# Biodiesel and Sustainable Economic Development in the Dragon Run Watershed

**Part 1, Exploring the feasibility of biodiesel consumption and production as tools for natural resource-based economic development and preservation of existing land uses**

**For additional background, see *Opportunities for Sustainable Natural Resource-Based Development in the Dragon Run Watershed*, an economic development study, which can be found on the Dragon Run Special Area Management Plan website:** www.mppdc.com/dragon**)**

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**Executive Summary**

Central to the Dragon Run project and this first phase feasibility study is a question. How can development of the biodiesel market and production industry achieve two goals: provide economic benefit to the watershed community and help to preserve natural resources in the sensitive watershed by sustaining current land uses, predominantly agriculture, forestry and outdoor recreation.

How can biodiesel achieve the project goals?

*"A Rising Tide Lifts All Ships"*

Even if local farmers can't directly sell their soybeans or other feedstocks to the nearby Eltham biodiesel refinery, more biodiesel demand means more feedstock demand and higher prices to all farmers. As seen with corn last year, the price doubled as ethanol production increased from 3 to 5 billion gallons. The USDA now projects corn prices staying above $3.50 a bushel and rising to $3.75 a bushel in 2009, driven by increased demand for ethanol. Furthermore, farmers are finally getting a price for their corn that is over their cost of production for the first time in almost 30 years.

*The Multiplier Effect*

A dollar spent for biodiesel produced at the Virginia Biodiesel Refinery LLC in New Kent County mostly stays in the state of Virginia. The Eltham biodiesel refinery purchases soy oil from Purdue, which buys soybeans from Virginia and elsewhere. Additionally, the refinery provides a few local jobs, pays taxes, hires contractors, etc. While it is a difficult task to pinpoint how much of the dollar stays in the local and state economy, it is quite easy to assert that most of a dollar spent on petroleum diesel leaves the country and certainly the local economy.

*"Save the Dragon, Use Biodiesel"*

Branding the concept of sustainable fuel selection practices by using taglines such as "Save the dragon, use biodiesel" may work in the Middle Peninsula, and possibly elsewhere in largely rural Virginia. "Sustainable" fuel selection could speak to economic, ecological, and ethical sustainability, and therefore a variety of individuals residing in the Dragon Run watershed and Middle Peninsula. If successful, an incremental increase in demand and, more importantly, a friendly climate to grow the biofuels "industry" in Virginia might result.

The biomass sector is still in its infancy, and much is still needed for the sector to truly emerge (i.e. research, crop development, infrastructure development, supportive policies, etc.) as a significant force in curbing our "oil addiction." If the climate embraces biodiesel, the Middle Peninsula and Dragon Run communities

could stand to benefit from future involvement as the biomass sector emerges and evolves.

*A Sustainable Community is a Resilient Community*

Energy is becoming part of the sustainable development and environmental groups chatter as communities are realizing energy is the lifeblood of any society. Unfortunately, many communities are 100% dependent on one source of energy. If supply disruption occurs, such as has happened after the 1973 Arab oil embargo and Hurricane Katrina, a community which has a diverse energy portfolio already established and accepted is in a far better place than one that does not.

*Alternative Fuels May Have Price Advantage Over Petroleum in the Near Future*

Experts predict oil prices will continue to rise. Rising demand from other industrializing nations, global politics, and peaking oil fields is making the light bulb illuminate for many. Bottom line, oil is a finite resource and if we do not begin the process of transitioning to other alternatives, we will, one day, run out. As global oil production begins to peak, prices will rise, and will position fuel sustainable communities for economic success while severely damaging other economies.

<u>Considerations for Maximizing Environmental and Economic Benefits</u>

Most recommendations for creating a successful bio-economy have noted the potential for rural development, but have failed to address how communities might participate in the process or how the bio-economy would actually benefit the rural economy.

Biofuels development has been compared to a "liquid gold rush." As the rush to grow the sector continues, "the benefits to rural communities may be muted or lost if federal, state, and local policies and programs that help determine the sector's ownership scale and structure do not sufficiently support rural development priorities."[1]

One key aspect to rural communities maximizing benefit from biofuels development is local ownership. Ownership of the refineries by local farmers and community members is seen as the key aspect to sustainable rural development. Facilities owned locally have proven to be based to some extent on local resources and needs, and much of the money generated from the facility remains in the local economy.

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[1] "Biofueling Rural Development: Making the Case for Linking Biofuel Production to Rural Revitalization." Carsey Institute. Policy Brief No. 5. Winter 2007. http://www.carseyinstitute.unh.edu/documents/Biofuels_final.pdf

John Urbanchuk has conducted several studies assessing the economic impacts on the farm community of cooperative ownership of ethanol plants. All of his studies show a higher return to communities than absentee-owned facilities. The most recent study concludes that a community-owned facility will increase the local economy half again as much (56 percent) as an absentee-owned plant.[2]

David Morris, Co-Founder of the Institute for Local Self Reliance, authored "Energizing Rural America: Local Ownership of Renewable Energy Production is Key."[3] In this report, Morris speaks about how policy makers have historically approached renewable energy as an energy security or environmental issue, with agricultural implications. Today, however, goals of displacing significant portions of our nation's energy with homegrown biofuels and renewable electricity are making agricultural implications become paramount.

With the construction of some 2,500 biorefineries throughout the nation, if predominantly locally owned, rural America would be transformed. He argues that it should be a high national priority to ensure that these positive investments in rural America are realized, and the benefits widely shared. Furthermore, Morris shows that to date, public policy has focused principally on simply achieving the quantitative goal of expanding renewable energy production. However, qualitative goals such as maximizing economic development in rural communities through the promotion of renewable energy have largely been overlooked.

For Further Reading:

Institute for Agriculture and Trade Policy
*Cultivating a New Rural Economy*
www.iatp.org

Carsey Institute
*Biofueling Rural Development: Making the Case for Linking Biofuel Production to Rural Revitalization*
http://www.carseyinstitute.unh.edu/documents/Biofuels_final.pdf

Institute for Local Self-Reliance
*25 by '25: Getting the Priorities Right*
http://www.newrules.org/de/speech25by25.pdf

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[2] Urbanchuk, John. "Economic Impacts on the Farm Community of Cooperative Ownership of Ethanol Production," for the National Corn Growers Association. September 2006. Online: www.ncg.com/ethanol/pdfs/2006/farmerownedethanoleconomicimpact.pdf

[3] Morris, David. "Energizing Rural America: Local Ownership of Renewable Energy Production is Key" for the Center for American Progress. January 2007. Online: http://www.americanprogress.org/issues/2007/01/pdf/rural_energy.pdf

Apollo Alliance
*New Energy for America: The Apollo Jobs Report: For Good Jobs & Energy Independence*
www.apolloalliance.org/jobs/index.cfm

Worldwatch Institute: Biofuels for Transporttion: Global Potential and Implications for Sustainable Agriculture and Energy in the 21st Century (2006)
www.worldwatch.org/taxonomy/term/445

The University of Tennessee, Agricultural Economics
*25% Renewable Energy for the United States By 2025: Agricultural and Economic Impacts*
http://www.agpolicy.org/ppap/report%2025x25.pdf

**Characterization of Fleets and Potential Retail Market for Biodiesel in Dragon Run Watershed**

Oil Distributor Survey

Virginia Clean Cities surveyed 14 oil companies operating in the Middle Peninsula April 30, 2007 through May 17, 2007 via phone and email. Of the 14 oil companies identified, 43% responded (6) to the survey within the time frame specified after multiple attempts.

Distributors were asked:

- Total highway diesel sales (annually, gallons)
- Total retail highway diesel sales
- Number of retail highway diesel locations supplied
- Total off-road diesel sales (annually, gallons)
- Total off-road diesel sales
- Number of off-road diesel locations supplied
- Total #2 heating fuel oil sales
- Total biodiesel sales
- Number of retail biodiesel locations supplied

Results of the survey are presented below in Table 1.

*Table 1. Results of Middle Peninsula oil distributor survey conducted by Virginia Clean Cities during the period of April 30-May 17, 2007. Survey were conducted via phone and email. NOTE: Based on the response rate and the inability to track every diesel gallon moving through the Middle Peninsula, the following results are very conservative, but serve as a starting point to determine potential market penetration.*

| | | |
|---|---|---|
| **# of Distributors Included** | 6 | |
| | | |
| **Commercial Highway Diesel Sales:** | 3,487,180 | gallons annually |
| **Retail Highway Diesel Sales:** | 3,767,180 | gallons annually |
| **Number of Retail Highway Diesel Locations:** | 19 | stations |
| **TOTAL HIGHWAY DIESEL** | 4,807,180 | gallons annually |
| | | |
| **Total Off-Road Diesel Sales:** | 1,216,000 | gallons annually |
| **Retail Off-Road Diesel Sales:** | 1,035,691 | gallons annually |
| **Number of Retail Off-Road Diesel Locations:** | 6 | stations |
| **TOTAL OFF-ROAD DIESEL** | 2,136,000 | gallons annually |
| | | |
| **Total #2 Heating Fuel Oil Sales:** | 2,387,000 | gallons annually |
| | | |
| **Biodiesel Sales and Locations:** | 232,700 | gallons annually |
| **Biodiesel Retail locations in Middle Peninsula, VA :** | Phillips Energy, Inc<br>2586 George Washington Memorial Highway<br>Hayes, VA<br>B5 (5% biodiesel, 95% petroleum) on-road biodiesel | |

Table 2 presents various scenarios using the survey results and biodiesel market penetration levels. Scenarios are labeled A-E on the left column. Scenario A, for example, was calculated on the basis that all diesel sold (based on survey results) contained a 2, 5, 10, and 20% blend of biodiesel. Highway diesel and off-road diesel scenario results are presented.

*Table 2. Various scenarios of biodiesel market penetration levels using survey results from Table 1.*

| | | | | | |
|---|---|---|---|---|---|
| **A** | All diesel sold contains | B2 | B5 | B10 | B20 |
| | Highway diesel (gallons) | 96143.6 | 240359 | 480718 | 961436 |
| | Off-road diesel (gallons) | 42720 | 106800 | 213600 | 427200 |
| | | | | | |
| B | 5% of diesel sold contains | B2 | B5 | B10 | B20 |
| | Highway diesel (gallons) | 4807.18 | 12017.95 | 24035.9 | 48071.8 |
| | Off-road diesel (gallons) | 2136 | 5340 | 10680 | 21360 |
| | | | | | |
| C | 10% diesel sold contains | B2 | B5 | B10 | B20 |
| | Highway diesel (gallons) | 9614.36 | 24035.9 | 48071.8 | 96143.6 |
| | Off-road diesel (gallons) | 4272 | 10680 | 21360 | 42720 |
| | | | | | |
| D | 20% diesel sold contains | B2 | B5 | B10 | B20 |
| | Highway diesel (gallons) | 19228.72 | 48071.8 | 96143.6 | 192287.2 |
| | Off-road diesel (gallons) | 9548 | 23870 | 47740 | 95480 |
| | | | | | |
| E | 50% diesel sold contains | B2 | B5 | B10 | B20 |
| | Highway diesel (gallons) | 48071.8 | 120179.5 | 240359 | 480718 |
| | Off-road diesel (gallons) | 23870 | 59675 | 119350 | 238700 |

School Fleet Manager Survey

School districts in the Middle Peninsula area were surveyed to determine how many diesel vehicles or pieces of equipment were in operation, and how much fuel is used on an annual base. The aggregated results of the survey are presented below for King and Queen County Schools, Essex County Schools, Gloucester County Schools, King William County Schools, Lancaster County Schools, King William County Schools, Middlesex County Schools, and Bay Transit (not a school fleet)[4]:

[4] Bay Transit was included in the school fleet totals because Virginia Clean Cities thought it was a "marquee" fleet as the schools are and therefore has a higher level of public attention than a private fleet.

*Table 3. Fleet profile survey results for Gloucester, Middlesex, King William, King and Queen, Essex, Mathews, Lancaster, Bay Transit*

| Fleet Profile Total: Gloucester, Middlesex, King William, King and Queen, Essex, Mathews, Lancaster, Bay Transit | |
|---|---|
| LD Gas* | 222 |
| LD Diesel | 25 |
| HD gas | 33 |
| HD diesel | 337 |
| Off road gas | 1 |
| Off road diesel | 7 |

**excluding King William County*

Respondents that reported diesel fuel use include Lancaster, Gloucester, Middlesex, and Mathews County schools. Of the 4 school districts, a total of 303,631 gallons of diesel fuel is used on an annual basis. The figure is probably approaching over 500,000 gallons per year if the remaining fleets surveyed are included. The following calculations are based on the actual survey results of 303,631 gallons and show the amount of biodiesel demand that would be created if all diesel fuel used in the 4 school districts that responded were converted to various biodiesel blends.

*Table 4. Potential biodiesel demand at various blend levels created from 4 school districts surveyed in Middle Peninsula.*

| Blend Level | B2 | B5 | B10 | B20 |
|---|---|---|---|---|
| Gallons | 6072.62 | 15181.55 | 30363.1 | 60726.2 |

## Characterizing the Roles of Strategic Partners

*Biodiesel Manufacturer (refinery)*

Biodiesel production in Virginia is still in the developmental stages. Currently, there is only 1 plant in Virginia consistently producing ASTM quality biodiesel. Virginia Biodiesel is located at 7475 Ready Mix Drive in West Point, Virginia. Virginia Biodiesel has been involved in the early stages of the Dragon Run Watershed biodiesel project. Virginia Biodiesel already supplies ASTM quality biodiesel to distributors around the Middle Peninsula and throughout Virginia. Because of its close proximity to the (20 miles from King and Queen County) Middle Peninsula counties, the refinery will play a significant role in future biodiesel supply and possibly provide economic benefit to the community.

*Biodiesel Distributor*

Until biodiesel use becomes more widespread, difficulties in marketing the fuel continue. Economies of scale are the vehicle by which a firm or industry lowers the unit price of the product; until that point, biodiesel sales will remain limited.

Fourteen oil distributors were identified as supplying product in the 6 county Middle Peninsula area. Six reported already distributing biodiesel product to end users or retail outlets in the Middle Peninsula area.

*Biodiesel Retailer*

If biodiesel is to become mainstream in the Middle Peninsula area, retailers must become interested stakeholders. Increasing the biodiesel fuel station network should be a top priority to provide as many Middle Peninsula residents who operate diesel vehicles with a choice.

Only 1 oil company reported a retail biodiesel location in the Middle Peninsula area.

*Biodiesel Users/Fleets*

Any diesel vehicle or piece of equipment can use biodiesel, which is one of its advantages. Potential fleet types (list specific to Middle Peninsula) which can take advantage of a biodiesel blend, and that perhaps should be considered as a target market, include:

- "Niche Markets"
    - Agriculture
    - Forestry
    - Recreation
        - Tour boats and charters
        - Marinas (for private citizen boats, see http://middlepeninsula.com/boating.htm for a listing)
        - Campgrounds (Thousand Trails Campground)
    - Institutes of higher education
        - Virginia Institute of Marine Since (VIMS)
        - Rappahannock Community College (RCC)
- Transit buses
    - Bay Transit
- School buses
    - Essex, King and Queen, Middlesex, Gloucester, Mathews, King William, and Lancaster Counties
- Refuse haulers
- Delivery vehicles (beer, beverage, snack foods)
- Long-haul trucks

- Government fleets (not a significant target market, very little diesel equipment operated by government fleets – see section of report)

**Factors Affecting the Continued Growth of Biodiesel**

Various factors can affect the future growth of biodiesel in the Middle Peninsula and Dragon Run watershed areas:

- Limitations of biodiesel manufacturing
- Costs and difficulties associated with transition and fuel
- Fuel quality issues
- Environmental and social factors
- Incentives

**Outlets for Continued Education of Stakeholders, Partners, and End Users**

Continued education of stakeholders, strategic partners, end users, and the general public should be viewed as a key priority in getting a biodiesel initiative off the ground. This section contains recommendations for outreach and education.

**Conclusions**

This first-phase report is meant to provide a framework to assist the contractor and MPPDC in determining directions and paths to consider in the next phases of the project.

Foremost, however, this report provides support for the decision whether to advance the project to the next planned phase or rethink project objectives, a determination to be based in part on whether there appears to be adequate market viability and stakeholder interest in developing the biodiesel market.

Some positive conclusions are easy and obvious: clearly, whether biodiesel is promoted as a sustainable fuel practice and "can help save the dragon," is used by farmers and school districts for cleaner air and reduced dependence on foreign oil, or is used as a catalyst for a cooperative initiative, biodiesel can provide economic, environmental, and social benefit to the Dragon Run watershed and Middle Peninsula communities. Stakeholder interest and willingness to support the project appear to be strong and growing.

Tailoring a biodiesel project to provide the maximum possible local economic benefit will not be as easy, however, and will require thoughtful strategic planning.

## Background

The Dragon Run Watershed Special Area Management Plan (SAMP) project's mission is to support and promote community-based efforts to preserve the cultural, historic and natural character of the Dragon Run, while preserving property rights and the traditional uses within the watershed.

As part of the Dragon Run Special Area Management Plan managed by the Middle Peninsula Planning District Commission (MPPDC), a study titled "Opportunities for Sustainable Natural Resource-Based Development in the Dragon Run Watershed" (referred hereafter as the Yellow Wood study) was conducted in October 2005. The overall purpose of the project was to identify and explore economic development activities and opportunities that sustain traditional land uses while enhancing the natural resource base or at least minimizing adverse impacts. Seven areas were selected for further exploration, including biodiesel utilization (and production) for municipal vehicles. The Yellow Wood study found biodiesel utilization to be an example of enterprise that fits within the overall goal of sustainable natural resource-based economic development for the Watershed, whether carried out within the public or private sectors.

The Yellow Wood study reviews the basics of biodiesel including a description of fuel properties, storing the fuel, operations and maintenance considerations, engine warranty concerns, converting diesel fueling stations to biodiesel, environmental benefits of biodiesel, and other applications of biodiesel. The study concluded that because biodiesel involved relatively minor changes compared to other alternative fuels, and has documented environmental and health benefits, biodiesel is a logical choice for communities that are interested in promoting sustainability. Furthermore, the raw materials for biodiesel are primarily soybeans, which are grown extensively in the region. This study did not, however, delve into the deeper implications of how biodiesel could potentially impact traditional land uses in the Dragon Run Watershed, namely farming, forestry and recreation.

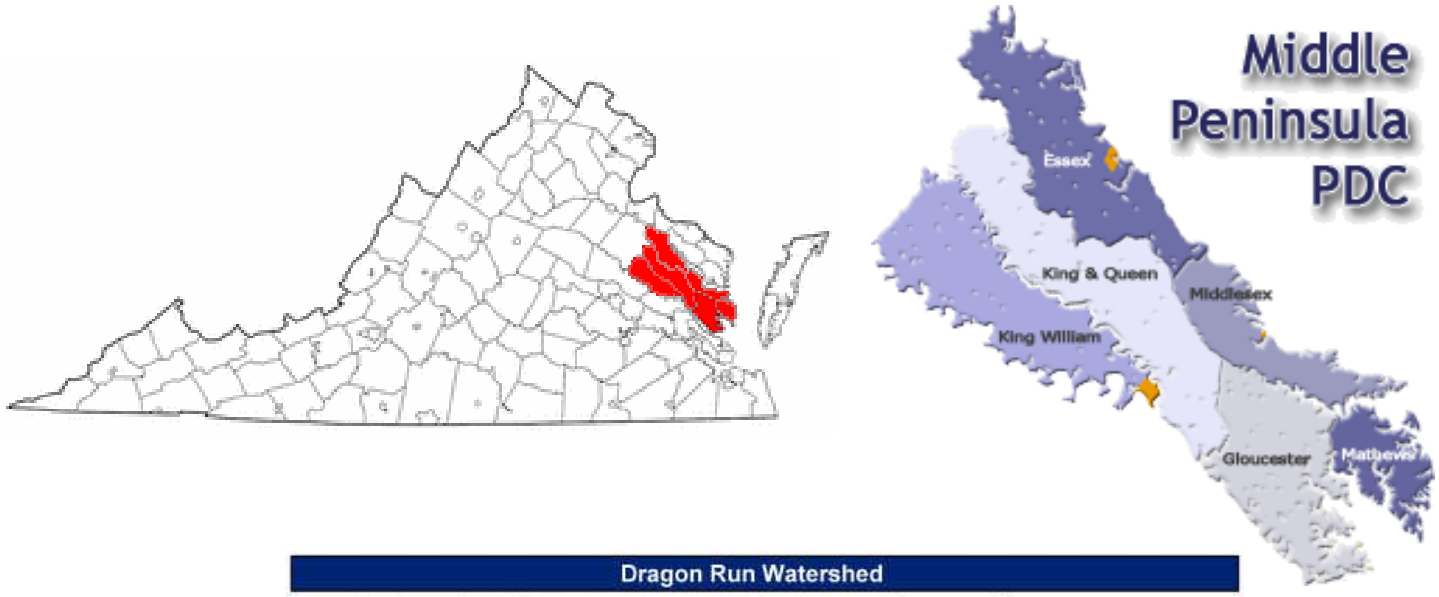
Virginia Clean Cities was contracted by the MPPDC to continue further exploration of biodiesel market viability and present recommendations based on survey summaries and stakeholder interest detailing potential to fulfill the goal to provide sustainable natural resource-based economic benefit to the watershed community centered around the use and production of biodiesel as a cleaner, healthier, domestic alternative to fossil fuel.

To that end, the following analysis: 1) presents arguments for how biodiesel use and/or production could provide benefit to the Middle Peninsula and Dragon Run Watershed areas; 2) refines the roles of strategic partners; 3) attempts to characterize and quantify potential capacity, will and market for biodiesel end users, including local governments, school bus and other diesel-powered equipment, farmers, and commercial fleets; 4) assesses factors impacting biodiesel market

penetration; 5) examines cooperative approaches to traditional fuel retail sales; and 6) examines next steps and presents recommendations.

The Dragon Run Watershed and Geographic Boundaries for Biodiesel Utilization

Located in the Middle Peninsula of Virginia, the Dragon Run Watershed encompasses parts of Essex, King and Queen, Middlesex, and Gloucester Counties. The geographic boundaries of this analysis include the Dragon Run Watershed counties, as well as Mathews and King William Counties and regions surrounding the middle peninsula which include key stakeholders (i.e. Northern Neck, New Kent, Lancaster County).



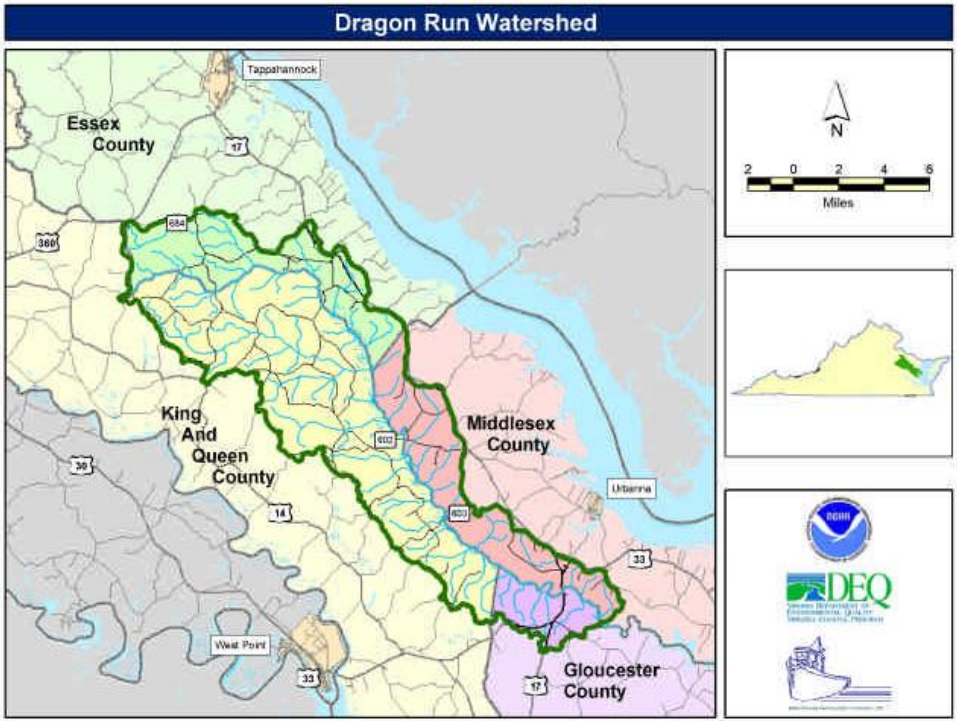




*Figure 1. Middle Peninsula (top) in Virginia and Dragon Run Watershed (bottom)*

Biodiesel Overview

Environmental and energy security concerns have increased interest in agricultural oils and fats for conversion to biodiesel. Biodiesel is produced by chemically modifying renewable, biologically based (biomass) oil or fats by reacting them with methanol and a catalyst and then separating/purifying the reaction products as shown in Figure 2. Following completion of reaction, glycerol and fatty acids, remain as the co-products.[5]

Biodiesel is a cleaner burning liquid fuel, which can be produced from various domestic, renewable resources like soybeans, sunflowers, and from recycled cooking oils or animal fats (see Fig. 2). Biodiesel contains no petroleum, but it can be blended at any level with petroleum diesel to create a biodiesel blend. It can be used in compression-ignition (diesel) engines with little or no modification, and in any other combustion equipment (i.e. boilers and heaters). Simple to use, biodegradable, nontoxic, essentially free of sulfur & aromatics, biodiesel also reduces serious air pollutants such as particulates, carbon monoxide, hydrocarbons, and other air toxins.

An overview of the biodiesel production process and feedstock sources is provided below.

[5] Bantz, Steve and Michael Deaton. Understanding US Biodiesel Industry Growth using Systems Dynamics Modeling.

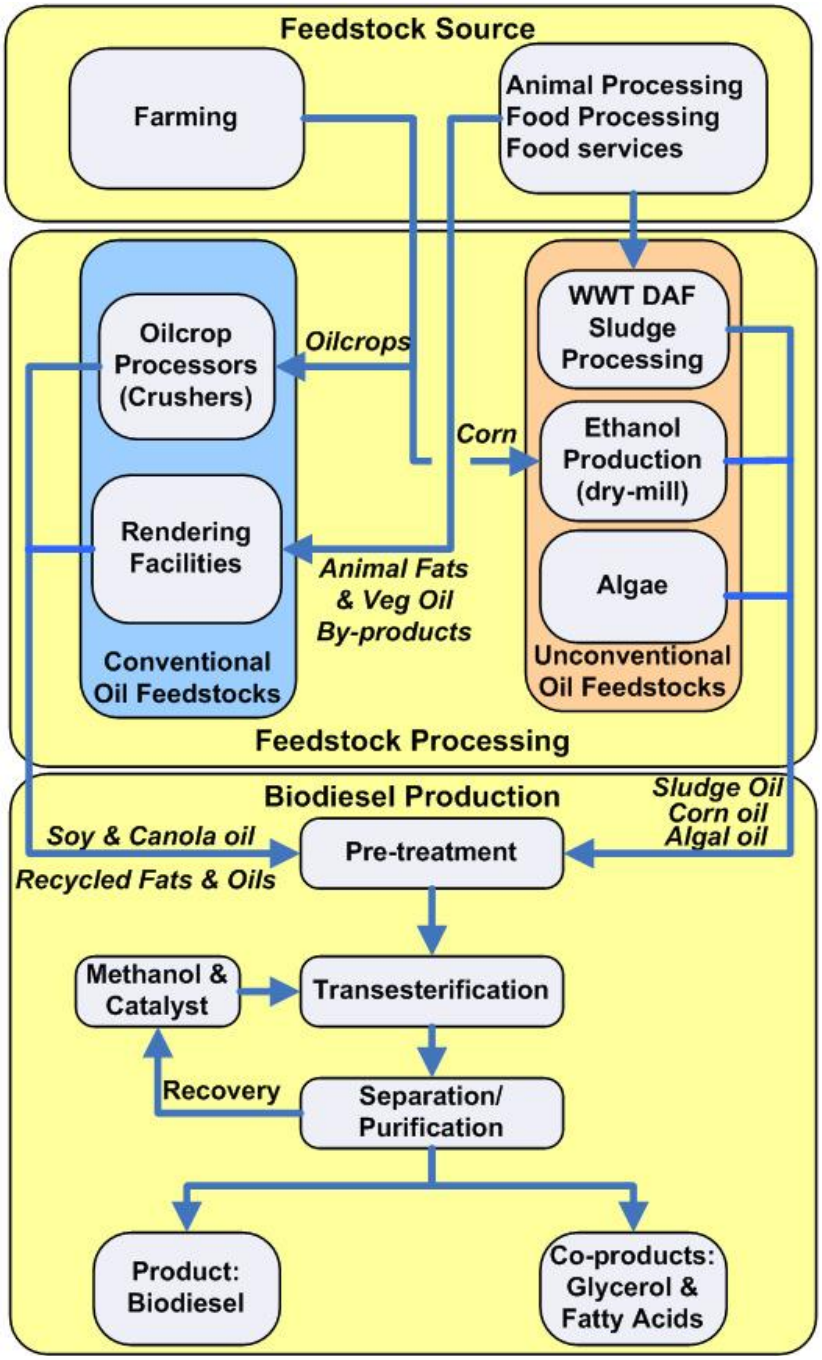



Figure 2. Biodiesel Production Process and Feedstock Sources[6]

[6] Bantz, Steve and Michael Deaton. Understanding US Biodiesel Industry Growth using Systems Dynamics Modeling.

## II. Arguments for Promoting Biodiesel as a Means Toward Preservation of Traditional Land Uses of the Dragon Run Watershed

"A Rising Tide Lifts all Ships"

*Even if local farmers can't directly sell soybeans or other feedstocks to the Eltham refinery, more biodiesel demand means more feedstock demand and higher prices to all farmers.*

Rural areas are rich in biomass, a transportable renewable fuel. A great example of how the growth of biofuels has affecting farmers is ethanol. Last year, the price of corn doubled as ethanol production increased from 3 to 5 billion gallons. The USDA now projects corn prices staying above $3.50 a bushel and rising to $3.75 a bushel in 2009, driven by increased demand for ethanol.[7]

Although much of the negative has been accentuated in the media with regards to rising corn prices and ethanol demand, a positive outcome is for the first time in almost 30 years, farmers are getting a price for their corn that is over their cost of production. A recent USDA study found that in the decade before 2006, without government payments, corn farmers, on average, didn't meet cost of production except for the drought year of 1996. The USDA recently estimates that at a price of $3 per bushel, the corn farmer just marginally earns revenue over the cost of producing the crop. With corn prices above $3.50 a bushel for the foreseeable future, the marketplace has replaced the taxpayer. [8]

The Food and Agricultural Policy Research Institute (FAPRI) February 2007 Briefing Book presents a summary of ten-year baseline projections for U.S. agricultural markets. Figure 3 shows how more demand for biofuels translates to greater revenue for rural farmers as corn and soybean prices are predicted to rise again in 2007-2008.

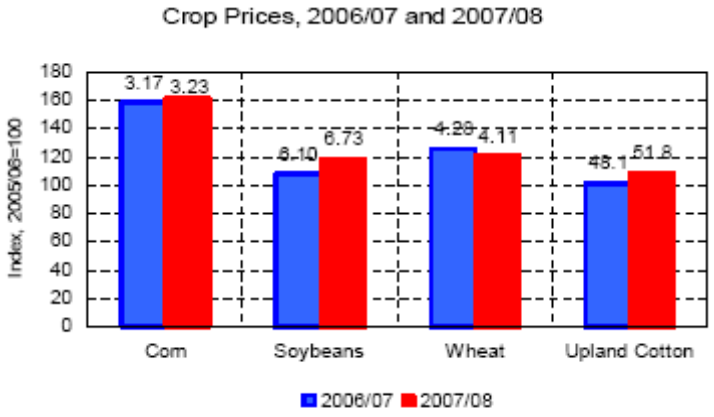



*Figure 3. FAPRI prediction, crop prices 2006-2008*

[7] Morris. David. 25 by '25: Getting the Priorities Right. Institute for Local Self-Reliance. 21 March 2007. Presented at the 3rd National Renewable Energy Summit in Washington, D.C. http://www.newrules.org/de/speech25by25.pdf

[8] Ibid.

Another example of agricultural benefit created from biofuels is the Minnesota B2 mandate. In 2002, the Minnesota legislature mandated that all diesel fuels sold in the state must contain at least 2 percent biodiesel by year 2005. The biodiesel mandate became a catalyst for Minnesota's soy-diesel industry, which emerged to fulfill the 16-million-gallon-a-year mandate requirements, and later grew into a 60-million gallon a year industry. At the 60-million-gallon a year production level, soy diesel in Minnesota generates various economic impacts that include: increased demand for Minnesota's soybean crop by 13 percent annually; increased in-state soybean processing capacity by 31 percent; an annual output impact of $928 million; employment opportunities for 5,668 jobs; and the "multiplier impact" will benefit various economic sectors, such as agriculture, manufacturing, construction, transportation, trade, services, finance, insurance, and real estate. [9]

The Multiplier Effect

*A dollar spent for biodiesel produced in New Kent County mostly stays in the state of Virginia. The Eltham biodiesel refinery purchases soy oil from Purdue, which buys soybeans from Virginia and elsewhere. Additionally, the refinery provides a few local jobs, pays taxes, hires contractors, etc. While it is a difficult task to pinpoint how much of the dollar stays in the local and state economy, it is quite easy to assert that most of a dollar spent on petroleum diesel leaves the country and certainly the local economy*.

Most sectors of the United States economy stand to benefit from increased domestic renewable energy use. It's often cited that widespread use of biodiesel has the potential to reduce our dependence on imported oil while simultaneously strengthening domestic agriculture. Let's take a look at a dollar spent on crude oil from overseas, versus a dollar spent on a biomass fuel such as biodiesel**.**

The use of biodiesel in Virginia can have positive benefits for the state economy. Currently, for every $1 spent buying diesel in Virginia, large portion of the premium goes to crude oil with only $.134 staying locally through state tax and local distributor income (Figure 4). If locally produced biodiesel was used, for every $1 spent, potentially 90 cents would stay in the local or state economy (Figure 5).[10]

[9] Ye, Su. Economic Impact of Soy Diesel in Minnesota. 2006 September. Minnesota Department of Agriculture. www.mda.state.mn.us.

[10] Biodiesel Fuel. Virginia Tech Cooperative Extension. Publication Number 442-880. October 2006. Available online: http://www.ext.vt.edu/pubs/ageng/442-880/442-880.html

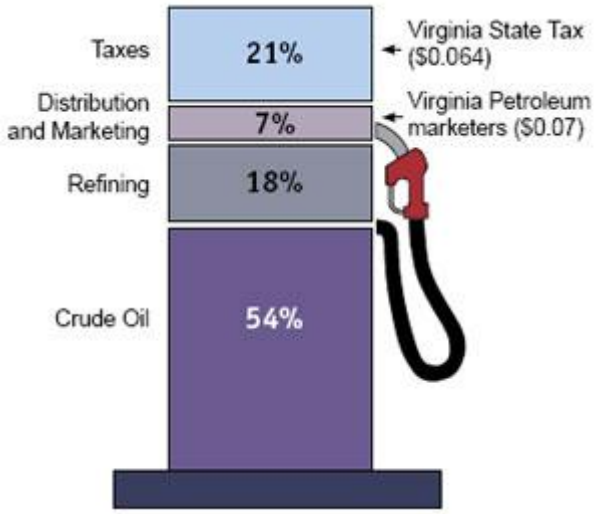



*Figure 4. Distribution of $1 cost of diesel fuel at public pumps*

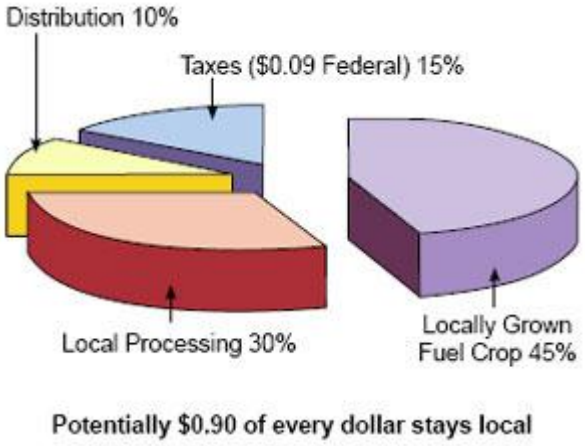



*Figure 5. Distribution of $1 cost of biodiesel fuel at public pumps*

In 2003, the United States imported nearly $130 billion of energy related products, accounting for nearly 25% of the $490 billion trade deficit.[11] The Energy Information Administration predicts oil imports will continue to increase over time from 11.5 million bbl/day to 20.7 million bbl per day by 2025. The DOE further projects this will lead to a trade deficit for imported crude oil and petroleum products of close to $200 billion.[12]

A DOE study estimated that U.S. oil dependence has already cost the country $3.4 trillion from 1970 to 1999. According to the report, "the present value of these losses is close to $7 trillion, almost an entire year's GDP… Clearly, oil dependence

[11] "Biomass Benefits: Economic Growth," Biomass Program, Department of Energy. http://www.eere.energy.gov/biomass/economic_growth.html

[12] "Annual Outlook 2004 with Projections to 2025," Energy Information Association. U.S. Department of Energy, http://www.eia.doe.gov/oiaf/aeo/economic.html.

ranks among the most significant economic problems the United States has faced over the past thirty years."[13]

Obviously, our local communities and our country stand to benefit from developing local renewable energy resources.

"Save the Dragon, Use Biodiesel"
*If branding the concept of sustainable fuel selection practices ("Save the dragon, use biodiesel") works in the Middle Peninsula, it could work elsewhere in largely rural Virginia, providing incremental increase in demand and, more importantly, a friendly climate to grow the biofuels "industry" in Virginia.*

As discussed in the first argument, an increased demand for biodiesel will ultimately lead to more favorable returns for biodiesel feedstock growers. If the Middle Peninsula Community embraces biodiesel and associates preservation of the Dragon Run watershed with biodiesel use, a friendly climate towards the Biofuels industry in general will develop.

Much is still needed for the biomass sector to truly emerge in terms of research, infrastructure development and supportive policies (from breeding work and appropriate equipment to contracting systems, fuel supply assessments, and facility siting and investment). The Middle Peninsula and Dragon Run communities could stand to benefit from future involvement as the biomass sector emerges and evolves.

A Sustainable Community is a Resilient Community
*The strength a sustainable community possesses might not be apparent until the next crisis that restricts supply of petroleum, but this resiliency may be a communities saving grace.*

Sustainable development is a strategy by which communities seek economic development approaches that also benefit the local environment and quality of life. Obviously, energy is the lifeblood of any community. A community which diversifies its energy portfolio is in a far better position than one which relies entirely on one source of energy.

With all of the talk from analysts, economists, the media, etc. about how volatile the petroleum market has become and will continue to be, it's important for communities to become smarter about energy choices.

A good example of how alternative fuels can help in a time of crisis is Hurricane Katrina. Before the storm, one-tenth of all the crude oil consumed in the United States and almost half of the gasoline produced in the country came from refineries

[13] "Costs of Oil Dependence: A 2000 Update." Oak Ridge National Laboratory, Department of Energy, http://www.ornl.gov/~webworks/cpr/v823/rpt/107319.pdf, p 27.

in the states along the Gulf's shores. At least twenty offshore oil platforms were missing, sunk, or had gone adrift, according to the United States Coast Guard. The Louisiana Offshore Oil Port, which imports 11% of all U.S. oil consumption, closed on August 27, and Shell reported a reduction in production of 420,000 barrels per day. West Texas Intermediate crude oil futures reached a record high of over $70 per barrel. Long lines developed at some gas stations throughout the U.S. as customers rushed to buy gasoline, anticipating price increases in the wake of the storm.[14]

Biodiesel came to rescue and helped fuel hospitals and emergency vehicles, and spewed significant fewer toxins into the air too. [15] Biodiesel is not necessarily the answer to our petroleum problems, but is one of the solutions. Perhaps by beginning the process of alternative fuels awareness, ultimately leading to comfort and acceptance, the Middle Peninsula can begin the process of diversifying its energy portfolio and providing the community with an economic, environmental and security cushion.

Biofuels More Economic than Petroleum?

*It is possible that biofuels will be cheaper than petroleum fuels eventually, positioning fuel sustainable communities for economic success.*

Many experts predict oil prices will not only continue to rise, but may double or triple in our lifetimes. As demand for oil grows, acceleration in the upward direction with regards to price will occur and may be exacerbated by global oil extraction peaks. Regardless of which peak oil analyst is correct, the fact is that oil is a finite resource, and we will one day run out of a cheap and accessible supply of it.

Our industrial society faces a challenging new paradigm of possible unstable and expensive energy markets and therefore higher prices for most commodities and products. Forty-percent of global energy consumption is fueled by oil.[16] Although the demise of our “black gold” infrastructure is a “slow emergency,” communities must face the facts and prepare accordingly if to avoid possible major disruptions.

David Morris, co-founder and vice president of the Institute of Local Self-Reliance asserts we will look back a decade from now and find that the most pain was experienced when we went from a 2 percent to a 5 percent Biofuels blend in our nation’s fuel supply. Going from 5 to 25 percent will be less disruptive, in part because a national delivery and storage infrastructure will be in place, and in part

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[14] Laverty, Gene. "Oil, Gas May Soar as Storm Shuts U.S. Gulf Production." *Bloomberg*. August 28, 2005.
[15] Hurricane Katrina Relief Effort Fueled with Biodiesel. September 15, 2005. NBB News Release. http://www.michigansoybean.org/news/biodiesel%20News/Katrina%20Relief%20Fuedl%20with%20Biodiesel.pdf
[16] Room, David. Energy Preparedness: A municipal perspective. 25 April 2006. http://energypreparedness.net/resources/whitepaper/1?PHPSESSID=5e033a11ca51e44561842f12fc21d301

because we will have shifted to a more abundant and less controversial fuel source.[17]

The point concerning the development of a delivery and storage infrastructure is well taken. As more and more federal and state policy dictates ways in which our communities move away from traditional fossil-fueled based infrastructure to renewable-alternative fueled infrastructure, impacts will be felt at all levels of our fuel supply chain. The better prepared a community is to receive these new alternative fuels, the better positioned a community is for economic and environmental success.

[17] Morris. David. 25 by '25: Getting the Priorities Right. Institute for Local Self-Reliance. 21 March 2007. Presented at the 3rd National Renewable Energy Summit in Washington, D.C.

## III. Considerations for Maximizing Environmental and Economic benefit

Many sources of biomass can grow in many parts of the United States. For this reason, biomass has an advantage over traditional fossil fuel product extraction. Fossil fuels can be found in certain parts of the world and largely not in the United States as U.S. oil peaked in the 1970s. Biomass growth could potentially be widespread and community specific. One factor that must be considered, however, is biomass is generally more suited for processing close to the feedstock production.

Creating small refineries may prove challenging as they require high levels of capital investment to be competitive in a global market. But for long-struggling rural communities, this may offer the promise of new investment, job growth and revitalization. For farmers, landowners and rural communities to truly benefit, policies and incentives need to be established that equally support rural development goals and environmental and economic considerations. Furthermore, the needs of the rural community must be clearly communicated with biomass refineries or processing facilities. Likewise, the facility must communicate clearly to the community what is necessary to continue economic success and therefore economic benefit to the community. Common goals must be agreed upon and the two parties must continue dialogue.

An interesting policy brief completed by the Carsey Institute discussed rural revitalization and biofuels. The brief discusses how politicians and biofuels proponents tout biofuels as a means towards job creation and economic growth, but unless rural development priorities are not kept as top priority, benefits may be muted. As seen in Figure 6 below, ownership of the refineries by local farmers and community members can be seen as the key aspect to sustainable rural development. Local ownership assures that the facility is based to some extent on local resources and needs, and that much of the money generated remains in the local economy.

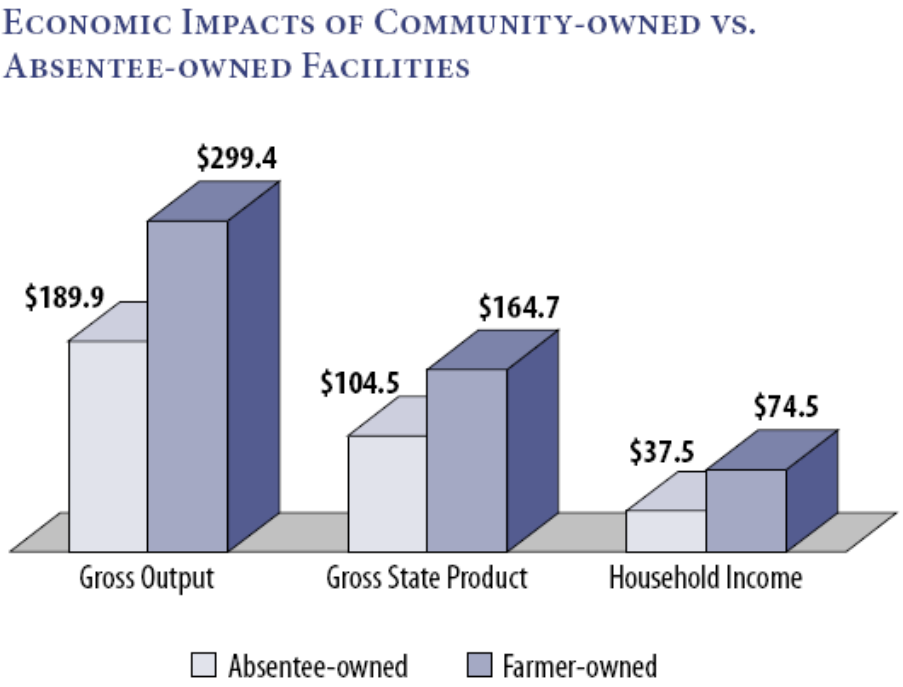


*Figure 6. Economic Impacts of Community-owned vs. Absentee-owned Facilities.*[18]

If the Middle Peninsula community wishes to benefit from biofuels development in the area, ownership should be seen as a key factor in maximizing benefits. Cooperative scenarios and case studies are presented in this report, and may be a direction the MPPDC wishes to explore further.

[18] Urbanchuk, John. "Economic Impacts on the Farm Community of Cooperative Ownership of Ethanol Production," for the National Corn Growers Association September 2006 (http://www.ncga.com/ethanol/pdfs/2006/FarmerOwnedEthanolEconomicImpact.pdf)

## IV. Characterization of Fleets and Potential Retail Market for Biodiesel in Dragon Run Watershed

The first and obvious step in determining the potential for biodiesel market penetration is to characterize potential fleets and retail markets for biodiesel. A survey was used to determine how many diesel vehicles operated by school districts and government fleets in the 6 County district of the middle peninsula, and how many of these vehicles could potentially use biodiesel. A copy of the email survey is shown below.

Fleet Manger Survey
Fleet Name:
Fleet Description (area, type of fleet):
Contact Information (email):
Data Received via (email, phone, mail, fax):

1. How many vehicles and pieces of equipment are currently operating in your fleet?
2. Please help us characterize your fleet by breaking down the number of:
    a. Light-duty gasoline vehicles:
    b. Light-duty diesel vehicles:
    c. Heavy-duty gasoline vehicles:
    d. Heavy-duty diesel vehicles:
    e. Off-road gasoline vehicles:
        i. Please describe vehicle/equipment type
    f. Off-road diesel vehicles:
        i. Please describe vehicle/equipment type
3. How much fuel does your fleet use on a monthly or annual basis?
    a. Gasoline
    b. Diesel
    c. Other fuel
4. Who is your fuel distributor?
5. Are you using any biofuels (biodiesel blend or ethanol blend)?
6. Would you like to learn more about biodiesel, or are you interested in possibly using a biodiesel blend?

A fuel distributor survey was also conducted to attempt to determine how much diesel fuel flows through the Middle Peninsula area, and therefore what the outer boundaries of potential biodiesel use would be. A copy of the fleet distributor survey is shown below. Surveys were sent via email after an introductory phone call was made. A brief description of the project was included in the email along with a note that the survey is a blind and confidential survey and no oil company will be identified, and that while we are trying to establish the maximum potential of biodiesel, it would never equal the total amount of diesel sold in the Middle Peninsula.

Fuel Distributor Survey
*(Call followed by an email)*
Fleet Name:
Fleet Description (area, type of fleet):
Contact Information:

If possible, could we please get the following information concerning your sales in the Middle Peninsula area of Virginia?

- Total highway diesel sales (annually, gallons)
- Total retail highway diesel sales
- Number of retail highway diesel locations supplied
- Total off-road diesel sales (annually, gallons)
- Total off-road diesel sales
- Number of off-road diesel locations supplied
- Total #2 heating fuel oil sales
- Total biodiesel sales
- Number of retail biodiesel locations supplied
- Areas you serve in the Middle Peninsula (Essex, Gloucester, King and Queen, Mathews, Middlesex, King William)

Results of the surveys are presented in the next section of this report.

## V. Characterizing the Roles of Strategic Partners

A successful biodiesel venture requires a number of key elements to succeed. Success with an alternative fuels project is directly dependent upon the successful planning and execution of the supply chain. Ultimately, strategic flexibility and a favorable cost structure are important in encouraging widespread use of a burgeoning alternative energy source. As can be seen in Figure 7 below, many players can be involved when getting biodiesel product from the biodiesel manufacturer, Virginia Biodiesel Refinery LLC in our case, to the end user (i.e. farmer, school bus, general public).

Infrastructure

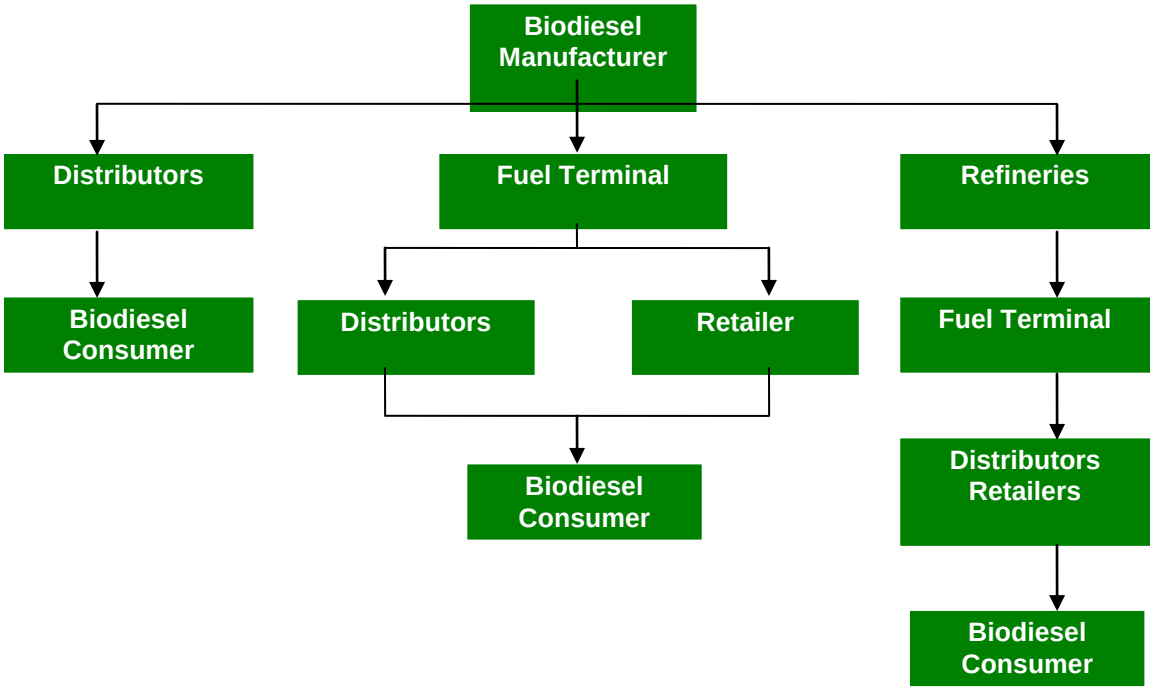


*Figure 7. Biodiesel Infrastructure and Supply Chain Model.*

Strategic Partners

Another factor largely affecting the success of a biodiesel venture or initiative is strategic partners. Strategic partners can facilitate or hinder a project from moving forward. For example, if very little biodiesel supply exists in an area with very high demand, an obvious rise in price and little market penetration will occur. However, if a very small portion of the community supports biodiesel but there is a large influx of supply from a new refinery, the refinery may find itself with a lot of biodiesel and noone to purchase it locally. On there other hand, there may be demand from end users and a refinery may be ready to ramp up production to meet the demand, but the economics don't pan out because of one or many factors (i.e. feedstock prices).

*Biodiesel Manufacturer (refinery)*

Biodiesel production in Virginia is still in the developmental stages. Currently, there is only 1 plant in Virginia consistently producing ASTM quality biodiesel.

Virginia Biodiesel is located at 7475 Ready Mix Drive in West Point, Virginia. Virginia Biodiesel has been involved in the early stages of the Dragon Run Watershed biodiesel project. Virginia Biodiesel already supplies ASTM quality biodiesel to distributors around the Middle Peninsula and throughout Virginia. Because of its close proximity to the (20 miles from King and Queen County) Middle Peninsula counties, the refinery will play a significant role in future biodiesel supply. One of the main

RECO Biotechnology, LLC has constructed a biodiesel refinery in Richmond, VA. The main impediment to production is the price of soybean oil. Currently,

The two other production plants listed on the National Biodiesel Board site could not be contacted or are not significant players in the Virginia's biodiesel production arena.[19]

With feedstock expenses accounting for around 80 percent of a biodiesel plant's operating cost, margins are highly sensitive to the prices of oils and fats. Between 75 and 90 percent of U.S. biodiesel production is based on the U.S. production of soybean oil, indicating that margins for many industry participants will be dependent on soybean oil prices.[20] The share is expected to decrease over time, as many new plants will be able to produce biodiesel using multiple feedstocks, thereby giving producers the flexibility to switch among feedstocks as relative costs dictate.

As feedstock prices exceed 30¢ per pound, the price of biodiesel needs to be above $3 per gallon for the plant to make a profit. The Food and Agricultural Policy Research Institute projects that the price of soybean oil will be 30.7¢ per pound for the 2007/08 crop year and will surpass 34¢ per gallon by the 2009/10 crop year, obviously making margins tight with soybean oil.

The current viability of the biodiesel industry depends on financial support by the government in the early stages of development.

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[19] Commercial Biodiesel Production Plants. National Biodiesel Board. Available online: http://www.nbb.org/buyingbiodiesel/producers_marketers/ProducersMap-Existing.pdf

[20] Carriquiry, Miguel. "US Biodiesel Production: Recent Developments and Propects." Iowa Ag Review. Spring Volume 2007, Vol 13 No 2. http://www.card.iastate.edu/iowa_ag_review/spring_07/article4.aspx

*Biodiesel Distributor*

Until biodiesel use becomes more widespread, difficulties in marketing the fuel continue. Economies of scale are the vehicle by which a firm or industry lowers the unit price of the product; until that point, biodiesel sales will remain limited.

The following companies were identified as key oil distributors in the Middle Peninsula area:

1. Phillips Energy Inc
2. June Parker Oil Company
3. Thrift Oil
4. Atkins Petroleum
5. Papco Energy Inc.
6. Frederick Northrup Inc.
7. Northern Neck Oil Co.
8. TCH Oil Co.
9. WF Parker Oil
10. ET Lawson
11. Massey Oil Co.
12. Milby Oil Co.
13. Sears Oil Co.
14. Wroten Oil Co.

Of the 14 oil companies identified, 6 reported currently distributing biodiesel or a biodiesel blend:

1. TCH Oil Co.
2. ET Lawson ("bioheat" or biodiesel blended in #2 heating fuel oil)
3. Kilduff Oil Co.
4. Wroten Oil Co.
5. Papco Energy Inc.
6. Phillips Energy Inc.

The oil distributor survey was conducted from April 30, 2007 through May 17, 2007 via phone and email. Of the 14 oil companies identified, 43% responded (6) to the survey within the time frame specified after multiple attempts.

Distributors were asked:

- Total highway diesel sales (annually, gallons)
- Total retail highway diesel sales
- Number of retail highway diesel locations supplied
- Total off-road diesel sales (annually, gallons)
- Total off-road diesel sales
- Number of off-road diesel locations supplied

- Total #2 heating fuel oil sales
- Total biodiesel sales
- Number of retail biodiesel locations supplied

Results of the survey are presented below in Table 1.

*Table 1. Results of Middle Peninsula oil distributor survey conducted by Virginia Clean Cities during the period of April 30-May 17, 2007. Survey were conducted via phone and email. NOTE: Based on the response rate and the inability to track every diesel gallon moving through the Middle Peninsula, the following results are very conservative, but serve as a starting point to determine potential market penetration.*

| | | |
|---|---|---|
| **# of Distributors Included** | 6 | |
| | | |
| **Commercial Highway Diesel Sales:** | 3,487,180 | gallons annually |
| **Retail Highway Diesel Sales:** | 3,767,180 | gallons annually |
| **Number of Retail Highway Diesel Locations:** | 19 | stations |
| **TOTAL HIGHWAY DIESEL** | 4,807,180 | gallons annually |
| | | |
| **Total Off-Road Diesel Sales:** | 1,216,000 | gallons annually |
| **Retail Off-Road Diesel Sales:** | 1,035,691 | gallons annually |
| **Number of Retail Off-Road Diesel Locations:** | 6 | stations |
| **TOTAL OFF-ROAD DIESEL** | 2,136,000 | gallons annually |
| | | |
| **Total #2 Heating Fuel Oil Sales:** | 2,387,000 | gallons annually |
| | | |
| **Biodiesel Sales and Locations:** | 232,700 | gallons annually |
| **Biodiesel Retail locations in Middle Peninsula, VA :** | Phillips Energy, Inc<br>2586 George Washington Memorial Highway<br>Hayes, VA<br>B5 (5% biodiesel, 95% petroleum) on-road biodiesel | |

The survey results represent a very conservative estimate of the diesel fuel sold in the Middle Peninsula area, as response was not 100% nor was it expected that every oil company that supplies product in the Middle Peninsula area was identified. Nevertheless, these numbers can be used as a baseline to project biodiesel market penetration.

Table 2 presents various scenarios using the survey results and biodiesel market penetration levels. Scenarios are labeled A-E on the left column. Scenario A was calculated on the basis that all diesel sold (based on survey results) contained a 2, 5, 10, and 20% blend of biodiesel. Highway diesel and off-road diesel scenario results are presented.

Scenario B was calculated on the basis that 5% of all diesel sold (based on survey results) contained a 2, 5, 10, and 20% blend of biodiesel. Highway diesel and off-road diesel scenario results are presented.

Scenario C was calculated on the basis that 10% of all diesel sold (based on survey results) contained a 2, 5, 10, and 20% blend of biodiesel. Highway diesel and off-road diesel scenario results are presented.

Scenario D was calculated on the basis that 20% of all diesel sold (based on survey results) contained a 2, 5, 10, and 20% blend of biodiesel. Highway diesel and off-road diesel scenario results are presented.

Scenario E was calculated on the basis that 20% of all diesel sold (based on survey results) contained a 2, 5, 10, and 20% blend of biodiesel. Highway diesel and off-road diesel scenario results are presented.

*Table 2. Various scenarios of biodiesel market penetration levels using survey results from Table 1.*

| | | | | | |
|---|---|---|---|---|---|
| **A** | All diesel sold contains | B2 | B5 | B10 | B20 |
| | Highway diesel (gallons) | 96143.6 | 240359 | 480718 | 961436 |
| | Off-road diesel (gallons) | 42720 | 106800 | 213600 | 427200 |
| | | | | | |
| B | 5% of diesel sold contains | B2 | B5 | B10 | B20 |
| | Highway diesel (gallons) | 4807.18 | 12017.95 | 24035.9 | 48071.8 |
| | Off-road diesel (gallons) | 2136 | 5340 | 10680 | 21360 |
| | | | | | |
| C | 10% diesel sold contains | B2 | B5 | B10 | B20 |
| | Highway diesel (gallons) | 9614.36 | 24035.9 | 48071.8 | 96143.6 |
| | Off-road diesel (gallons) | 4272 | 10680 | 21360 | 42720 |
| | | | | | |
| D | 20% diesel sold contains | B2 | B5 | B10 | B20 |
| | Highway diesel (gallons) | 19228.72 | 48071.8 | 96143.6 | 192287.2 |
| | Off-road diesel (gallons) | 9548 | 23870 | 47740 | 95480 |
| | | | | | |
| E | 50% diesel sold contains | B2 | B5 | B10 | B20 |
| | Highway diesel (gallons) | 48071.8 | 120179.5 | 240359 | 480718 |
| | Off-road diesel (gallons) | 23870 | 59675 | 119350 | 238700 |

The National Biodiesel Board maintains a list of biodiesel distributors by state and is shown in Appendix A. This list is created through user input, therefore may not be comprehensive or updated.[21]

*Biodiesel Retailer*

If biodiesel is to become mainstream in the Middle Peninsula area, retailers must become interested stakeholders. Increasing the biodiesel fuel station network should be a top priority to provide as many Middle Peninsula residents who operate diesel vehicles with a choice.

The oil distributor survey was conducted from April 30, 2007 through May 17, 2007. Of the 14 oil companies identified, 43% responded (6) to the survey within the time frame specified after multiple attempts. Of the 6 respondents, a total of 19 on-highway diesel retail locations and 6 off-road diesel retail locations were reported.

The only retailer identified which is already providing a biodiesel blend at a traditional gas station fueling island is Phillips Energy, Inc:

Phillips Energy, Inc
2586 George Washington Memorial Highway
Hayes, VA
B5 (5% biodiesel, 95% petroleum) on-road biodiesel

The National Biodiesel Board site of biodiesel retailers in Virginia sorted by city is included in Appendix B.[22]

*Biodiesel Users/Fleets*

Any diesel vehicle or piece of equipment can use biodiesel, which is one of its advantages. Below is a list of potential fleet types (list specific to Middle Peninsula) which can take advantage of a biodiesel blend, and that perhaps should be considered as a target market.

Fleet Types

- "Niche Markets"
    - Agriculture
    - Forestry
    - Recreation

[21] Biodiesel Distributors. National Biodiesel Board. Updated May 8, 2007. http://www.nbb.org/buyingbiodiesel/distributors/showstate_bycity.asp?st=VA

[22] National Biodiesel Board retail fueling sties. Updated May 8, 2007. http://www.nbb.org/buyingbiodiesel/retailfuelingsites/showstate.asp?st=VA

        - Tour boats and charters
        - Marinas (for private citizen boats, see http://middlepeninsula.com/boating.htm for a listing)
        - Campgrounds (Thousand Trails Campground)
    - Institutes of higher education
        - Virginia Institute of Marine Since (VIMS)
        - Rappahannock Community College (RCC)
- Transit buses
    - Bay Transit
- School buses
    - Essex, King and Queen, Middlesex, Gloucester, Mathews, King William, and Lancaster Counties
- Refuse haulers
- Delivery vehicles (beer, beverage, snack foods)
- Long-haul trucks
- Government fleets

*School Fleets*

School bus and government fleets are obvious targets. School buses are one of the largest mass transit programs in the United States. Every school day, approximately 440,000 school buses transport over 24 million children. Many of these school buses are powered by heavy-duty diesel engines and burn convention #2 diesel.

School districts in the Middle Peninsula area were surveyed to determine how many diesel vehicles or pieces of equipment were in operation, and how much fuel is used on an annual base. The aggregated results of the survey are presented below for King and Queen County Schools, Essex County Schools, Gloucester County Schools, King William County Schools, Lancaster County Schools, King William County Schools, Middlesex County Schools, and Bay Transit (not a school fleet)[23]:

*Table 3. Fleet profile survey results for Gloucester, Middlesex, King William, King and Queen, Essex, Mathews, Lancaster, Bay Transit*

| Fleet Profile Total: Gloucester, Middlesex, King William, King and Queen, Essex, Mathews, Lancaster, Bay Transit | |
|---|---|
| LD Gas* | 222 |
| LD Diesel | 25 |
| HD gas | 33 |
| HD diesel | 337 |
| Off road gas | 1 |
| Off road diesel | 7 |

[23] Bay Transit was included in the school fleet totals because Virginia Clean Cities thought it was a "marquee" fleet as the schools are and therefore has a higher level of public attention than a private fleet.

**excluding King William County*

Respondents that reported diesel fuel use include Lancaster, Gloucester, Middlesex, and Mathews County schools. Of the 4 school districts, a total of 303,631 gallons of diesel fuel is used on an annual basis. The figure is probably approaching over 500,000 gallons per year if the remaining fleets surveyed are included. The following calculations are based on the actual survey results of 303,631 gallons and show the amount of biodiesel demand that would be created if all diesel fuel used in the 4 school districts that responded were converted to various biodiesel blends.

*Table 4. Potential biodiesel demand at various blend levels created from 4 school districts surveyed in Middle Peninsula.*

| Blend Level | B2 | B5 | B10 | B20 |
|---|---|---|---|---|
| Gallons | 6072.62 | 15181.55 | 30363.1 | 60726.2 |

*Government Fleets*

Governments are in strategic potions to be community leaders as new technologies are introduced to the marketplace by demonstrating feasibility. The majority of the government fleets surveyed only owned a handful of diesel vehicles, if any. Most owned a tractor for lawn maintenance. Since a small percentage of the government fleet is diesel, a route to consider is "bioheat" or a blend of pure biodiesel with conventional home heating oil.

A Bioheat fuel FAQ page has been posted to the NBB site, and can be accessed: http://www.nbb.org/markets/hom/faqs.asp.

*General Public*

The MPPDC website shows the Middle Peninsula population in 2000 to be 83,684 persons, and over 55,000 over the age of 17 and of driving age (1990 figure).[24]

Although diesel powered vehicles dominate the transportation of goods, accounting for nearly 95 percent of all freight ton-miles, only 3 percent of passenger miles are by diesel vehicle.[25] Even so, at a 3% ratio of diesel to gasoline, at least 1650 people are driving a diesel powered vehicle living in the Middle Peninsula and can use a biodiesel blend.

[24] Population Data. Middle Peninsula Planning District Commission. http://www.mppdc.com/e_data/populatn.htm

[25] Diesel Technology and the American Economy. Prepared by Charles River Associates by the Diesel Technology Forum. October 2000. http://www.dieselforum.org/fileadmin/templates/whitepapers/DTF-Economic-Study.PDF

*Farmers*

Farmers are apparent beneficiaries of biofuels since the feedstocks are grown on American soil. How can farmers become involved in a Middle Peninsula biodiesel initiative?

The first and most obvious choice is for farmers to use the product and support domestically grown and produced energy alternatives. Farmers are already a strong customer base for biodiesel, and the reason many oil distributors began carrying the product in the first place. Farmers commitment to biodiesel is also reflected in their $25 million investment in the product through checkoff dollars.[26]

A second approach for farmers is to get involved in the actual production of oilseed crops, production of biodiesel, or a biodiesel research project.

The USDA National Agricultural Statistics Service reports that Essex, Gloucester, Middlesex, Mathews, King and Queen, and King William Counties collectively have 593 farms total, comprising 145,409 acres.[27] Looking at this farmland from a biomass perspective, or more specifically an oilseed perspective, soybean appears to be the primary oilseed crop grown in the Middle Peninsula area. The NASS reported 227 soybean farms with production of 1.44 million bushels.

*Table 5. USDA NASS Report Middle Peninsula farming statistics.*

| | |
|---|---|
| **Total Cropland (farms)** | 593 |
| **Total Cropland (acres)** | 145,409 |
| | |
| **Total Corn for grain (farms)** | 204 |
| **Total Corn for grain (acres)** | 53,662 |
| **Total Corn for grain (bushels)** | 3,138,137 |
| | |
| **Total soybean for grain (farms)** | 227 |
| **Total soybean for grain (acres)** | 62,146 |
| **Total soybean for grain (bushels)** | 1,436,714 |

Of the 145,409 acres of farmland in the Middle Peninsula, 115,808 is used for corn and soybean already, the main feedstocks for biodiesel and ethanol. The main buyers of soybean in the Middle Peninsula are Purdue and Old Dominion Grain, as well as some buyers of food grade soybeans.

[26] "Biodiesel on the Farm." NBB. http://www.biodiesel.org/markets/far/

[27] U.S. Dept of Agriculture. National Agricultural Statistics Service. Virginia Data – Crops. Year 2006-2007. http://www.nass.usda.gov/Census/Pull_Data_Census

The Essex County Extension Agent, Keith Balderson, stated the single most important concern of soybean farmers in the Middle Peninsula, and anywhere, is anything to improve the price of soybean (i.e. more demand). Soybeans are the only oilseed feedstock currently grown in the Middle Peninsula, however, Keith Balderson did discuss the ability to grow canola (Brassica napus L.) in the region. Test plots of canola were grown in Essex County in the Early 1990s for at least 2 years, and Keith Balderson remembers good yields.

Canola is a member of the Brassicaceae or mustard family and is similar to oilseed Rape. Rape was modified in Canada to make it edible by eliminating erucic acid and glucosinolates. The result was Canada oil, low acid rape, commonly known as canola. Seed of canola typically has 40-42% oil content but higher amounts are possible through breeding. Two varieties that are adapted to Virginia soils and climate, VSX-1 and VSX-2, have been developed at Virginia State University. Winter type canola varieties could replace wheat in a soybean-wheat-corn rotation. Summer types that are adapted to Virginia are under development and could some day replace soybean in the rotation. Soybean averages around 32 bu/A (1600 lb/A) and could produce about 320 lbs of oil per acre; whereas canola averages about 40 bu/A (2000 lb/A) in Virginia, and could yield up to 800 lb of oil per acre. With a lower content of saturated fatty acids and lower cloud point, biodiesel from canola feedstocks has better cold weather performance than soydiesel. With a lower iodine value canola biodiesel also has greater stability than soydiesel. Byproducts of vegetable oil biodiesel include meal and glycerin. Based on amino acid content canola meal has about 10% lower digestability than soybean meal but is usable in swine and poultry feeds. If processed into a food grade, the glycerin component can be a valuable byproduct and constitutes about 1/10 of the bioprocessing output.[28]

Furthermore, a current pilot demonstration by Virginia State University headed by Harbans Bhardwaj is demonstrating the growth potential of canola. The University received a grant to grow canola, purchase a small oilseed crusher, and a biodiesel reactor in order to demonstrate the ability of small scale production on a local scale.

A more detailed feasibility study would need to be conducted to determine Middle Peninsula potential to produce oilseed crops for the biodiesel market. A good model was completed by the Tennessee's Soybean Promotion Board, the Tennessee Farm Bureau, the Tennessee Department of Agriculture, USDA Rural Development, and the Tennessee Valley Authority. The group contracted the Agri-Industry Model and Analysis Group to conduct an economic feasibility study of producing biodiesel in Tennessee. The study concluded a 13 million gallon biodiesel plant was feasible and would use 9 million bushels of soybeans. After the study was completed, the question of producer interest in selling soybeans to a biodiesel facility arose. As a result, a study was conducted to examine Tennessee soybean growers' views on

[28] Shokes, Fred, et al. Virginia Tech Dean's Forum on Energy Security and Sustainability. 16 October 2006. "Canola – An Alternative Oilseed Crop for Virginia with Good Biofuel Potential." http://www.research.vt.edu/energy/Applications.html

biodiesel, their interest and capability to supply sufficient production to a biodiesel plant, and their interest in formation of a cooperative to produce biodiesel.

The survey is located in Appendix D, and is a good model if the determination to involve farmers to a higher degree than use is decided.

Appendix E contains some further information on biodiesel cooperative models that may make sense for Middle Peninsula farmers.

## VI. Factors Affecting the Continued Growth of Biodiesel

1. Limitations of biodiesel manufacturing

Factors affecting the impacting the continued growth in biodiesel production capacity includes:

- Biomass oil feedstock availability
- Biodiesel/diesel and glycerol prices
- Government regulations and incentives (see discussion in section 5).

The Energy Information Administration (EIA) uses a process-costing approach to model the impacts of net feedstock production costs plus capital and operating costs. The feedstock cost of the oil or grease is the largest single component of biodiesel production costs. Yellow grease is much less expensive than soybean oil, but its supply is limited, and it has uses other than fuel—for example, yellow grease is used as an animal feed additive and in the production of soaps and detergents.[29]

Further discussion on feedstock prices and manufacturing profitability is located in Section IV "biodiesel manufacturer."

Biodiesel prices are the most obvious and largest factor impacting biodiesel market penetration and viability, especially in the context of school bus fleet which suffer from ballooning fuel budgets and underfunded programs in the first place.

2. Costs and Difficulties Associated with Transition and Fuel

The major considerations include: basic fuel efficiency, infrastructure needs to accommodate alternative fuels; and cost of vehicle modifications.[30]

Basic fuel efficiency: Reflects both the differing energy levels per unit for each fuel and the fact that only unmodified or slightly modified diesel engines are needed, rather than engines specifically designed for alternative fuels. Luckily, biodiesel requires no modifications and engine operability is very similar to that of a diesel (in general, no mileage penalty experienced such as with ethanol).

Infrastructure needs: One major advantage of biodiesel relative to other low-emissions fuels is it can use the current diesel technology and equipment without modification. By contrast, changes in infrastructure required for alternative fuels can be substantial.

[29] Radich, Anthony. Biodiesel Performance; Costs, and Use. Energy Information Administration. 2004. http://www.eia.doe.gov/oiaf/analysispaper/biodiesel/index.html

[30] http://www.nbb.org/resources/reportsdatabase/reports/fle/19950701_fle-003.pdf

Cost of bus modifications: Costs for vehicle modifications related to biodiesel transition are very little. To make the transition to biodiesel a smooth one, follow Ric Hiller's (Arlington County) recommendations:.

- Clean fuel storage tanks thoroughly before filling them with biodiesel. Due to biodiesel's solvent effect, it will scrub off any deposits in the tank and carry them straight through to the pump and into your trucks' fuel tanks.
- Use 10-micron filters on fuel dispensers to catch tank deposits before they reach vehicle tanks.
- Stock plenty of primary and secondary fuel filters for any equipment that will use biodiesel. The cleansing property of biodiesel means filters will at first become clogged more quickly if the equipment's fuel tank and system contain sludge and sediment from years of diesel buildup.
- Educate drivers, equipment operators and technicians. Make sure they understand that if they notice any degradation in vehicle power, rough engine idling, etc., they should bring the vehicle into the shop immediately to replace the fuel filters. That will solve the problem 99.9% of the time.

3. Fuel Quality Issues
*Proper biodiesel handling practices, blending, and cold weather prep*

Assuming biodiesel comes out of a refinery meeting ASTM quality standards, the considerations for storage, handling and blending are different for biodiesel versus petroleum diesel. If improper blending techniques are used, an end user can end up with a very different blend level than expected. If the blend level is much lower than expected, the user is paying a premium for diesel fuel. If the blend level is much higher than expected, problems can occur because biodiesel is a good solvent and may loosen and/or dissolve sediments in fuel tanks and fueling systems left by conventional diesel over time.

B100 also freezes at higher temperatures than most conventional diesel fuel. Most soy-based B100 starts to cloud at around 35°F. As B100 begins to gel, the viscosity also begins to rise, and it rises to levels much higher than most diesel fuel, which can cause increased stress on fuel pumps and fuel injection systems. Improved cold weather properties are a major reason many people use biodiesel blends instead of B100.

B100 is not compatible with some hoses and gaskets. B100 may soften and degrade certain types of rubber compounds found in hoses and gaskets (i.e. buna N, nitrile, natural rubber) and may cause them to leak and become degraded to the point they crumble and become useless. This could cause a fuel spill on a hot engine, could ruin a fuel pump, or could result in filter clogging as the hose material gradually wears away.

B100 is not compatible with some metals and plastics. Biodiesel will form high sediment levels if contacted for long periods of time with copper or copper containing metals (brass, bronze) or with lead, tin, or zinc (i.e. galvanized surfaces). These high sediment levels may cause filter clogging. Diesel systems are not supposed to contain these metals, but sometimes they can occur anyway. In addition, B100 may permeate some typical types of plastics (polyethylene, polypropylene) over time and they should not be used for storing B100.

If oil distributors are educated on proper blending techniques, problems should be kept to a minimum. Virginia Clean Cities was recently awarded a grant from the National Biodiesel Foundation to conduct fuel quality education workshops, which should help alleviate this issue.

4. Environmental and Social Factors

As public pressure mounts to tackle global warming, air quality issues, and energy security, politicians will begin to respond by passing legislation favorable to alternative, renewable fuels development. As discussed below in the incentives section, policy measures are extremely effective in stimulating biofuels development. Virginia has not become as aggressive as some other states on alternative fuels policies, which have proven very successful.

5. Incentives

Scott Hughes, NBB Director of Government Affairs, testified at a Congressional hearing on alternative fuels and said two federal policy measures have been extremely effective in stimulating biodiesel's increased production and use. One is the Bioenergy Program, which stimulates crop use for energy production. The other is the biodiesel blenders tax credit, which passed in the JOBS Act of 2004. That incentive has been the primary stimulant since 2005 for the dramatic increase in new plants, jobs, and local investment in biodiesel, bringing economic opportunity to both rural and urban areas. Since it took effect, biodiesel producers have grown more than 4-fold. Today there are 105 plants capable of producing 864 million gallons of domestic biodiesel from coast to coast.[31]

Making biomass a viable industry would decrease the need for tax-supported agricultural and forestry support payments, generate jobs and tax revenues in rural communities, create cash flow back into rural areas, and in general revitalize rural economies.

Achieving these benefits sometimes takes government policies and incentives to direct, guide, or lead people in the desired direction.

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[31] Hughes, Scott. "National Biodiesel Board Testifies on Impact of Public Policy" National Biodiesel Board News Release. April 18, 2007.
http://www.biodiesel.org/resources/pressreleases/gen/20070418_alt%20fuels%20hearing%20nr2.pdf

## VII. Outlets for Continued Education of Stakeholders, Partners, and End Users

Use existing networks

- Local parks & recreations
- Local Chamber of Commerce
- RC&D councils
- School boards monthly meetings

Use marquee fleets and press

- Press release/conference whenever opportunity presents itself or create the opportunity

Hold a number of stakeholder meetings throughout the year (monthly, quarterly, etc.)

Create and publish a newsletter

- Update stakeholders on progress
- Outline how stakeholders can get involved
- Create a database of contacts

Participate in local events, festivals, meetings in the area

- Clean marina program
- Dragon Run Day
- Gloucester Daffodil Festival
- West Point Crab Festival
- Mathews Markets Days
- Urbanna Oyster Festival
- Annual events and meetings held in the area

Distribute quick guides and brochures developed as part of this project (see Appendix F)

- At fuel retailer outlets, community resource areas (recreation centers, nature centers, RC&D offices, government agency offices, etc.)

Biodiesel school curriculum

Provide technical support and outreach to commercial users

Organize an expert speakers bureau

Conduct biodiesel forums or include a biodiesel educational component in town hall meetings

Create resources specifically for marine (boating) and agricultural communities

Partner with environmental, agricultural groups, and “marquee” fleet

Find successful case studies and promote them

Form a biodiesel cooperative

## VIII. Summary and Conclusions

This first phase feasibility study is meant to assess market viability and stakeholder interest, and provide recommendations detailing the potential to fulfill project goal of providing economic benefit to the watershed community and, therefore, help to preserve natural resources in the sensitive watershed and sustain current land uses, predominantly agricultural, forestry and outdoor recreation. This report does not include recommendations for a final path or paths to take toward the goals.

Stakeholder meetings and survey results confirmed there is a lot of potential for biodiesel use and growth in the watershed and surrounding communities. Up to 16 distributors were identified, with only 6 confirming they had handled biodiesel in the past. Only 1 retailer of biodiesel was confirmed in the area, which can be used as a model for other retail locations.

The question of stakeholder interest is fairly easy to asses:

- Nearly half of fuel distributors already sell biodiesel
- One school district already uses biodiesel and another (Lancaster County) expressed interest in starting a pilot,
- The biodiesel refinery near West Point has attended every meeting and visited other stakeholders who have expressed an interest . Support from the refinery is key.
- Bay Transit wants to use biodiesel and is currently having a hard time finding it
- Thousand Trails Campground requested brochures and expressed desire to add biodiesel to their green marketing approach
- Phillips Energy is very aggressively pursuing biofuels including biodiesel and ethanol

This first-phase report is meant to provide a framework to assist the consultants and MPPDC in determining some potential directions and paths to consider in the next phases of the study and project. Foremost, however, this report provides support for the decision whether to advance the project to the next planned phase or rethink project objectives, a determination to be based in part on whether there appears to be adequate market viability and stakeholder interest in developing the biodiesel market . A positive conclusion seems obvious: clearly, whether biodiesel is promoted as a sustainable fuel practice and “can help save the dragon,” is used by farmers and school districts for cleaner air and reduced dependence on foreign oil, or is used as a catalyst for a cooperative initiative, biodiesel can provide economic, environmental, and social benefit to the Dragon Run watershed and Middle Peninsula communities, and stakeholder interest is strong.

## Appendix A.

*National Biodiesel Board Virginia Database of Biodiesel Distributors*

### Virginia

| Business Name/Location (Sort by Name, Sort by Blend) | Contact | Phone | Blend |
|---|---|---|---|
| **James River Petroleum**<br>10487 Lakeridge Pkwy<br>Suite 100<br>Ashland, VA 23005 | Google Maps | Bert Polk | 800-825-5599 | All |
| **Foster Fuels, Inc.**<br>113 Old Main Street<br>Brookneal, VA 24528 | Google Maps | Judy Peak | 434-376-2322 | All |
| **Woodfin Watchcard**<br>1156 River Road<br>Charlottesville, VA 22901 | Google Maps | Tim Earley | 804-355-7104 | All |
| **Domestic Fuels & Lubes Inc.**<br>400 Freeman Avenue<br>Chesapeake, VA 23324 | Google Maps | Buddy Ivey | 888-231-8540 | B100,B5,B10,B20 |
| **Culpeper Petroleum Cooperative**<br>15297 Brandy Road<br>Culpeper, VA 22701 | Google Maps | Kevin W. Corbin | 540-825-9651 | all |
| **Southern States Coop.Fredericksburg**<br>11324 Tidewater Trail<br>Fredericksburg, VA 22408 | Google Maps | Rick or Ernest | 540-373-3631 | B-20 |
| **TCH Oil**<br>73 Seafood Lane<br>Irvington, VA 22480 | Google Maps | Mike Christian | 804-438-5231 | |
| **Noblett Oil & Propane**<br><br>Kilmarnock, VA 22482 | Google Maps | | 800-633-4467 | B2 & up |
| **Noblett Appliance**<br><br>Kilmarnock, VA 22482 | Google Maps | | 800-535-0084 | |
| **Woodfin Watchcard**<br>3904 Bellson Park Dr.<br>Midlothian, VA 23112 | Google Maps | Tim Earley | 804-355-7104 | All |
| **Peoples Oil**<br><br>Montross, VA 22520 | Google Maps | | 800-633-4467 | |
| **Holtzman Corp**<br>5534 Main St<br>Mt Jackson, VA 22842 | Google Maps | Darren Swartz | 540-477-3131 | All |
| **Bagwell Oil**<br><br>Onancock, VA 23417 | Google Maps | | | |
| **Kilduff Oil**<br>691 Main St<br>Reedville, VA 22539 | Google Maps | Al Christopher | 888-276-3320 | B2,B5,B10,B20 |
| **Woodfin Watchcard**<br>1625 N. Hamilton St.<br>Richmond, VA 23230 | Google Maps | Tim Earley | 804-355-7104 | All |
| **Central Oil of Virginia**<br>240 Eastover Rd | Google Maps | Don Thacker | 540-483- | all |

| | | | | |
|---|---|---|---|---|
| Rocky Mount, VA 24151 | | | 5342 | |
| **Griffin Oil & Propane**<br>1224 Holland Road<br>Suffolk, VA 23434 | Google Maps | Chris Pond | 757-539-4761 | All |
| **Ware Oil**<br><br>Tappahannock, VA 22560 | Google Maps | | 800-633-4467 | |
| **PEP-UP**<br><br>Temperanceville, VA 23442 | Google Maps | Ralph S. Mathis, Jr | 757-824-0091 | |
| **Thrift Oil**<br><br>Urbanna, VA 23175 | Google Maps | Chappy Wake | 800-210-8735 | |
| **Northern Neck Oil Company**<br>11549 History Land Highway<br>Warsaw, VA 22572 | Google Maps | Carroll Pemberton | 804-333-3835 | B2-B20 |
| **Frederick Nothrup, Inc**<br><br>Warsaw, VA 22572 | Google Maps | Stan Terhune | 800-701-1033 | |

# Appendix B.

*National Biodiesel Board Virginia Database of Biodiesel Retail Locations*

## Virginia

| Business Name/Location (Sort by Name, Sort by Blend) | | Contact | Phone | Blend | Restrictions |
|---|---|---|---|---|---|
| **Quarters K Citgo Mini Mart**<br>801 S Joyce St.<br>Arlington, VA 22204 | Google Maps | Barbara | 703-979-0405 | B20 | M-F 5:30am - 7:30pm Sat. 7:30am - 6:00pm Sun. 9:30am - 6:00pm |
| **Village Green Exxon**<br>17456 Richmond Road<br>Callao, VA 22435 | Google Maps | Norman Faulkner | 804-529-7420 | B20 | 24 hours, all Major Credit Cards |
| **Woodfin Watchcard**<br>1156 River Road<br>Charlottesville, VA 22901 | Google Maps | Tim Earley | 804-355-7104 | B20 | 24/7 Call office to acquire an access card. |
| **Domestic Fuels & Lubes Inc**<br>100 E. Liberty Street<br>Chesapeake, VA 23324 | Google Maps | Buddy Ivey | 757-545-5100 | B10 | 24 |
| **Domestic Fuels & Lubes Inc.**<br>400 Freeman Avenue<br>Chesapeake, VA 23324 | Google Maps | Buddy Ivey | 888-231-8540 | B10 | |
| **Domestic Fuels & Lubes Inc.**<br>808 Professional Pl. W.<br>Chesapeake, VA 23320 | Google Maps | Buddy Ivey | 757-545-5100 | B10 | 24 |
| **Culpeper Petroleum Cooperative**<br>15297 Brandy Road<br>Culpeper, VA 22701 | Google Maps | Kevin W. Corbin | 540-825-9651 | B5 | |
| **Southern States Coop.Fredericksburg**<br>11324 Tidewater Trail<br>Fredericksburg, VA 22408 | Google Maps | Rick or Ernest | 540-373-3631 | B-20 | 24--7 ALL MAJORS |
| **Quarles Petroleum Inc.**<br>2301 Plank Road<br>Fredericksburg, VA 22401 | Google Maps | Debbie Ouellette | 540-371-1660 | B10 | All credit cards, 24 hours |
| **Royal Liberty Food Mart**<br>507 North Royal Ave<br>Front Royal, VA 22630 | Google Maps | Darren Swartz | 540-635-4880 | B5 | |
| **Duke's Liberty**<br>710 Port Republic Road<br>Harrisonburg, VA 22801 | Google Maps | | 540-434-8805 | B5 | |
| **Courtesy Service Station/Kilduff Oil**<br>7043 Northumberland Highway<br>Heathsville, VA 22473 | Google Maps | Kevin Brey | 804-580-8888 | B2 | Public pump |
| **Kilmarnock Bayco**<br>579 North Main Street<br>Kilmarnock, VA 22482 | Google Maps | Norman Faulkner | 804-435-3790 | B20 | 24 hours, all Major Credit Cards |
| **Leesburg Liberty**<br>2 Harrison St<br>Leesburg, VA 22075 | Google Maps | Jacque Gladu | 703-777-6600 | B5 | |
| **East End Exxon**<br>717 East Main Street<br>Luray, VA 22835 | Google Maps | Bobby Smith | 540-743-4993 | B5 | |
| **Middletown Liberty**<br>2135 Reliance Road<br>Middletown, VA 22645 | Google Maps | Darren Swartz | 540-869-2777 | B5 | |
| **Woodfin Watchcard**<br>3904 Bellson Park Dr.<br>Midlothian, VA 23112 | Google Maps | Tim Earley | 804-355-7104 | B5 | 24/7 Call office to acquire an access card. |
| **Holtzman Express STC**<br>250 Conicville Road<br>Mt. Jackson, VA 22842 | Google Maps | Darren Swartz | 540-477-2991 | B5 | |

| | | | | | |
|---|---|---|---|---|---|
| **Domestic Fuels & Lubes Inc.**<br>3455 Azalea Garden Road<br>Norfolk, VA 23513 | Google Maps | Buddy Ivey | 757-545-5100 | B10 | 24hr |
| **Finks Fueling**<br>2700 Victory Blvd.<br>Portsmouth, VA 23704 | Google Maps | Buddy Ivey | 757-545-5100 | B10 | 24 |
| **Kilduff Oil**<br>691 Main Street<br>Reedville, VA 22539 | Google Maps | | 888-276-3320 | B100 | Public pump, Monday - Friday, 8:00 am - 5:00 pm |
| **Woodfin Watchcard**<br>1625 N. Hamilton St.<br>Richmond, VA 23230 | Google Maps | Tim Earley | 804-355-7104 | B5 | 24/7 Call office to acquire an access card. |
| **Varina Pit Stop**<br>3275 New Market Rd<br>Richmond, VA 23231 | Google Maps | Justin Andress | 804-795-4213 | B20 | 24 hrs, all Major CC accepted |
| **Central Oil of Virginia**<br>240 Eastover Rd.<br>Rocky Mount, VA 24151 | Google Maps | Don Thacker | 540-483-5342 | | 7:30am to 7:30pm |
| **Ladysmith Pit Stop**<br>8270 Ladysmith Rd<br>Ruther Glen, VA 22546 | Google Maps | Justin Andress | 804-448-2217 | B20 | 24 hrs, all Major CC accepted |
| **Ruther Glen Pit Stop**<br>24270 Rogers Clark Blvd<br>Ruther Glen, VA 22546 | Google Maps | Justin Andress | 804-448-2217 | B20 | 24 hrs, all Major CC accepted |
| **Shenandoah Caverns Travel Ctr.**<br>1598 Caverns Road<br>Shenandoah Caverns, VA 22849 | Google Maps | Darren Swartz | 540-477-2442 | B5 | |
| **Domestic Fuels & Lubes Inc.**<br>600 Constance Road<br>Suffolk, VA 23434 | Google Maps | Buddy Ivey | 757-545-5100 | B10 | 24 |
| **Domestic Fuels & Lubes Inc.**<br>4869 N. Witchduck Road<br>Virginia Beach, VA 23462 | Google Maps | Buddy Ivey | 757-545-5100 | B10 | |
| **Tri-Cities Petroleum**<br>498 US Highway 23N<br>Weber City, VA 24290 | Google Maps | Jason Barger | 276-386-9075 | B20 | 24-7, Cash, cards, and fleet cards. |
| **Lee Jackson**<br>1026 Millwood Avenue<br>Winchester, VA 22602 | Google Maps | Darren Swartz | 540-667-3244 | B5 | |
| **Holtzman Express**<br>1511 Martinsburg Pike<br>Winchester, VA 22603 | Google Maps | Darren Swartz | 540-662-3719 | B5 | |

## Appendix C.

*USDA National Agriculture Statistics Service search of "Virginia Data – Crops. Year 2006-2007"*

| Table 1. County Summary Highlights: 2002 | | |
|---|---|---|
| **Source: http://www.nass.usda.gov/Census/Pull_Data_Census** | | |
| Geographic area ↑ | Item | Data |
| Virginia\Essex | Farms (number) | 127 |
| Virginia\Essex | Land in farms (acres) | 58,266 |
| Virginia\Essex | Farms by size - 1 to 9 acres | 1 |
| Virginia\Essex | Farms by size - 10 to 49 acres | 28 |
| Virginia\Essex | Farms by size - 50 to 179 acres | 48 |
| Virginia\Essex | Farms by size - 180 to 499 acres | 17 |
| Virginia\Essex | Farms by size - 500 to 999 acres | 15 |
| Virginia\Essex | Farms by size - 1,000 acres or more | 18 |
| Virginia\Essex | Total cropland (farms) | 102 |
| Virginia\Essex | Total cropland (acres) | 37,108 |
| Virginia\Essex | Total cropland - Harvested cropland (farms) | 75 |
| Virginia\Essex | Total cropland - Harvested cropland (acres) | 33,764 |
| Virginia\Essex | Irrigated land (farms) | 11 |
| Virginia\Essex | Irrigated land (acres) | 246 |
| Virginia\Essex | Selected crops harvested - Corn for grain (farms) | 45 |
| Virginia\Essex | Selected crops harvested - Corn for grain (acres) | 14,342 |
| Virginia\Essex | Selected crops harvested - Corn for grain (bushels) | 935,154 |
| Virginia\Essex | Selected crops harvested - Soybeans for beans (farms) | 51 |
| Virginia\Essex | Selected crops harvested - Soybeans for beans (acres) | 17,882 |
| Virginia\Essex | Selected crops harvested - Soybeans for beans (bushels) | 394,862 |
| Virginia\Gloucester | Farms (number) | 153 |
| Virginia\Gloucester | Land in farms (acres) | 25,699 |
| Virginia\Gloucester | Farms by size - 1 to 9 acres | 32 |
| Virginia\Gloucester | Farms by size - 10 to 49 acres | 56 |
| Virginia\Gloucester | Farms by size - 50 to 179 acres | 33 |
| Virginia\Gloucester | Farms by size - 180 to 499 acres | 18 |
| Virginia\Gloucester | Farms by size - 500 to 999 acres | 4 |
| Virginia\Gloucester | Farms by size - 1,000 acres or more | 10 |

| | | |
|---|---|---|
| Virginia\Gloucester | Total cropland (farms) | 119 |
| Virginia\Gloucester | Total cropland (acres) | 18,456 |
| Virginia\Gloucester | Total cropland - Harvested cropland (farms) | 93 |
| Virginia\Gloucester | Total cropland - Harvested cropland (acres) | 17,212 |
| Virginia\Gloucester | Irrigated land (farms) | 13 |
| Virginia\Gloucester | Irrigated land (acres) | 98 |
| Virginia\Gloucester | Selected crops harvested - Corn for grain (farms) | 39 |
| Virginia\Gloucester | Selected crops harvested - Corn for grain (acres) | 7,698 |
| Virginia\Gloucester | Selected crops harvested - Corn for grain (bushels) | 437,223 |
| Virginia\Gloucester | Selected crops harvested - Corn for silage or greenchop (farms) | 1 |
| Virginia\Gloucester | Selected crops harvested - Soybeans for beans (farms) | 34 |
| Virginia\Gloucester | Selected crops harvested - Soybeans for beans (acres) | 7,888 |
| Virginia\Gloucester | Selected crops harvested - Soybeans for beans (bushels) | 230,530 |
| Virginia\King and Queen | Farms (number) | 154 |
| Virginia\King and Queen | Land in farms (acres) | 58,876 |
| Virginia\King and Queen | Farms by size - 10 to 49 acres | 33 |
| Virginia\King and Queen | Farms by size - 50 to 179 acres | 55 |
| Virginia\King and Queen | Farms by size - 180 to 499 acres | 44 |
| Virginia\King and Queen | Farms by size - 500 to 999 acres | 12 |
| Virginia\King and Queen | Farms by size - 1,000 acres or more | 10 |
| Virginia\King and Queen | Total cropland (farms) | 138 |
| Virginia\King and Queen | Total cropland (acres) | 32,627 |
| Virginia\King and Queen | Total cropland - Harvested cropland (farms) | 109 |
| Virginia\King and Queen | Total cropland - Harvested cropland (acres) | 30,454 |
| Virginia\King and Queen | Irrigated land (farms) | 10 |
| Virginia\King and Queen | Irrigated land (acres) | 743 |
| Virginia\King and Queen | Selected crops harvested - Corn for grain (farms) | 47 |
| Virginia\King and Queen | Selected crops harvested - Corn for grain (acres) | 12,173 |
| Virginia\King and Queen | Selected crops harvested - Corn for grain (bushels) | 539,804 |
| Virginia\King and Queen | Selected crops harvested - Corn for silage or greenchop (farms) | 1 |
| Virginia\King and Queen | Selected crops harvested - Corn for silage or greenchop (acres) | (D) |
| Virginia\King and Queen | Selected crops harvested - Corn for silage or greenchop (tons) | (D) |
| Virginia\King and Queen | Selected crops harvested - Soybeans for beans (farms) | 60 |
| Virginia\King and Queen | Selected crops harvested - Soybeans for beans (acres) | 14,533 |
| Virginia\King and Queen | Selected crops harvested - Soybeans for beans (bushels) | 323,651 |

| | | |
|---|---|---|
| Virginia\King William | Farms (number) | 135 |
| Virginia\King William | Land in farms (acres) | 61,370 |
| Virginia\King William | Farms by size - 10 to 49 acres | 38 |
| Virginia\King William | Farms by size - 50 to 179 acres | 45 |
| Virginia\King William | Farms by size - 180 to 499 acres | 23 |
| Virginia\King William | Farms by size - 500 to 999 acres | 13 |
| Virginia\King William | Farms by size - 1,000 acres or more | 16 |
| Virginia\King William | Total cropland (farms) | 119 |
| Virginia\King William | Total cropland (acres) | 37,364 |
| Virginia\King William | Total cropland - Harvested cropland (farms) | 95 |
| Virginia\King William | Total cropland - Harvested cropland (acres) | 33,563 |
| Virginia\King William | Irrigated land (farms) | 19 |
| Virginia\King William | Irrigated land (acres) | 2,456 |
| Virginia\King William | Selected crops harvested - Corn for grain (farms) | 39 |
| Virginia\King William | Selected crops harvested - Corn for grain (acres) | 12,536 |
| Virginia\King William | Selected crops harvested - Corn for grain (bushels) | 736,966 |
| Virginia\King William | Selected crops harvested - Corn for silage or greenchop (farms) | 7 |
| Virginia\King William | Selected crops harvested - Corn for silage or greenchop (acres) | 1,048 |
| Virginia\King William | Selected crops harvested - Corn for silage or greenchop (tons) | 9,740 |
| Virginia\King William | Selected crops harvested - Soybeans for beans (farms) | 48 |
| Virginia\King William | Selected crops harvested - Soybeans for beans (acres) | 13,693 |
| Virginia\King William | Selected crops harvested - Soybeans for beans (bushels) | 299,715 |
| Virginia\Mathews | Farms (number) | 47 |
| Virginia\Mathews | Land in farms (acres) | (D) |
| Virginia\Mathews | Farms by size - 1 to 9 acres | 8 |
| Virginia\Mathews | Farms by size - 10 to 49 acres | 18 |
| Virginia\Mathews | Farms by size - 50 to 179 acres | 8 |
| Virginia\Mathews | Farms by size - 180 to 499 acres | 9 |
| Virginia\Mathews | Farms by size - 500 to 999 acres | 4 |
| Virginia\Mathews | Farms by size - 1,000 acres or more | - |
| Virginia\Mathews | Total cropland (farms) | 37 |
| Virginia\Mathews | Total cropland (acres) | 4,661 |
| Virginia\Mathews | Total cropland - Harvested cropland (farms) | 35 |
| Virginia\Mathews | Total cropland - Harvested cropland (acres) | 4,273 |
| Virginia\Mathews | Irrigated land (farms) | 6 |

| | | |
|---|---|---|
| Virginia\Mathews | Irrigated land (acres) | 117 |
| Virginia\Mathews | Selected crops harvested - Corn for grain (farms) | 9 |
| Virginia\Mathews | Selected crops harvested - Corn for grain (acres) | 1,179 |
| Virginia\Mathews | Selected crops harvested - Corn for grain (bushels) | 86,202 |
| Virginia\Mathews | Selected crops harvested - Corn for silage or greenchop (farms) | 1 |
| Virginia\Mathews | Selected crops harvested - Corn for silage or greenchop (acres) | (D) |
| Virginia\Mathews | Selected crops harvested - Corn for silage or greenchop (tons) | (D) |
| Virginia\Mathews | Selected crops harvested - Soybeans for beans (farms) | 9 |
| Virginia\Mathews | Selected crops harvested - Soybeans for beans (acres) | 1,978 |
| Virginia\Mathews | Selected crops harvested - Soybeans for beans (bushels) | 40,533 |
| Virginia\Middlesex | Farms (number) | 101 |
| Virginia\Middlesex | Land in farms (acres) | 21,216 |
| Virginia\Middlesex | Farms by size - 1 to 9 acres | 14 |
| Virginia\Middlesex | Farms by size - 10 to 49 acres | 40 |
| Virginia\Middlesex | Farms by size - 50 to 179 acres | 24 |
| Virginia\Middlesex | Farms by size - 180 to 499 acres | 14 |
| Virginia\Middlesex | Farms by size - 500 to 999 acres | 2 |
| Virginia\Middlesex | Farms by size - 1,000 acres or more | 7 |
| Virginia\Middlesex | Total cropland (farms) | 78 |
| Virginia\Middlesex | Total cropland (acres) | 15,193 |
| Virginia\Middlesex | Total cropland - Harvested cropland (farms) | 66 |
| Virginia\Middlesex | Total cropland - Harvested cropland (acres) | 14,055 |
| Virginia\Middlesex | Irrigated land (farms) | 10 |
| Virginia\Middlesex | Irrigated land (acres) | 651 |
| Virginia\Middlesex | Selected crops harvested - Corn for grain (farms) | 25 |
| Virginia\Middlesex | Selected crops harvested - Corn for grain (acres) | 5,734 |
| Virginia\Middlesex | Selected crops harvested - Corn for grain (bushels) | 402,788 |
| Virginia\Middlesex | Selected crops harvested - Corn for silage or greenchop (farms) | 1 |
| Virginia\Middlesex | Selected crops harvested - Corn for silage or greenchop (acres) | (D) |
| Virginia\Middlesex | Selected crops harvested - Corn for silage or greenchop (tons) | (D) |
| Virginia\Middlesex | Selected crops harvested - Soybeans for beans (farms) | 25 |
| Virginia\Middlesex | Selected crops harvested - Soybeans for beans (acres) | 6,172 |
| Virginia\Middlesex | Selected crops harvested - Soybeans for beans (bushels) | 147,423 |

**Appendix D.**
**Tennessee Soybean Producers' Views on Biodiesel Marketing – Survey**
*Source: http://beag.ag.utk.edu/pp/finalsurvey.pdf*

## GROWERS' VIEWS ON BIODIESEL PRODUCTION & MARKETING

The purpose of this study is to measure soybean producers' attitudes about biodiesel markets and formation of a cooperative to produce biodiesel from soybean oil in the West Tennessee area. Your response is important for obtaining an accurate measure of producers' views. Your participation is ***completely voluntary*** but will help us to serve you and other soybean growers. Only summaries of responses from the survey will be reported. Only researchers conducting the study will have direct access to the data. This questionnaire will take about 15 minutes to complete. You will be provided with an opportunity to request a copy of the study summary at the end of this questionnaire. We appreciate your participation.

### SECTION I. BIODIESEL MARKETS

Biodiesel is an alternative fuel that can be made from soybean oil. Blends of up to 20% biodiesel mixed with petroleum diesel fuels (B20) can be used in nearly all diesel equipment and are compatible with most storage and distribution equipment.

1. Please circle the rating that most closely matches your opinions on the following statements.

| | Strongly Agree | Agree | No Opinion | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| a. The U.S. markets for biodiesel will grow rapidly in the next 10 years | 1 | 2 | 3 | 4 | 5 |
| b. Biodiesel production will provide an important national market for soybeans in the next 10 years | 1 | 2 | 3 | 4 | 5 |
| c. If priced competitively with conventional diesel, I would be interested in using biodiesel from soybeans in a 20 percent blend on my farming operation. | 1 | 2 | 3 | 4 | 5 |

2. Do you believe that biodiesel from soybeans could be profitably produced in West Tennessee? (Circle the answer.)
   a. YES (Continue on to question 3.)
   b. NO Please indicate reasons why _____(Go to question 11)

3. Would you be willing to sell some or all of your soybeans directly to a biodiesel processing plant?
   a. YES (Continue on to question 4)
   b. NO (Go to question 11)

4. I would prefer to sell my soybeans to a processing plant that is (Please circle the answer):
   a. Privately owned (Continue on to question 5)
   b. Cooperatively owned (Go to question 6)
   c. No preference (Go to question 6)

5. Please indicate the number of bushels you (on an average year) would be willing to sell to a plant, then go to question 11.
   a. Through marketing contracts _____bushels
   b. On a spot basis (no contract) _____bushels

6. Please indicate the number of bushels you (on an average year) would be willing to sell to a plant (Continue on to question 7)

   a. Through marketing contracts _____bushels
   b. On a spot basis (no contract) _____bushels

## Section II. Cooperative Production of Biodiesel

7. Would you be interested in participating in a new generation cooperative to produce biodiesel?
   a. YES (Continue on to question 8)
   b. NO Please indicate reasons why _____ _____(Go to question 11)

8. What is the minimum percent per year you would find acceptable on any investment you made in a biodiesel production facility? _____% (for example, an 8% return would mean for every $100 invested, you would receive $8 per year). (Continue on to question 9)

9. At the rate you of return indicated above, and assuming a share price of $2.25 per bushel with minimum purchase of 2,500 shares or rights to deliver 2,500 bushels ($5,625 investment), would you be willing/able to purchase the minimum number of shares?
   a. YES (If Yes, continue on to question 10)
   b. NO (If No, go to question 11)

New Generation Cooperatives (NGC)
- Major focus is on "value-added" products, rather than commodities.
- Members sell raw products grown to their cooperatively-owned processing plant. Cooperative profits are then distributed back to members in proportion to raw product delivered.
- Shares allocate delivery rights so each share entitles & obligates a member to deliver soybeans to the cooperative
- Restricted or closed membership limits soybean deliveries to the amount the plant can absorb
- Investment may or may not include non-members. Investment by non-members is less than majority.

10. At the rate of return you stated in question 9, please indicate the number of additional shares you would be willing and able to purchase above the minimum of 2,500 (if none, indicate by answering '0')._____ additional shares (Continue on to question 11)

## Section III. Farming Operation and Producer Characteristics

11. Are you currently a member of an agricultural cooperative?
    a. YES b. NO

12. Acres of soybeans harvested in 2001 _____.

13. Please indicate the number of soybean bushels you can store on-farm. _____ bushels.

14. What percent of your soybeans do you typically sell through contracts? _____%.

15. Other acreage harvested or used on the farm(s) you operate in 2001

| | | | |
|---|---|---|---|
| a. Cotton | _____ | e. Pasture | _____ |
| b. Corn | _____ | f. Woodland | _____ |
| c. Wheat | _____ | g. Other (Please describe) | _____ |
| d. Other Crops Harvested (Please describe) | _____ | | _____ |

16. Number of livestock on your farming operation

| | | | |
|---|---|---|---|
| a. Beef Cows | _____ | e. Broilers | _____ |
| b. Milk Cows | _____ | f. Sows | _____ |
| c. Yearlings | _____ | g. Horses | _____ |
| d. Heifers | _____ | h. Other (Please describe) | _____ |

17. Your age in years _____.
Years experience farming _____.

18. For the farm(s) I operate, I am (Please circle the best answer)
a. A full owner (sole proprietorship)
b. A part owner in a partnership, family held corporation, or other corporation
c. A renter
d. Other (please describe): _____.

19. Net income from farming in 2001 (after taxes). (Please circle the best answer).
a. negative (less than $0)
b. $0-$9,999
c. $10,000-$14,999
d. $15,000-$24,999
e. $25,000-$34,999
f. $35,000-$49,999
g. $50,000-$74,999
h. $75,000-$99,999
i. $100,000-$149,999
j. Greater than or equal to $150,000

20. For every $100 of farm assets you have, how many dollars are financed with debt? (Please circle the answer).
a. $0
b. $1-$2.99
c. $3-$4.99
d. $5-$9.99
e. $10-$14.99
f. $15-$19.99
g. $20-$39.99
h. $40-$69.99
i. greater than $70

21. What percent of your household's income came from off farm sources in 2001 _____%

22. What is the highest education level you attained? (Please circle the answer).
a. Some high school or less
b. High school graduate
c. Some college
d. College graduate
e. Post graduate

END OF QUESTIONNAIRE. THANK YOU FOR YOUR TIME AND EFFORT.

_____Yes, I would like to receive a copy of the summarized results

Appendix E.
Cooperative Models and Case Studies

## Cooperatives

Piedmont Biofuels Coop
Pittsboro, North Carolina
Website: www.biofuels.coop

Piedmont Biofuels is possibly the largest biodiesel cooperative in the U.S. At the beginning of 2005, the membership was built from a small but dedicated group of about 25—backyard fuel-makers, advocates of sustainability, environmental stewards, supporters of local agriculture and commerce, and shade-tree mechanics. From there, the membership blossomed into a community of more than 200 by the end of 2006. Probably the largest biofuels Cooperative in the nation, Piedmont Biofuels has assumed a role as a flagship of the North Carolina grassroots alternative fuels movement. The support of the membership keeps the Coop financially healthy, drives the demand for B100 in the Triangle area of North Carolina, and generously provides the labor that turns their numerous construction and improvement projects into reality. Members take on projects from cold flow research to wash water treatment to greenhouse building, and contribute to the continuing transformation of the Moncure Research Farm.

The Cooperative facilitated the creation of a B100 community trail which provides B100 to coop members throughout the state of North Carolina. They also host a very successful internship program, build biodiesel reactors for coop members and organizations all over the nation using mostly recycled materials, provide fuel making training and other education, grow oilseed varieties for biofuels research, host events and tours, speak at many events throughout the nation, teach biofuels courses at Central Carolina Community College, and provide many, many more valuable contributions to the local and state community.

San Juan Biodiesel
Colorado
Website: http://sanjuanbiodiesel.com/index.php?inc=news.htm

San Juan Biodiesel (SJB) began as a cooperative and is now a new Limited Liability Company that seeks to construct a 5 million gallon per year (mmgy) oil extrusion and biodiesel manufacturing facility in the Four Corners area of Colorado. A coalition of farmers, diesel vehicle fleet owners, and community members came together in 2005 to form SJB. With generous funding from municipalities, a school district, ski resorts, foundations, and the state of Colorado, SJB completed a comprehensive feasibility study in January of 2006.

In 2006, SJB opened an office, contracted for 3,300 acres of sunflower crops; researched and selected vendors for oil extrusion, biodiesel manufacture, and other equipment; and

prepared a comprehensive business plan. By the beginning of 2008, SJB plans to commence operation of the facility using oil seed feedstocks stored from the 2006 and 2007 harvests.

SJB plans to initiate operations mainly selling sunflower oil into food markets. SJB will slowly move into production and integration of biodiesel into fuel markets (anticipated to initially encompass 5-10% of overall vegetable oil production, possibly including canola as well), permitting us to refine the quality monitoring and control capabilities so critical in ensuring the long term success of the biodiesel industry.

**Case Studies and Reports**

Michigan Biofuel Production Cooperative, Education & Outreach
http://www.biomich.com/Biodiesel_COOP_Plans.pdf

The report cited above delves into the many aspects of biodiesel chemistry, production technology, handling, safety, and cold weather use. Further, this report will delve into tax and regulatory issues which relate to biodiesel production, and finally, it will present a business model for a micro-scale production cooperative. Case studies, articles of incorporation, and other business modeling will be presented to lay-out somewhat of a road map to allow the startup of a small biodiesel club, commercial venture, or member owned cooperative.

An educational effort will accompany this report which will include a number of workshops and educational presentations. In addition, an educational web site has been created and will be maintained to promote biodiesel and present this information to the general public.

Appendix F.

*Example of quick guide that can be used at retail gas station selling biodiesel for public education*

## What is Biodiesel?

Biodiesel is a cleaner burning diesel fuel replacement. Although biodiesel includes the word "diesel," it contains no petroleum in its pure form. The word biodiesel combines the fuel's biodegradable material roots and it's use as a fuel in existing diesel engines. It can, be blended with any quantity of petroleum diesel because of the properties being so similar to diesel fuel. Biodiesel can also be used in boilers or furnaces as heating oil, or in any other diesel-fueled equipment.

Biodiesel is renewable, as biodegradable as sugar, and less toxic than table salt. Since biodiesel is made from renewable resources, it burns cleaner and is less damaging to humans and the environment. Biodiesel can be made from domestic renewable resources, which will decrease our dependence on foreign oil.

## Why Biodiesel?

It's Renewable: Unlike coal and oil which took millions of years to form, biodiesel is made from renewable biological resources.
It's Healthier: Biodiesel is healthier for the environment and your health because it reduces harmful tail pipe emissions.
It's Domestic: Biodiesel can help decrease petroleum imports because it can be made from domestic renewable resources.
It's Efficient: Biodiesel provides the highest energy content of any alternative fuel.
It's Easy: Any diesel vehicle will run on biodiesel with little to no modification and some monitoring during the transition.
It's Engine Friendly: Biodiesel has excellent lubricating properties and superior burn properties.
It's Carbon Neutral: Biodiesel has a closed carbon cycle, therefore contributes very little to global warming.

## Can I Use Biodiesel in My Existing Diesel Engine?

Biodiesel can be operated in any diesel engine with little or no modification to the engine or the fuel system. Before you fill up, keep a few things in mind:

- Biodiesel is NOT the same thing as raw vegetable oil. Fuel grade biodiesel must meet strict industry specifications. Be sure to buy ASTM spec biodiesel (your fuel provider should have this information).
- Biodiesel doesn't only burn cleaner; it's also a great cleaner. Biodiesel has a solvent effect that may release deposits accumulated on tank walls and pipes from previous diesel fuel storage. The release of deposits may clog filters initially and precautions should be taken. It is recommended after first switching to biodiesel that you check fuel filters often (especially during first 2 weeks).
- In older vehicles (in most cases, pre-1994), biodiesel's solvent effects may corrode natural rubbers (especially true if you intend on using B100). Check with the vehicle manufacturer as well as your mechanic in order to determine if any natural rubber hoses or seals need replacing before filling up with a high blend of biodiesel (You are probably safe if using a blend below B20).

## Where Can I Find More Information?

National Biodiesel Board
www.biodiesel.org
www.biodiesel.org/buyingbiodiesel/retailfuelingsites/default.shtm

Virginia Clean Cities
www.hrccc.org/biodiesel.html

Biodiesel Handling and Use Guidelines
www.nrel.gov/vehiclesandfuels/npbf/pdfs/40555.pdf

Clean Cities Virginia