Department of Agriculture, Trade and Consumer Protection
Division of Marketing
Agricultural Development & Diversification Program (ADD)

Grant Project Final Report

Contract Number: **16057**

Grant Project Title: **Technical and Market Feasibility of On-Site Bio-Diesel Manufacturing**

Project Beginning Date: **July 1, 2001** Project End Date: **June 30, 2002**

Amount of Funding Awarded: **$34,500.00**

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To the Grantee:

Please include this page as a cover sheet to your final report or create a cover sheet with similar information.

We have listed some guideline questions on the back of this sheet. You may find them helpful when writing your final report.

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Mail to: DATCP - Marketing - ADD Grants
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BUSINESS PLAN

HOMELAND DIESEL
Madison, Wisconsin

March, 2002

Prepared by:

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EXECUTIVE SUMMARY

I. Executive Summary

Bio-Diesel Systems, Inc. (BDS), in partnership with Woodridge Venture Group, LLC (Woodridge) and various other entities, is proposing to develop a network of three commercial scale manufacturing plants across the State of Wisconsin that will produce the bio-component portion of a proprietary brand of premium bio-fuel marketed as *Homeland Diesel*. The network is one part of a business strategy focused on introducing a new variety of bio-fuel additive into the U.S. marketplace that can be manufactured using a highly scalable and decentralized production process. The strategy seeks to develop manufacturing capacity at the following two levels:

- Small scale production on the farm using a fixed and/or mobile version of the system. Production levels in this segment will range from <&> to <&> gallons of bio-component annually.

- Large scale production in partnership with a regional distributor using a readily scalable commercial size plant. Production levels in this segment will average 1.0 million gallons of bio-component annually per plant. Scalability will be attained by adding presses to the manufacturing process as market demand dictates the need for increased production capacity.

The focus of this business plan is the development and commercialization of the latter larger scale commercial facilities. The three plants proposed for Wisconsin will have a total capacity of 3.0 million gallons of bio-component once they each reach full production in year 5 of operations. This bio-component can be splash or electronically blended with regular No. 1 and/or No. 2 diesel fuel to produce anywhere from 15 million gallons (80:20) to 60 million gallons (95:5) of bio-fuel depending upon the ratio of the blend, and the amount of oil processed into fuel[1]. The plants will each produce 17,500 tons of meal annually (52,500 tons combined) for sale primarily as animal feed.

Each plant will be developed as stand alone, turn key, operation. The three plants are targeted for development in the following strategic areas of the State:

- The south-central region to serve the Madison and Milwaukee markets. This region includes a pollution non-attainment area that can benefit from the introduction of a cleaner burning fuel such as *Homeland Diesel* into the marketplace.

- The west-central region to serve the Eau Claire, LaCrosse, and Minnesota markets. This region includes the Minneapolis-St. Paul area and should benefit from legislation recently passed by the State of Minnesota mandating a 2.0 percent blend of bio-diesel in the State's fuel supply by 2005.

[1] The base oil produced by the plants can also be sold into the marketplace for use in other food or industrial applications.

- The northeast region to serve the Green Bay and Fox Valley markets. This region includes a 23 county area that has been targeted by the Wisconsin Department of Administration, Division of Energy, for special consideration under the Focus on Energy Program. Businesses in this area qualify to receive low-interest loans and/or grants from the State for projects that promote the commercialization of biomass and other forms of renewable energy.

The key strengths of the business strategy, in terms of various types of project risk, can be summarized as follows:

Technology Risk

- The technology that will be used to manufacture *Homeland Diesel* was developed by the German company TESSOL GmbH in 1992, and was approved for a German patent in 1994 and an international patent in 1996. BDS maintains a non-exclusive license to manufacture and sell the product throughout North America.

- *Homeland Diesel* is registered with the U.S. Environmental Protection Agency (EPA) as a fuel additive, and meets the guidelines published by ASTM International for diesel fuel. Therefore, the bio-fuel will not void the engine warranties issued by the major diesel engine manufacturers.

Market Risk

- *Homeland Diesel* is cost competitive with other types of fuel additives and/or premium diesel fuels sold in the State. The product will be priced initially at $1.700 per gallon, which in a 95:5 blend results in a retail price at the pump of $1.289 per gallon. This price point is three cents higher then regular diesel fuel.

- *Homeland Diesel* will be marketed as a premium quality fuel that enhances engine lubricity, and generates more horsepower and better fuel economy then regular diesel fuel.

- Each of the plants will be developed in partnership with other business entities that provide access to the customer base for the bio-fuel and meal products that will be manufactured by the plant.

- The production is scalable, allowing the plant to manufacture an amount of product that closely matches the supply and demand conditions in the current market, and can be easily ramped-up with increasing demand.

- The plant is highly flexible in terms of its feedstock and can generate other products in additional bio-fuel. These characteristics offer the plant flexibility in responding to adverse fluctuations in raw material and diesel fuel pricing.

- *Homeland Diesel* is a quality product that is price competitive with other similar products in a Statewide marketplace that generates $829 million in proven sales annually. The total production capacity for the three plants represents between 1.8 and 7.2 percent of this total market. This is a mature marketplace, which is beginning to accept bio-fuels as an alternative to petroleum based products, and does not necessitate large expenditures of capital to create or move the market.

Operation Risk

- Each of the plants will be developed in partnership with other business entities that add value to the production process by providing access to infrastructure (including transportation and bulk fuel processing facilities); access to expertise in financially hedging prices for soybeans and meal; and access to other economies of scale through shared staffing and allocation of overhead. In return, the partners share in the profits they help generate and enhance their overall product diversification.

- Whenever possible, the plants will be sited adjacent to feed mills in order to avoid expensive trucking costs for the meal.

- The equipment used in the manufacturing process is produced by the German company Karl Strähle, GmbH, and is top quality with a proven operational track record in the European marketplace.

- The raw material inputs required by the production process are readily available from local suppliers at reasonable prices.

Financial Risk

- The equipment and other capital costs required to produce *Homeland Diesel* are substantially less then other competing products, including methyl ester based bio-diesel and other types of bio-fuel additives.

- The capital market is currently very good for commercial lending with the prime interest rate at 4.75 percent. The pro forma statements assume the plant's borrowed funds will be conservatively priced at 7.0 percent for a term of ten years. The plant will most likely receive better terms, particularly with the backing of a strong partner. In addition, the pro forma statements include a bankable level of working capital.

- The pro forma does not require government subsidies to generate a profit. Accessing these types of subsidies and/or low-interest government loans will only serve to increase profitability.

MARKET FEASIBILITY

HOMELAND DIESEL
Madison, Wisconsin

January, 2002

Prepared by:

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What Is Biodiesel?

Biodiesel is the name for fuels made from vegetable oil. Dr. Rudolf Diesel first used vegetable oil to fuel the world's first diesel engine in 1895. This new technology was showcased at the World Exhibition in Paris in 1900 using peanut oil as fuel.

Who Can Use Biodiesel?

Biodiesel can be used directly in any existing, unmodified diesel engine. Because it has similar properties to petroleum diesel fuel, biodiesel can be blended in any ratio with petroleum diesel. Currently, biodiesel in being used to power cars, trucks, buses, tractors, boats, locomotives, airplanes, heavy machinery, generators, and for home heating.

Engine Warranties

Manufacturer warranties' cover defects in material and workmanship, and these warranties extend to engines burning biodiesel. Warranties do not cover engine problems related to any type of fuel including traditional petroleum diesel. Manufacturers specify that fuel must meet certain criteria which may differ slightly basically follow the standards set by the American Society for Testing and Materials. The standard for diesel fuels is covered in section D975. The American Society for Testing and Materials looks at several specific properties of fuels such as: sulfur content, cetane number, and cloud point.

Several Original Equipment Manufacturers have done extensive testing on the effects of biodiesel on their engines. These include but are not limited to: Caterpillar, Cummins, Detroit Diesel, International, and John Deere.

Microeconomics of Biodiesel

An important factor that is not usually considered when calculating the costs and benefits of feedstock materials is the economic effect associated with locally produced, renewable energy sources. Economic benefits of a bio-fuels industry in the U.S. will include value added to the feedstock, an increased number of manufacturing jobs, an increased tax base from plant operations and income taxes, investments in plant and equipment, improvement of our trade balance, and reductions in health care costs due to improved air quality and lower greenhouse gas emissions.

Biodiesel has positive impacts on the state economy. An Iowa State University study concluded that three economic benefits would accrue from biodiesel. First, biodiesel expands demand for vegetable oil, causing processors to pay more for oil seeds. In addition, farmers near the biodiesel plant would receive slightly higher prices for their oil crops; and third, the presence of a facility that creates energy from vegetable oil would add value to the state's industrial and income-base.

Biodiesel has positive implications for production agriculture. A 1996 economic study published by the United States Department of Agriculture Office of Energy predicted that a modest, sustained annual market for biodiesel of 100 million gallons in the United States would contribute approximately seven cents to the price of each bushel of soybeans produced in the United States. Based on last year's harvested crop, the increase could have resulted in more than $168 million directly to the use of biodiesel.

Biodiesel has a positive impact on our balance of trade. A 1998 biodiesel lifecycle study jointly sponsored by the United States Department of Energy and the United States Department of Agriculture concluded that increased use of biodiesel would substantially benefit our economy. The report concluded that national spending to import petroleum sends significant amounts of dollars out of our domestic economy every year. Biodiesel offers the potential to shift this spending from foreign imports to domestically produced energy. The report notes: "With its ability to be used directly in existing diesel engines, biodiesel offers the immediate potential to reduce our demand for petroleum in the transportation sector."

Biodiesel contributes jobs to the local economy. Economic work conducted at the University of Missouri estimated the benefits of producing biodiesel in a metropolitan region. This study concluded that 100 million gallons of biodiesel production could generate an estimated $8.34 million increase in personal income and over 6,000 additional temporary or permanent jobs for the metropolitan region.

Obstacles of Proposed Biodiesel Production

- Market Acceptance
- Input Costs
- Meal Co-Product

Market Acceptance of Biodiesel

Biodiesel is not widely available or used in Wisconsin. As a result, it will be essential for the biodiesel industry to educate consumers about its product's benefits and potential applications. Further, oil crop growers are naturally skeptical of producing biodiesel because the market has not yet embraced this technology. It is likely that biodiesel will need to be widely accepted by the market before on-site biodiesel production readily occurs. On-site biodiesel production is essentially ahead of the market but is poised to grow in the near future.

Biodiesel's primary competitor is petroleum diesel, where, biodiesel is intended to replace petroleum diesel use in diesel fuel injection engines. Currently, petroleum diesel has over 99 percent of the market share of fuel sold to power diesel fuel injected engines. The main reason why petroleum diesel controls the diesel market is due to its cost and availability; biodiesel typically costs one and one-half times as much as petroleum diesel and is relatively unavailable.

Wisconsin's No. 2 Diesel Fuel Industry

- Wisconsin consumes over 2 million gallons of No. 2 diesel fuel per day and 800 million gallons per year.
- Diesel fuel demand is expected to increase steadily by roughly 5% each year over the next 5 years.
- No diesel fuel is produced in the state.
- The price of Wisconsin diesel fuel ranges from 1 to 6 cents higher than the national average.
- A large amount of fuel cost is the result of transportation.
- Fuel prices have risen over 20% in the last 5 years and are projected to rise at nearly the same rate over the next 5 years.
- The agriculture sector of the state's economy incurred $102 million in diesel fuel expenditures in 2000, a 48 percent increase from the previous year.

Table 1
Diesel Fuel Sales and Prices: 1996 to 2001

Year	Wisconsin		United States	
	Annual Sales (gallons)	Average Price	Annual Sales (gallons)	Average Price
2001	829 million	$0.9952	44,994 million	$0.941
2000	810 million	$1.062	43,673 million	$1.036
1999	825 million	$0.713	42,869 million	$0.685
1998	782 million	$0.61	40,580 million	$0.593
1997	772 million	$0.753	38,492 million	$0.745
1996	754 million	$0.795	37,506 million	$0.788

Source: United States Department of Energy: EIA's Petroleum Product Prices and Sales for United States.

U.S. Ester Based Biodiesel Industry

Unlike ester based biodiesel, Homeland Diesel is not refined; as a result, far less energy is consumed in its production. Additionally, the capital cost of ester based biodiesel makes on-site farm production using this technology much less economical.

- 10 million gallons produced in the U.S. in 2001.
- Slow to gain market acceptance due to its cost.
- Typically priced 50 percent higher than petroleum diesel.
- Few government subsidies; resulting in little market acceptance.
- Production facilities require high capital costs.
- Agriculture markets currently using 0.25 to 1 percent blends.

Input Costs

A central problem with commercializing biodiesel is that its input costs are higher than those of conventional diesel fuel. The market price of one gallon of vegetable oil alone is greater than $0.90. This compares to the costs of conventional diesel, which sells for nearly $0.75 per gallon wholesale.

There are several ways of potentially addressing the comparably high input cost of biodiesel. Listed below are several.

1. Use a blend of biodiesel and conventional diesel. Doing so allows the same benefits that result from biodiesel in its proportion of the blend, with costs that are more similar to those of conventional diesel.

2. Use waste yellow grease as the base oil in biodiesel instead of raw vegetable oil. Yellow grease is the waste product from frying foods in vegetable oil; it is sold as a commodity for about half of the cost of raw vegetable oil. If this strategy is used, the fuel additive will be required to be reformulated in order to work with yellow grease which has different chemical properties than cold-pressed vegetable oil.

3. Use solvent extracted oil as the base oil in biodiesel instead of cold pressed vegetable oil. Solvent extracted oil is sold as a commodity for roughly the same price as the cost to produce cold pressed oil. If this strategy is used, the fuel additive will be required to be reformulated in order to work with solvent extracted oil which has different chemical properties than cold-pressed vegetable oil.

4. Use biodiesel's ecological values as a basis for its use and/or sale.

Meal Co-Product

While input cost is a significant obstacle in the way of commercializing biodiesel, the oil seed meal is potentially an even bigger hindrance. Current production design results in meal accounting for over 80 percent of total finished product. As a result, on-site producers will either be required to feed their own livestock with this meal or sell it.

Future soybean meal prices are predicted to drop in Wisconsin as a result of increasing meal supplies. A large portion of this supply increase will result from a glut of distillers' grain entering the market; a bi-product from ethanol production. If this is the case, livestock farmers may be better off purchasing meal rather than producing it themselves.

Current Wisconsin Soybean Meal Industry

- Livestock industry is the biggest consumer.
- Standard and high grades widely available.
- Several commercial brands available.
- Price determined by the content of protein, bypass protein and fat.
- Higher protein and fat content meals receive price premiums.

Table 2
U.S. Soybean Meal Supply and Demand: 2000 to 2004

Year	2000/2001	2001/2002	2002/2003	2003/2004
Soybean Meal Price (per ton)	$173.60	$155.00	$155.00	$152.50
Total Supply (thousand short tons)	39,409	39,750	40,660	41,570
Total Demand (thousand short tons)	39,425	39,850	40,750	41,650

Source: USDA: http://usda.mannlib.cornell.edu/data-sets/baseline/2002/.

Department of Agriculture, Trade and Consumer Protection
ADD Grant Project Economic Impact Survey

Grant Contract #: **16057**

THE BIO CRUSHER SK 66, SK 150 (4 PRESS), SK 150 (8 PRESS)
ECONOMIC ANALYSIS

Cost of Operation ($/gal)	**SK 66**	**SK 150 4 Press Facility**	**SK 150 8 Press Facility**
Bio-Component Base Oil Costs (per gal)			
Cost of Seed-Feedstock	$1.2447	$1.2447	$1.2447
Cost of Additive	$0.3600	$0.3600	$0.3600
Capital Costs	$0.0251	$0.0225	$0.0225
Lease Costs	$0.0148	$0.0074	$0.0037
Labor Costs	$0.2954	$0.2585	$0.1662
Maintenance Costs	$0.0369	$0.0554	$0.0554
Electricity	$0.0268	$0.0268	$0.0268
Miscellaneous	$0.0074	$0.0185	$0.0092
Subtotal Bio-Component Base Oil Costs (per gal)	*$2.0111*	*$1.9937*	*$1.8884*
Savings on Animal Feed	($1.1117)	($1.1117)	($1.1117)
Total Bio-Component Base Oil Costs (per gal)	***$0.8995***	***$0.8820***	***$0.7768***
Bio-Diesel Fuel			
Bio-Component Base Oil	$0.1779	$0.1764	$0.1554
Regular Diesel Fuel	$0.5232	$0.5232	$0.5232
Transportation	$0.0250	$0.0250	$0.0250
Taxes	$0.5170	$0.5170	$0.5170
Profit-Retailer	$0.0500	$0.0500	$0.0500
Profit-Manufacturer	$0.0500	$0.0500	$0.0500
Total Bio-Diesel Fuel Costs (per gal)	**$1.3451**	**$1.3416**	**$1.3206**

Profit Analysis			
Total Gallons Produced	677,029	2,708,117	5,416,234
Profit-Retailer	$33,851	$135,406	$270,812
Profit-Manufacturer	$33,851	$135,406	$270,812
Total Profit	**$67,703**	**$270,812**	**$541,623**

Key Assumptions	
Price of Regular Diesel Fuel ($/gal)	$1.2590
Price of Soybeans ($/bu)	$3.80
Price of Meal ($/ton)	$180.00
Price of Additive ($/gal)	$3.00