fuel from waste restaurant grease in July 2007. Nearly 500 restaurants in Manhattan, Brooklyn and Queens have signed up to receive the free waste cooking oil removal service from that company. B5 (5% biodiesel) to B20 is tested to an ASTM (American Society for Testing and Materials) quality standard for biodiesel as heating fuel.*

Keywords: *biofuels, biodiesel, bioheat, extension education, New York*

1 Pound = 0.4536 kg	1 Bushel = 60 Pounds = 27.22 kg (Dried Soybean, Corn)
1 Gallon = 3.785 Liters (Liquid Measure)	1 Acre = 0.4047 Hectare
1°F (Degree Farenheit) = -17.22 °C (Degree Celsius)	32 °F = 0 °C
Source: http://www.metricconversion.us	

Introduction

Biodiesel refers to vegetable oil- or animal fat-derived fuels that can replace or blend with conventional diesel fuel and heating oil. The original diesel engine, invented by Rudolf Diesel in the late 1800's, was actually designed to run exclusively on plant-based oils. While today's engines are designed to run on petroleum-based feedstock. BD can be used directly in many cases without major hardware modifications. Due, however, to storage properties, long-term performance, and high cost, BD is more likely to enter the market as a fuel additive, or as a BD-diesel blend, than as a stand-alone fuel.

Use of biodiesel offers significant benefits. Biodiesel burns cleaner than pure diesel with lower particulate and CO_2 emissions and comes from natural, renewable sources that are domestically produced. It also has the benefit of coming from natural, renewable sources that are domestically produced, such as new and used vegetable oils and animal fats (EERE, 2005). Compared to conventional diesel, BD is safer to handle and store, and though it increases NOx emissions, it reduces overall greenhouse gas emissions. (ISU, 2005) BD has good lubricating properties even when only included as 1-2% of a diesel blend. Also, where waste oil is converted into BD, a new market for a waste product is created and less waste is sent to landfills or sewers. Growth in the BD industry would also create high- and low- skill jobs in urban and rural areas (Behr, 2005).

Biofuels production has created new opportunities throughout rural areas and small communities. There are now over 100 ethanol plants in operation in the United States with more than 70 additional plants in various stages of planning and construction. These plants are generally large scale with 50-100 million gallons per year capacity. As with ethanol, biodiesel is taking off in a big way with plants being built at a rapid pace. Biodiesel however doesn't require the same large-scale type production as ethanol. In fact smaller operations can take advantage of reduce transportation cost by using local feedstock. Biodiesel is a more simple process requiring less input energy and less equipment.

The process, called trans-esterification is a chemical reaction that cleans and refines vegetable oils or animal fats into biodiesel. The feedstock for this process can be waste vegetable oils from fryers, animal fats from rendering or virgin vegetable oils such as soybean oil. The use of waste oils for biodiesel has grown significantly, however these feedstocks become harder and harder to obtain. Biodiesel production from virgin oils in New York State has grown with a plant in Rochester and at least 2 large-scale plants in New York City. So far these plants have had to obtain raw oil from out of state due to a lack of soybean processing capacity in New York State.

The main objectives of the study were 1) Educate and heighten awareness among selected New York City audiences via media and outreach regarding the potential savings and environmental benefits of biofuel use; 2) Develop a network of producers and processors to aid viable and renewable industry; 3) Expand on the use of biofuel (B20) as a heating fuel (Bioheat) in New York City apartment buildings to generate new regional demand by owners and management; and 4) Assist participants in the biofuel distribution system to examine development and siting of processing plants and 'biorefineries' accessible to New York City and regional markets.

Biodiesel Overview

What is Biodiesel?

Biodiesel is a renewable diesel fuel substitute that can be made by chemically combining any natural oil or fat with an alcohol such as methanol or ethanol. Methanol has been the most commonly used alcohol in the commercial production of biodiesel. In Europe, biodiesel is widely available in both its neat form (100% biodiesel, also known as B100) and in blends with petroleum diesel. Most European biodiesel is made from rapeseed oil (a cousin of canola oil). In the United States, initial interest in producing and using biodiesel has focused on the use of soybean oil as the primary feedstock, mainly because this country is the world's largest producer of soybean oil (Sheehan & et al., 1998).

Biodiesel is the mono-alkyl esters of fatty acids derived from vegetable oils or animal fats. In simple terms, biodiesel is the product you get when a vegetable oil or animal fat is chemically reacted with an alcohol to produce a new compound that is known as a fatty acid alkyl ester. A catalyst such as sodium or potassium hydroxide is required. Glycerol is produced as a byproduct. The approximate proportions of the reaction are (www.uidaho.edu/bioenergy/Bioshortcourse/biodiesel101index.htm):

100 lbs of oil + 10 lbs of methanol ⟶ 100 lbs of biodiesel + 10 lbs of glycerol

Soybean oil and methanol are the most popular feedstocks in the United States. Soybeans are a major U.S. crop and government subsidies are available to make the fuel economically attractive to consumers who need or want to use a nonpetroleum-based fuel. Biodiesel from soybeans is sometimes called soydiesel, methyl soyate, or soy methyl esters. In Europe, most biodiesel is made from rapeseed oil and methanol and it is known as rapeseed methyl esters. The University of Idaho has done considerable work with rapeseed esters using ethanol, which produces rapeseed ethyl esters.

Biodiesel is made through a chemical process called transesterification that involves the methylation of the fatty acid from a triglyceride molecule of animal or vegetable fat or oil, via a catalytic reaction using an alkaline catalyst. The process leaves behind two products: methyl-ester of fatty acids (the chemical name for Biodiesel) and glycerin (used for animal feed, pharmaceuticals and as an additive for many other products).

Biodiesel can also be made from other feed stocks: Vegetable oils such as corn oil, canola oil, cottonseed oil, mustard oil, palm oil, etc.; Restaurant waste oils such as frying oils; Animal fats such as beef tallow or pork lard; Trap grease (from restaurant grease traps); and Float grease (from waste water treatment plants) etc. Using the rough guideline that a pound of oil or fat will give a pound of

biodiesel, we can use the total production of fats and oils in the United States to estimate the impact of biodiesel on total diesel consumption. The table 1 below shows the annual production figures for vegetable oils and animal fats (Peterson, 2005).

Table 1. Total Annual Production of US Fats and Oils.

Vegetable Oil Production (Billion pounds/yr)	
Soybean	18.340
Peanuts	0.220
Sunflower	1.000
Cottonseed	1.010
Corn	2.420
Others	0.669
Total Vegetable Oil	23.659
Animal Fats (Billion pounds/yr)	
Edible Tallow	1.625
Inedible tallow	3.859
Lard & Grease	1.306
Yellow Grease	2.633
Poultry Fat	2.215
Total Animal Fat	11.638
Total Vegetable Oil + Animal Fats Production (Billion pounds/yr)	**35.297**

As can be seen, in the United States, soybean oil dominates the vegetable oil market comprising over 75% of the total vegetable oil volume. The total Animal fats are almost 50% of the vegetable oil market. The combined vegetable oil and animal fat production are 35.3 billion pounds per year. At about 7.6 pounds per gallon of oil, this production (35.3/7.6) would equal 4.64 billion gallons of biodiesel (Peterson, 2005).

Advantages and Drawbacks of Biodiesel

Throughout the world, governments are beginning to realize that in terms of pollution, health, and geo-political stability, petroleum is no longer the fuel of choice. Also, being a finite resource, petroleum oil will only become more expensive as it becomes more scarce.

Biodiesel is a vegetable oil-based fuel that runs in unmodified diesel engines - cars, buses, trucks, construction equipment, boats, generators, and oil home heating units. Health problems that are caused by emissions exposure can be greatly reduced by the cleaner emissions of biodiesel. It's usually made from soy or canola oil, and can also be made from recycled fryer oil. You can blend it with regular diesel or run 100% biodiesel.

Since biodiesel is made domestically, it can reduce our dependence on foreign petroleum. Petroleum imports are at record levels in the United States, and will continue to rise as domestic oil supplies shrink. Our transportation sector, with its great demand for gasoline and diesel fuel, relies almost exclusively on petroleum for energy. Biodiesel can be produced domestically from agricultural oils and from waste fats and oils. Because it can be used directly in any diesel engine or boiler without any engine modifications, biodiesel offers the immediate potential to reduce our demand for petroleum. It's sustainable, non-toxic and 100% renewable. The burning of fossil fuels during the past century has dramatically increased the levels of carbon dioxide (CO_2) and other greenhouse gases that trap heat in our atmosphere. Biodiesel is truly renewable and it could help reduce greenhouse gas emissions from the transportation sector. Biodiesel is nearly carbon-neutral, meaning it contributes almost zero emissions to global warming!

Biodiesel also dramatically reduces other emissions fairly dramatically. One of the U.S. Environmental Protection Agency's (EPA) primary charges is to reduce public Health risks associated with environmental pollution. Biodiesel can play a role in reducing Emissions of many air pollutants, especially those targeted by EPA in urban areas. These include Particulate matter, Carbon monoxide, Hydrocarbons, Sulfur oxides, Nitrogen oxides, and air toxics. Health problems as a result of emissions exposure are also greatly reduced by the cleaner emissions of biodiesel. According to the American Lung Association biodiesel emissions are 90% less toxic than petrol-diesel and will reduce incidents of health hazards such as asthma, emphysema and lung cancer.

Biodiesel is rapidly biodegradable and non-toxic to handle. Biodiesel handling and use is far less damaging to the environment than petroleum fuel, and is particularly superior in the event of a spill or leak. BD can be stored anywhere that petroleum diesel fuel is stored. All diesels fueling infrastructure including pumps, tanks and transport existing trucks can be used with biodiesel. BD is safer to transport. Biodiesel has a high flash point, or ignition temperature, of about 300°F compared to petroleum diesel fuel, which has a flash point of 125°F. It has a pleasant aroma in comparison to the toxic smell of petroleum diesel fuel. Engines running on biodiesel run normally and have similar fuel mileage to engines running on diesel fuel. Auto ignition, fuel consumption, power output, and engine torque are relatively unaffected by biodiesel. Engines running on biodiesel have been shown to need less maintenance. Also, biodiesel use allows federal fleet managers to keep existing equipment on the road longer and still adhere to new, stricter emissions standards.

Spending on foreign imports of petroleum takes dollars away from our economy. Biodiesel can help us shift this spending to domestically produced energy, and offers new energy-related markets to farmers. Using biodiesel keeps our fuel buying dollars at home instead of sending it to foreign countries.

There are five primary reasons for encouraging the development of biodiesel in the United States (Peterson, 2005).

1. It provides a market for excess production of vegetable oils and animal fats. There is increasing demand around the world for soybean meal to provide the protein for human and animal consumption. If new markets are not found for the soybean oil, then the price will be low and farmers will have even more difficulty producing a profit. The animal by-products industry also has a problem with more supply than the current market can absorb.

2. It decreases the country's dependence on imported petroleum. Obviously, this reason should not be overemphasized since the percentage of the country's fuel supply that can be replaced with biodiesel will be small. However, petroleum markets tend to be sensitive to small fluctuations in supply so an additional source of fuel can have a surprising impact on keeping fuel prices stable.

3. Biodiesel is renewable and contributes less to global warming than fossil fuels due to its closed carbon cycle. Because the primary feedstock for biodiesel is a biologically-based oil or fat, which can be grown season after season, biodiesel is renewable. And, since most of the carbon in the fuel was originally removed from the air by plants, there is very little net increase in carbon dioxide levels. However, some fossil carbon is contained in the methanol used to make methyl esters, and some fossil fuel is used during the production process. A life cycle study on biodiesel use in an urban bus conducted by the National Renewable Energy Laboratory (Sheehan & et al., 1998) found that CO_2 emissions were reduced by 79% for pure biodiesel compared with petroleum diesel fuel. Again, this reason should not be overemphasized because biodiesel does not have the potential to make a major impact on the total carbon dioxide production.

4. The exhaust emissions from biodiesel are lower than with regular diesel fuel. Biodiesel provides substantial reductions in carbon monoxide, unburned hydrocarbons, and particulate emissions from diesel engines. While the carbon monoxide and unburned hydrocarbons from diesels are already very low compared with gasoline engines, biodiesel reduces them further. Particulate emissions, especially the black soot portion, are greatly reduced with biodiesel. Unfortunately, most emissions tests have shown a slight increase in oxides of nitrogen (NOx) emissions with biodiesel. This increase in NOx can be eliminated with a small adjustment to the engine's injection timing while still retaining a particulate decrease.

5. Biodiesel has excellent lubricating properties. Even when added to regular diesel fuel in an amount equal to 1-2%, it can convert fuel with poor lubricating properties, such as modern ultra-low-sulfur diesel fuel, into an acceptable fuel. It increases engine life and can be used to replace sulfur, the acid-rain-causing lubricating agent in petroleum diesel.

Biodiesel dramatically reduces harmful emissions that cause environmental problems such as global warming, acid rain and smog. Biodiesel reduces CO_2 emissions by 79% compared to petroleum diesel. In fact, even blended with petroleum diesel, biodiesel significantly reduces emissions. Additionally, the plants used to make biodiesel feedstock actually absorb more CO_2 as they grow than the biodiesel produces when it is burned. This means that in the lifecycle of biodiesel production and use no new carbon is produced. The figure 1 shows the comparison of emissions reduction by B100 and B20 (Tri-State Biodiesel. http://nyc.tristatebiodiesel.com).

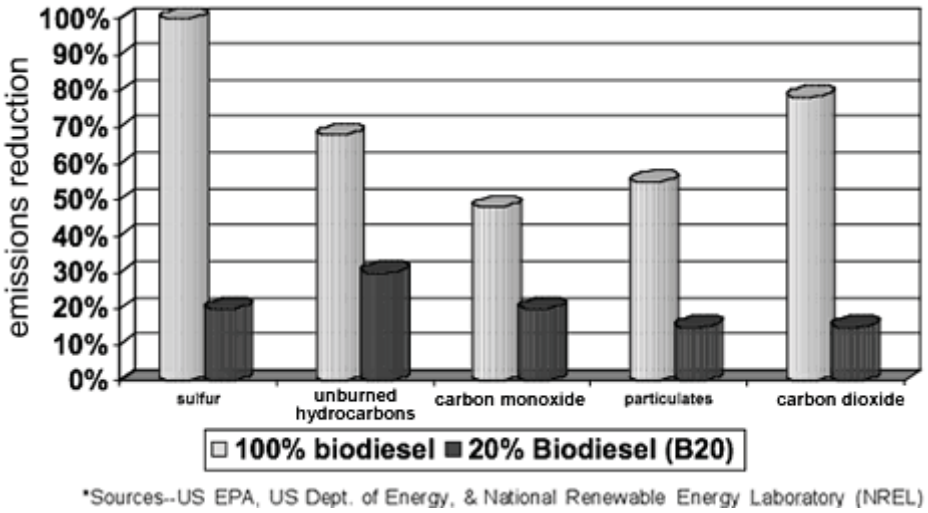

Figure 1. Emissions Reduction Comparison by B100 and B20

There is no perfect fuel. Biodiesel has a higher gel point. B100 (100% biodiesel) gets slushy a little under 32°F. But B20 (20% biodiesel, 80% regular diesel - more commonly available than B100) has a gel point of -15°F. Like regular diesel, the gel point can be lowered further with additives such as kerosene (blended into winter diesel in cold-weather areas). The one emission that goes up with biodiesel is NOx. NOx contributes to smog. A slight increase (up to 15%) in NOx is greatly offset by the reduction in all other emissions and the major reduction in greenhouse gasses (Tri-State Biodiesel. http://nyc.tristatebiodiesel.com).

New York's Biodiesel Demand, Supply and Market

The market for diesel fuel in New York is substantial. Total distillate fuel use in New York is estimated at 3.2 billion gallons in 2002 and is projected to increase at an annual rate of about 1.2 percent over the next decade. A B2 mandate covering all end uses would create a market of 64.1 million gallons that would increase to 73.7 million gallons by 2012. A more limited mandate covering on-highway diesel uses beginning in 2007 and expanding to include residential, commercial, industrial, and utility uses in 2009 would create a market of 23.3 million gallons in 2007 increasing to 70.6 million gallons by 2012 (Jarnefeld, 2004).

The maximum capacity of New York to produce biodiesel is currently estimated at about 30 million gallons. This is projected to increase to 40 million gallons by 2012. This assumes that all of the soybeans grown in New York are crushed using current technology (mechanical extraction that yields 7.8 pounds of oil per bushel) and all of the oil produced along with all of the yellow fat produced in the State is used to produce biodiesel. Consequently, New York could theoretically meet all of the demand for a B2 mandate covering on-highway transportation fuel by 2007 and about half the demand created by a full B2 mandate by 2012.

Soybeans are the major oilseed currently produced in New York. While oilseed crops have never been grown extensively in New York State, the area devoted to soybeans has increased significantly over the past 20 years. Soybean acreage increased to 40,000 acres in the 1990-1991 growing seasons, 100,000 acres in 1997-1998, and about 150,000 acres in 2001-2002. In 2003, New York growers produced 5.3 million bushels of soybeans on about 144,000 acres.

Commercial farmers have successfully produced other oilseeds - notably winter canola and sunflowers - on limited acreage in New York in the 1980s and 1990s. Both of these crops could be successfully produced in New York if there were lucrative markets. However, New York has limited capacity to process these crops and they would divert acreage that otherwise would be planted to soybeans.

The major field crops produced in New York are hay, corn, winter wheat, and soybeans. Taken together these crops were planted to nearly 2.9 million acres in 2003. Over the past 25 years the number of acres planted to these crops has declined nearly 27 percent. Most of this land was lost to development; however some acreage shifted to higher value crops such as fruit and vegetables, or was taken out of production.

The demand for vegetable oil to produce biodiesel is significant enough to provide an incentive for New York farmers to shift acreage from other crops to soybeans, and bring idled land back into production. In the absence of a national energy program or New York State biodiesel policy it is expected that New York soybean acreage will continue to expand reaching 188,000 acres by 2007 with additional land coming from idled acreage and modest shifts from hay, corn, wheat, and vegetables.

The additional demand for soybean oil to supply New York biodiesel industry under a combined B2 mandate and supply incentive policy is expected to increase soybean acreage by an additional 99,000 acres to a total of 287,000 acres by 2012. Approximately 26,000 acres are expected to come from hay, 20,000 acres from corn, 10,000 acres from wheat, and the remaining 43,000 acres from idled land and other crops. These acreage shifts can accommodate the production of an additional 11.2 million bushels of soybeans between 2007 and 2012 without jeopardizing the amount of hay or corn silage needed to supply New York's declining dairy herds (Jarnefeld, 2004).

Although acreage shifts from hay and corn will lead to a decline in cash receipts of $38.9 million for these crops between 2007 and 2012, additional soybean revenues of $85.5 million will result in a net gain of $46.2 million for New York farmers over the same period, or $6.6 million per year (Jarnefeld, 2004). Since the acreage shifts are relatively modest; little or no additional equipment or services should be required; and since both soybeans and alfalfa fit into existing crop rotations with corn, most of the increase in cash receipts should fall to the farmer's bottom line and increase net cash income.

Opportunities and Obstacles to the Use of Biofuels

Although biofuels are increasingly in the news, much of the coverage glosses over inherent limits to such fuels while ignoring the clear benefits they may offer in urban settings.

Biofuels are derived from biomass (plant products) or biomass byproducts (methane, etc.).The two primary biofuels are ethanol and biodiesel. Ethanol is made in the United States from corn via a process yielding just less than 3 gallons/bushel of corn (10 liters from 35) along with distillers' dry grains for animal feed. Brazil and other Caribbean producers make ethanol from sugar cane or cane waste (bagasse) at much higher efficiencies. Biodiesel is produced either from virgin or waste vegetable oils, yielding 'crush' from the beans used as animal feed. In the U.S., BD is made almost entirely from soybeans, while the European Union (EU) uses rapeseed (canola) as a feedstock. A range of other crops (flax- and mustard seed, etc) can also be used to power diesel engines, which were initially demonstrated by Rudolf Diesel's prize-winning engine at the 1900 Paris World's Fair, powered with peanut oil (Cho & Nettleton, 2007).

Biofuels have been presented as the 'magic bullet' by the current administration, which represents such crops as the 'key to reducing our demand for foreign oil'. They are not and in fact will not reduce anything. First, biofuels have a very low 'power density', measured in watts/meter square (W/m2). Numerous estimates from the EU and elsewhere have shown that a meaningful reduction (more than 10%) in the U.S. fleet fuel demand would require planting more than 1/6 of all arable land in the lower 48 States. There is further and growing evidence that competition between food and biofuels for arable cropland is increasing, with grain prices under increasing pressure (Nettleton, 2007).

Biodiesel use at the 20% level (B20) for heating fuel cuts particulates, carbon dioxide and sulphur dioxide; higher blends (B30 to B50) are possible with ongoing research. New York is underway in concert with a major New York City fuel oil supplier to assess BD blended with No. 6 fuel oil, an inexpensive, 'dirtier' fuel oil compared with No. 2 fuel oil. *No. 1 fuel oil, No. 2 fuel oil and No. 3 fuel oil are referred to as distillate fuel oils, diesel fuel oils, light fuel oils, gas oil or just distillate. No. 4 fuel oil is usually a blend of distillate and residual fuel oils, such as No. 2 and 6, however, sometimes it is just a heavy distillate. No. 4 may be classified as diesel, distillate or residual fuel oil. No. 5 fuel oil and No. 6 fuel oil are called residual fuel oils or heavy fuel oils* (http://en.wikipedia.org/wiki/Fuel_oil).

Big small users from major universities to hospitals use very large amounts of heating oil (No. 2 and No. 6) or duel fuel (oil and gas) boilers. For example, St. John's University alone burns 2 million gallons of heating oil each year, and large power plants can consume as much as 60,000 gallons per hour (at about 80 gallons/MW/hour). To cite the example of the NYC Housing Authority (NYCHA), more than 80% of NYCHA's 170,000 apartments use oil heat, and many NYCHA developments are located in Health Districts with the highest rates of asthma among children and the elderly. Immediate conversion of those developments should be viewed as both an environmental and a public health imperative. Wide adoption of BD for municipal bus fleets, such as Municipal Transit Authority (MTA)

would further benefit residents in those communities of color where MTA bus deports are invariably sited.

"If biofuel use is such a good idea, why doesn't everyone use it?" The adoption of a new fuel and technology is rarely simple or direct, and impediments-from the physical to the perceptual-need to be overcome to build a sustainable industry of benefit to user and producer alike (Nettleton, 2007).

Currently, renderers collect almost all waste vegetable oil (WVO), which makes them potential future BD sources. If there were widespread adoption of B20 as a heating fuel for all apartments yields, overall NYC demand for B20 would take up 1/5 of all projected BD produced in the U.S. in 2007. Biodiesel presently arrives either by rail (from the Midwest) or by barge (from Mid-Atlantic States).

Biodiesel Plants in New York City

Tri-State Biodiesel, **LLC** ("Tri-State" or the "Company"), a start-up operation, plans to convert recycled cooking oil into a renewable, non-toxic, bio-sustainable alternative fuel known as biodiesel. The Company is located in the Red Hook section of Brooklyn in New York City, and anticipates producing 2.6 million gallons of biodiesel annually with plans to expand to 5 million gallons per year in its third year of operation. Tri-State anticipates the supply will come from over 1500 New York City restaurants, as well as other contracts.

Tri-State Biodiesel (TSB), New York City's biodiesel pioneer, provides NYC with top-notch waste cooking oil collection service and clean burning, recycled oil-produced biodiesel fuel of the highest quality. TSB provides its own oil collection service via a truck fleet. It is expected to have the potential to collect waste oil from 200 to 300 restaurants by the end of November 2007. Tri-State's biodiesel is an EPA (Environmental Protection Agency) approved and certified alternative diesel fuel made waste cooking oil collected at local restaurants that is much better for our health, economy and the environment. Tri-State's biodiesel can be used in any diesel engine and no engine conversions are necessary. TSB is proud to be the first biodiesel fleet fuel provider in the New York City and looks forward to continuing to supply this great renewable fuel.

TSB is not the only biodiesel producer with big hopes for commercializing renewable fuel in New York City. Another company, Metro Fuel Oil Corporation, is reportedly seeking approval to break ground on a plant that would be capable of producing 110 million gallons of biodiesel from raw vegetable oil annually. That would represent more than a third of estimated nationwide output this year.

At the federal level, the 2005 Renewable Fuels Standard requires the use of 7.5 billion gallons of biofuels for transportation by 2012. And under the 2005 Federal Energy Policy Act, biodiesel blenders are eligible through 2008 for a $1 per gallon federal tax credit for biodiesel made from raw vegetable oil and 50 cents per gallon for the fuel made from yellow grease. Congress is currently considering legislation that would extend those credits for two more years.

By producing biodiesel from leftover restaurant oil, known as yellow grease, Tri-State's business plan addresses air pollution and solid waste management conundrums at the same time. The company is making cleaner-burning fuel from a product that could otherwise end up in a landfill, but sometimes ends up being dumped illegally in the city sewers, where it can cause blockages over time.

There are some reasons for using biodiesel in New York City: For example, biodiesel will reduce the incidence of respiratory sickness and death throughout New York City, saving thousands of lives and millions of dollars each year. Biodiesel will reduce smog and air pollution, helping make New York City a more attractive city in which to live and do business. BD will reduce New York City 's dependence on foreign oil. Biodiesel in NYC fleets will stimulate our economy, bringing new jobs at both the factory and the farm, and a new, forward-thinking industry into our city.

A biodiesel industry feasibility study conducted by New York State Energy Research and Development Authority found that a 40 million gallon per year industry could create about 1,300 new jobs in NY State. Biodiesel could save the city millions in fleet replacement as it will and allow city vehicles to stay on the road longer and still be in compliance to the clean air act and other anti-pollution regulations. BD can help New York City become more energy independent. New York City can lead the way to a brighter future by transitioning to biodiesel today.

Conclusion and Policy Implication

The process, called trans-esterification is a chemical reaction that cleans and refines vegetable oils or animal fats into biodiesel. The feedstock for this process can be waste vegetable oils from fryers, animal fats from rendering or virgin vegetable oils such as soybean oil. The use of waste oils for biodiesel has grown significantly, however these feedstocks become harder and harder to obtain. Biodiesel production from virgin oils in New York State has grown with a plant in Rochester and at least 2 large-scale plants in New York City. So far these plants have had to obtain raw oil from out of state due to a lack of soybean processing capacity in New York State.

As a home heating fuel (Bioheat), biodiesel produces less CO_2 on a life cycle basis than U.S. No. 2 fuel oil (distillate). Roughly half of all NYC residents, in 1.92 million apartments and homes use oil for winter heating, a huge potential market. With its lower sulfur content, B20 burns more cleanly, thereby reducing maintenance costs.

Extension staff is engaged in outreach to make this fuel blend better known: the New York State tax credits in place through June 2007 for B20 allows home heat customers to take a 20Cents/gallon credit for use of B20 in their home or apartment. This change has led to discussions with more than 60 apartment buildings owners, coop boards and real estate management organization. Awareness of these tax credits and the increased demand for B20 is leading to the following conditions. First, the increase in oil dealers supplying B20 for heating, up from 1-2 companies (2005) to 8-10 at present is putting pressure on supply, especially as most of the soybean oil is produced, refined and transported from the Midwest.

Introduction of the ULSD (Ultra Low Sulphur Diesel) standard for the trucking industry nationwide will soon heighten overall demand, as the removal of sulphur from fleet fuel will require a new lubricity agent and B2, or 2% soybean oil added to diesel provides that. The need for shortened supply lines has led some NYC dealers to secure soy oil from Virginia and the Carolinas for their B20 blends.

National biodiesel production has grown from 25 million gallons (2004) to 75 million (2005) and 150-300 million (2006); in 2002, distillate fuel demand in New York State was 3.2 billion gallons, or 10% of the national truck demand. Statewide use of B2 would generate a 64 million gallons demand.
Most United States biodiesel uses soybean oil processed to ASTM D 6751 (American Society for Testing and Materials - The Biodiesel Standard). Almost all biodiesel in the European Union uses rapeseed oil; biodiesel can be drawn from many cool weather crops (rapeseed, mustard seed and flaxseed) perhaps more appropriate across New York State.

Refining utlizing waste vegetable oil is a clear resource in institutional and urban settings where the economies of collection and processing can be used. A 2005 study by Cornell Cooperative Extension/New York City assessing the volume and nature of WVO in Brooklyn had two main findings. First, the potential supply of WVO generated by retail food business in Brooklyn alone was estimated at 1.65 to 1.82 million gals annually; second, over 90% of that WVO amount is being taken off by renderers and processed for animal feed and related industrial uses.

The key to implementation is using biodiesel blends in existing petroleum tanks and infrastructure. This is accomplished by blending biodiesel as far upstream as possible, i.e. petroleum terminals. Therefore, efficient implementation of a B2 incentive or policy would necessitate participation from terminal owners throughout the State, not necessarily the fuel dealers. Each of the 85 active deep-water storage terminals would need to determine which infrastructure upgrades their respective terminal would require. These include, but are not limited to; splash blending, preset rack blending, wild stream rack blending, and header supply wild stream blending. The cost associated with this investment is estimated at approximately $64 million (Jarnefeld, 2004).

A mandate that would require that diesel use for one or more end use segments contain a certain percentage of biodiesel (e.g. two percent, or B2) should be phased in to allow adequate time for the necessary capital investment for production and infrastructure to be made and should be tied to New York biodiesel capacity.

The market for diesel fuel in New York is substantial. Total distillate fuel use in New York is estimated at 3.2 billion gallons in 2002 and is projected to increase at an annual rate of about 1.2 percent over the next decade. A B2 mandate covering all end uses would create a market of 64.1 million gallons that would increase to 73.7 million gallons by 2012. A more limited mandate covering on-highway diesel uses beginning in 2007 and expanding to include residential, commercial, industrial, and utility uses in 2009 would create a market of 23.3 million gallons in 2007 increasing to 70.6 million gallons by 2012.

References

Behr, Christopher, 2005. An Assessment of Waste Vegetable Oil Supply in Brooklyn, NY and it's Potential as a Biodiesel Feedstock. Research Report to Cornell University.

Cho, Khin Mar; Nettleton, John, 2007: Biofuel-Based Economic Development: Current Situations and Future Opportunities in New York State. Paper presented at the 15th European Biomass Conference & Exhibition: From Research to Market Deployment, Berlin, Germany, 7-11 May 2007.

EERE, 2005. Alternative Fuels Data Center. US Department of Energy - Energy Efficiency and Renewable Energy (http://fcvt.nrel.gov/afdc/altfuel/biodiesel.html)

ISU, 2005. Iowa State University Biodiesel website (2005)

Jarnefeld, Judy, 2004. Statewide Feasibility Study for a Potential New York State Biodiesel Industry. Final report. New York State Energy Research and Development Authority (NYSERDA).

Nettleton, John, 2007. Opportunities and Obstacles to the Use of Biofuels. Formerly Fusaro Focus, Vol (3) No. (58). P.2-3. www.EnergyHedgeFunds.com

Peterson, Charles, 2005. Potential Production of Biodiesel. (http://www.uidaho.edu/bioenergy)

Sheehan, John; V. Camobreco; J. Duffield; M. Graboski; & H. Shapouri, 1998. Life Cycle Inventory of Biodiesel and Petroleum Diesel for Use in an Urban Bus," Report from the National Renewable Energy Laboratory for the U.S. Department of Energy's Office of Fuels Development and for the U.S. Department of Agriculture's Office of Energy, NREL/SR-580-24089, May 1998.

Tri-State Biodiesel, 2007. Biodiesel Fact Sheets. (http://nyc.tristatebiodiesel.com)

Wikipedia, the free encyclopedia (http://en.wikipedia.org/wiki/Fuel_oil)