

**FEASIBILITY STUDY & PRELIMINARY BUSINESS PLAN
FOR A MICHIGAN SOYBEAN CRUSH PLANT, SOYBEAN OIL REFINERY
AND/OR BIODIESEL PRODUCTION PLANT
IN GRATIOT COUNTY OR OTHER MICHIGAN SITES**

**PHASE 2 REPORT – FEASIBILITY OF A STAND-ALONE BIODIESEL PLANT
(WITH SOYBEAN CRUSH PLANT & SOY OIL REFINERY SUBJECT OF A PRIOR PHASE 1 REPORT)**

PREPARED BY



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FOR

**THE MICHIGAN DEPARTMENT OF AGRICULTURE
LANSING, MICHIGAN**

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I. STATEMENT OF WORK¹

The Grant Agreement between MDA and REMCO LLC & De Smet Ballestra states:

“The Michigan Department of Agriculture (MDA) is ... exploring the possibility of ... either a soybean crushing (**SC**) and/or a crude soybean oil processing, refining and esterification plant (**SOPREP**) or only a refined soybean oil esterification plant (**REP**) in Gratiot County, Michigan. Other Michigan sites for only a REP will also be explored as options. It is an objective ... to produce a finished biodiesel fuel product (B100) that meets standards specified under ASTM D-6751, prior to use as a commercial fuel or being blended with petroleum diesel fuel. It is expected that the annual capacity of the contemplated biodiesel facility would be 5 to 10 million gallons.”

The State of Michigan and MDA do not currently know the feasibility of the above-mentioned three options. In order to assist interested entities in building a manufacturing facility that produces neat biodiesel, there is a need to study the feasibility of the SC and/or SOPREP or only REP options.

¹ © 2006 Geoffrey S. Soares – This report has been prepared by Geoffrey S. Soares, President, REMCO LLC, 27980 Alpine Lane, Yorba Linda, California 92887, in conjunction with Martin L. Ross, Director – Marketing, REMCO LLC, with technical assistance from W. Wes Berry, Director – Technology, REMCO LLC and Timothy G. Kemper, President, De Smet Process & Technology Inc., Marietta, Georgia. Questions or comments regarding this report should be addressed to Mr. Soares (geofsoares@aol.com).

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II. BACKGROUND

This is best described by the following article published by the Michigan Department of Agriculture on their web-site (www.michigan.gov/mda) as part of The New Market Developer, Issue 1, 2005 (with highlighted sections shown for emphasis):



Issue 1, 2005

MDA Receives USDA Grant for Feasibility Study on a Soybean-Biodiesel Production Plant

MDA submitted an application in early February to USDA Rural Development for a Rural Business Enterprise Grant (RBEG) and will receive \$65,000. It is for technical assistance to **conduct a feasibility study and preliminary business plan development as well as to rapidly assess the development opportunities for a soybean crushing and biodiesel production plant in Wheeler Township, Gratiot County, Michigan.** MDA is conducting the project along with the Michigan Soybean Promotion Committee, Michigan Corn Marketing Committee, Capital Area Producers Cooperative (CAP Co-op), Michigan Farm Bureau and Gratiot County Farm Bureau, Greater Gratiot Development and MSU Extension/Gratiot County along with several individual farmers and agri-businesses. The CAP Co-op has its headquarters in Mason, as well as their subordinate elements, being the Capital Area Innovative Farmers Organization and Mid-Michigan Buyers Group. The CAP Co-op is a 501©7 organization consisting of 23 agricultural producers of corn, soybeans and other commodities, from various mid-Michigan counties, including Gratiot County.

MDA and its partners are exploring the possibility of a private business establishing a soybean crushing (SC) and/or a crude soybean oil processing, refining and esterification plant (SOPREP) or only a refined soybean oil esterification plant (REP) in Gratiot County, Michigan. It is their objective to produce a finished biodiesel fuel product (B100) that meets standards specified under ASTM D-6751, prior to use as a commercial fuel or being blended with petroleum diesel fuel. **It is expected that the annual capacity of the contemplated biodiesel production facility would be 5-10 million gallons.** MDA doesn't know the feasibility of its three options on an industry group building a manufacturing facility that produces neat biodiesel and other associated products and needs a professional study of the SC and/or SOPREP or only REP options. If any of these are proven feasible, it is estimated that between 10 and 60 full time jobs will be created by this new small and emerging, rural private business. These job numbers are the range from three nationally recognized consultants who provided competing bids on this feasibility study proposal.

The recommended firms to conduct the feasibility study are REMCO LLC and De Smet Ballestra. These two firms will also prepare a preliminary business plan, if the initial study demonstrates feasibility. They were successful bidders in a competitive bidding process of national firms vying to do the study last winter. **MDA and others will rapidly assess the development opportunities and challenges for Biodiesel Plant Production in Wheeler Township, Gratiot County, Michigan.** As the study progresses, further **alternative sites may be identified by MDA and others for REMCO and De Smet Ballestra to study as a**

result of such factors as proximity to lower cost feedstock or end-product markets, if the Gratiot County fully integrated project is not feasible.

The primary project area of interest is in the Gratiot County Renaissance Zone area in Wheeler Township and near McClelland Road. Gratiot County is a prominent agricultural county in mid-Michigan that is an economically depressed rural area. Wheeler Township has a population of 2,785 people.

The partnership's ultimate goal is to foster and sustain small rural farm business establishments and other rural businesses to examine the development opportunities of new emerging, soybean-biodiesel processing business operation in Wheeler Township of Gratiot County. Michigan small farmers and processors in the target area desire to participate in value-added processing business ventures and market their soybean commodities through a profitable value-added processing business. If they can sell their soybeans to a nearby soybean-biodiesel fuel processor, higher bids for their commodities and lower feed costs to livestock and poultry feeders who purchase protein concentrates may result. Value-added processing business ownership opportunities to small farmers may emerge. While the feedstock for the proposed biodiesel plant is expected to be primarily refined, virgin soybean oil, it is the intention of MDA to be flexible and obtain corn oil, recycled cooking oil from restaurants, yellow grease, animal fats from rendered livestock and other vegetable oils as secondary feed stocks for the biodiesel manufacturing facility. Without profitable, value-added markets, the future of Gratiot County's agricultural industry is dismal. Putting the Gratiot Renaissance Zone property into a productive use that provides basic value-added agriculture manufacturing investment and employment is a crucial step toward assuring mid Michigan's long-term economic viability and community growth. The State of Michigan recognized the social and economic challenges facing Gratiot County and Wheeler Township back in January 1, 1997 when following extensive community planning and economic development meetings, the Michigan Economic Development Corporation and Strategic Fund Board of Directors approved their Rural Renaissance Zone application and designated a "Gratiot-Montcalm County Renaissance Zone."

Background on Michigan's Ethanol and Biodiesel Situation Biobased products are non-food, non-feed agricultural chemical products provided as raw materials for various industries. The U.S. government has set the goal of tripling American use of bioenergy and biobased products by the year 2010. U.S. Department of Agriculture estimates that meeting this goal could create \$15-20 billion a year in new income for farmers and rural America and reduce annual greenhouse gas emissions. The growth in consumption of ethanol and biodiesel fuels, both nationally and within Michigan, has grown significantly over the past five years. As new production facilities are constructed to meet this expanding biofuels use, particularly here in Michigan with Caro's new Michigan Ethanol LLC facility now in operation, it behooves us to be keenly aware of the Michigan energy markets for the supply and demand of products coming from such facilities. New 50 million gallon a year ethanol plants are also being studied to be built in Michigan with some likely to break ground later this year.

While no biodiesel esterification/production facilities currently exist in Michigan, several organizations have made the switch to using soy-based biodiesel fuel in their fleet. These include the U.S. Postal Service, USDA, Michigan Department of Management and Budget, University of Michigan-Ann Arbor, St. Johns Public Schools, Ithaca Public Schools, Zeeland Public Schools, the Pictured Rocks National Lakeshore, Consumers Energy and others. An assessment of market demand for biodiesel fuel in Michigan will also be undertaken in cooperation with the Michigan Farm Bureau, Michigan Soybean Promotion Committee, Michigan State University Extension and others.

Both state soybean processors, Zeeland Farm Soya and Thumb Oilseed Producers Cooperative, have soybean oil refineries and Zeeland Farm Services now has storage and distribution for biodiesel fuel. As Gratiot County is situated midway between Michigan's two soybean oil processors, a development opportunity may exist there and should be analyzed if feasible biodiesel fuel demand exists or is forecast to soon exist in Michigan. Finally the Wheeler site appears to possess many of the developmental infrastructure pre-requisites that a commercial biodiesel manufacturing plant needs, including a nearby soybean and corn production base, railroad service, all-season road network, nearby access to natural gas pipeline, a willing labor force and other items. It does not have refined soybean oil or other

feedstocks, but these could be available from various soybean oil processors and others. Perhaps a closer relationship with an existing soybean processor in Michigan would be better than building another soybean crushing facility in mid-Michigan. Presently no biodiesel fuel is produced in Michigan, although the Michigan Soybean Promotion Committee states that 2003 biodiesel fuel consumption is 1 million gallons, more than double the 2001 consumption, and expected to grow rapidly.

While the feedstock for the proposed biodiesel plant is expected to be primarily refined virgin soybean oil, it is the intention of the MDA and its partners to be flexible and obtain corn oil, recycled cooking oil from restaurants, yellow grease or animal fats from rendered livestock as well as canola oil and other vegetable oils as feed stocks for the biodiesel manufacturing facility. Future demand and production of biodiesel fuel blends for the Michigan and U.S. automotive and truck industry also need to be examined with both the federal and state administrations interested in alternative fuels.

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III. EXECUTIVE SUMMARY – PHASE 1 / CRUSH PLANT & REFINERY

This study was made possible as a result of a grant (No. 791N5200816) awarded by The Michigan Department of Agriculture (MDA). Funding for the grant was provided by USDA Rural Development, Michigan Soybean Promotion Committee, Corn Marketing Program of Michigan, and numerous others identified in the earlier mentioned article published by MDA.

Michigan is currently exporting about 85% of its soybean production to crush plants in adjoining states, while at the same time importing soy meal into the state. This situation has prompted interest in evaluating the feasibility of a new soybean processing facility within the state. Simultaneously, the high price of petroleum fuels and the recent tax incentives for biodiesel, a renewable fuel substitute made from soy oil, has opened up the possibility of in-state biodiesel production as an outlet for the soy oil produced from a new in-state soybean processing facility.

This Phase 1 Report presents the results of the study evaluating the viability of a new soybean crush plant and soy oil refinery in Michigan. Results of the biodiesel plant evaluation will be the subject of a future Phase 2 report.

There has been a major transformation of the worldwide soybean processing industry during the past 15 years with even more rapid changes having occurred during the most recent 5 year period. Specifically, South America has overtaken the United States to become the predominant producer of soybeans. The expanding economies of Asia, and specifically China, have resulted in increased meat consumption and led to higher requirements for meal. China has chosen to significantly add domestic crush capacity and import soybeans rather than soy meal. Argentina has access to first class port facilities that allow for efficient loading & shipping of soy meal. Brazil continues to open up vast amounts of land in the interior of the country to soybean production and is expected to overtake the U.S. as the largest soybean producing country within a decade. During just the past 5 years, these three countries have together added crushing capacity equal to 75% of U.S. crush capacity. While a few independent farmer cooperatives have opened new crush facilities in the U.S. during the past few years, the biggest industry players have shutdown numerous domestic facilities so that total crush levels in the U.S. have stayed essentially flat.

Economies of scale become a significant factor in a commodity business such as soybean processing where cost containment is the key to success. This requires crush plants to be at least as large as the average U.S. plant, 2,500 tons per day. An integrated crush plant & refinery of this size would require a capital investment of \$56-78 million. Due to the small size of the in-state market for soy meal, a plant of this competitive size would have to export 70% of its meal production out of state, a task made even more difficult when one considers the three states just south of Michigan – Illinois, Indiana, and Ohio – presently export 50 times the meal currently imported by Michigan.

Moreover, construction of a biodiesel plant as an outlet for all of the oil from such a plant would require a facility with a capacity of 45 million gallons per year. Additional capital needed is estimated to be \$30-35 million, increasing total capital requirement for a fully integrated soybean

crushing (**SC**) and soybean oil processing, refining, and esterification (**SOPREP**) plant to \$86-113 million. A biodiesel plant of this size is 5-10 times larger than the 5 to 10 million gallon per year facility contemplated by the study and almost 20 times larger than the present 2-3 million gallons per year Michigan market.

A smaller 1,000 ton per day facility, somewhat larger than the existing 850 ton per day Zeeland Farm Soya plant in the state, would still have to export 26% of its meal and make 18 million gallons per year of biodiesel to avoid soy oil exports. Should future soy meal and biodiesel demand increase within the state, such a plant may become feasible. If this were to happen, the Gratiot County Renaissance Zone in Wheeler Township would merit serious consideration as a potential site for the facility. However, for reasons outlined in this report, considerable caution needs to be paid prior to making such an investment.

A 5-10 million stand-alone biodiesel facility, requiring \$7-12 million in capital investment, is better capable of meeting the goal of the study to establish a “small rural business” provided a market for the product can be established. Refined soy oil feedstock for such a plant is readily available from the Zeeland refinery as well as out of state refineries in Indiana and Ohio. The Phase 2 Report of the feasibility study will include a more in-depth analysis of this Refined Oil Esterification Plant (REP) option.

IV. UPDATE TO PHASE 1 REPORT

Subsequent to the issuance of the Phase 1 report, Michigan has seen significant progress in the development of additional in-state ethanol plants beyond the existing Michigan Ethanol plant in Caro, Tuscola County. There are four (4) new ethanol plants that have progressed to an advanced stage of permitting or have commenced construction. These include:

- Great Lakes Ethanol LLC, Riga Township, Lenawee County
- Superior Corn Products/US BioEnergy Corp, Woodland Township, Barry County
- Andersons Albion Ethanol LLC, Sheridan Township, Calhoun County
- Marysville Ethanol LLC, Marysville, St. Clair County

Total annual ethanol production capacity of these new Michigan plants is expected to be in excess of 200 million gallons. Associated annual production of distiller grains with solubles (DGS), used as feed for dairy, livestock, poultry and aquaculture, is expected to be 620,000 tons. The additional DGS from these plants is almost three (3) times the current annual in-state production of soy meal and forty percent (40%) larger than the annual in-state demand for soy meal. The increased supply of DGS as another animal feed will place further negative pressure on the viability of any new in-state soybean crush plant, and reinforces the earlier Phase 1 Report conclusion that a new soybean crush plant and soy oil refinery in Michigan is not presently feasible due to inadequate in-state demand for animal feed. In the future, there needs to be significant expansion of dairy, livestock, poultry and/or aquaculture in Michigan in order to make feasible a new soybean crush plant and soybean oil refinery of the scale considered in this Feasibility Study.

V. EXECUTIVE SUMMARY – PHASE 2 / STAND-ALONE BIODIESEL PLANT

Market Feasibility/Supply & Demand:

Michigan demand for biodiesel fuel is estimated to have increased threefold from 850,000 gallons in 2004 to 2,750,000 gallons in 2005. The ending 2005 demand is higher than what was earlier projected (approximately 2 million gallons) based on meetings conducted in Summer 2005 with some of the largest in-state biodiesel marketers. This is mainly the result of very high diesel fuel prices during Fall 2005 caused by petroleum refinery disruptions on the Gulf Coast as a result of hurricanes Katrina & Rita. It is estimated that annual biodiesel demand in Michigan 18 months in the future, which is the earliest that a new plant will likely come on-line, will be approximately 5 million gallons based on trend line growth. This estimate does not include any legislative mandates or in-state tax incentives to stimulate biodiesel consumption in Michigan.

There is significant existing biodiesel capacity nationwide (317 million gallons per year, mmgpy) with additional plants in construction or advanced stages of development (282 mmgpy). Total projected nationwide capacity far exceeds 2005 nationwide demand (75 mmgpy). There is presently one plant, Ag Solutions Inc., in Gladstone, MI (Upper Peninsula) that is in an advanced stage of construction. There are at least four additional plants under serious consideration for development including Michigan Biofuels LLC in Belleville, Biodiesel Industries LLC in Detroit, Milan Biodiesel Company in Milan (all three in Southeast MI) and Michigan Biodiesel LLC in Bangor (Southwest MI). There is one extremely large (80 mmgpy) potential biodiesel project under consideration by Louis Dreyfus in Claypool, Indiana, that could have a significant impact on MI biodiesel supply if it were in fact to move ahead.

Financial Feasibility:

Capital investment (including equipment purchase, construction cost, project design, development and management costs, and construction phase interest) for a 5-10 million gallon per year stand-alone biodiesel plant would be \$7-10 million for refined soy oil feedstock. Addition of yellow grease processing capability would add \$1-2 million to the capital cost. Working Capital (inventory and accounts receivable) requirements would be \$2-4 million for a 5-10 million gallon per year facility and would be a function of the pricing environment at any given time as well as the cash cushion required to handle fluctuating market conditions.

At a 12/13/05 CBOT price of 21 cents per pound (c/lb) for crude degummed soy oil and an estimated 4 c/lb markup over CBOT for delivered refined soy oil to the biodiesel plant, the cost of producing B100 biodiesel is estimated at \$2.34 per gallon (\$/gal). This production cost drops to \$2.24/gal after taking into account the benefit of the \$0.10/gal Small Agri-Biodiesel Producer Tax Credit. With an estimated diesel price of \$1.70/gal, a biodiesel marketer will be willing to pay a maximum of \$2.70/gal for B100 biodiesel based on the current \$1.00 per gallon Federal Biodiesel Tax Credit (which is presently in place until 12/31/08). Under this pricing scenario, even assuming a \$0.10-\$0.20/gal markup for the marketer for freight, handling costs, and profit,

the profit on B100 production is \$0.26-\$0.36/gal (= \$2.70 - \$2.24 - \$0.10/\$0.20). This operating margin is sufficient to pay interest cost and provide a healthy return to equity investors.

According to the U.S. Energy Information Administration (EIA), the historical average annual selling price of No. 2 distillate fuel in the United States is as follows:

- 1999 - 67.8 c/gal
- 2000 - 104.4 c/gal
- 2001 - 94.8 c/gal
- 2002 - 87.4 c/gal
- 2003 - 105.8 c/gal
- 2004 - 133.9 c/gal

The fluctuating price of petroleum diesel, which sets the price of biodiesel in a market with plentiful supply and where there are no mandates, puts variability on the price of biodiesel and consequently the profitability of biodiesel plants. However, EIA is projecting higher than historical average petroleum diesel prices, which bodes well for the long term economics of a biodiesel plant provided the Federal Tax Credit is extended well beyond the current expiration date of 12/31/08. In any case, economic returns should be judged against risk and investment in a biodiesel plant should be considered as a high risk portion of a long term investment portfolio.

Plant Size: Due to (a) limited size of the MI biodiesel market (b) risk involved with a biodiesel plant investment (especially with the number of plants being constructed), and (c) risk involved with any startup operation, it is recommended that the initial plant be sized at 5 million gallon per year capacity with some pre-investment for future addition of a second 5 million gallon per year facility as the biodiesel market continues to develop. By pre-investing in such items as the boiler and cooling tower, as well as the facility layout, any loss from economies of scale in capital and operating costs can be minimized. Further, if a technology vendor is selected that provides a process guaranty, such a plant will typically produce as much as 20% beyond design (or 6 mmgpy). With the right engineering expertise, capacity of process plants such as this can typically be further expanded an additional 20-25% (to 7-7.5 mmgpy) by upgrading selective equipment at nominal incremental capital expense.

In the event firm market contracts for B100 product can be put in place, or if there is a strong management team with prior marketing experience, then the risk of investing in a larger 10 million gallon per year facility can be reduced for the benefit of economies of scale. Such contracts would have to be structured to ensure they contain appropriate "take or pay" provisions.

Site Feasibility/Plant Location:

A number of potential sites were considered. Key factors in site selection include:

- proximity to low cost feedstock (such as a soy oil refinery),
- proximity to markets (Detroit, Grand Rapids, Flint, Chicago, etc.),

- rail & road access (rail less important in MI due to larger allowable on-road heavy duty truck loads),
- availability of skilled process plant labor,
- rural location (to qualify for a USDA loan guaranty),
- 6-10 acre site,
- free of environmental contamination,
- MI Renaissance Zone or Agricultural Processing Renaissance Zone designation,
- reasonably priced utilities,
- co-locating at an existing industrial facility, and
- ease of securing the necessary permits.

Michigan Biodiesel LLC has selected a site in Bangor, MI, a good low cost site meeting most of the key site selection factors listed above. A second site that is worthy of serious consideration is the Zeeland Farm Services site near Zeeland, MI that has many potential benefits, including the presence of a strong proven management and marketing team, if the right commercial transaction can be structured. In the absence of a soy crush plant and soy oil refinery, Gratiot County is an unlikely site at present unless one of the ethanol plants presently under consideration is actually built there to provide benefits of co-location for the biodiesel plant. Other sites in Michigan might similarly benefit and qualify.

Technical Feasibility:

There are numerous firms that offer biodiesel technology. In order to reduce technical risk, it is recommended that the process technology vendor selected have the following qualifications:

- established vendor with existing biodiesel plants to confirm the technology is proven,
- financially sound to provide a credible process performance guarantee (i.e. significant dollar penalty if plant performance is not met),
- technical personnel to assist with plant startup and quality problems to ensure the ASTM (American Society for Testing & Materials) D-6751 specification for B100 biodiesel is consistently met,
- R&D capability to develop improved technology for future incorporation into the plant as well as provide know-how to process difficult to process, low cost feedstock (such as turkey fat) in the event petroleum diesel prices were to drop and soy biodiesel is no longer profitable.

Four large vendors that meet these qualifications include:

- De Smet Ballestra,
- Crown Iron Works,
- Lurgi PSI, and
- Westfalia Separator.

Due to the number of biodiesel plants currently in development, some of these vendors may choose to focus on larger plant sizes at this time. Other process technology vendors might also meet the criteria above and should be evaluated on a case by case basis.

Construction risk can be mitigated by selecting a construction company that is able to provide a Performance and Construction Bond to ensure the plant is mechanically built to specification.

Based on review of MI DEQ regulations and an established history of biodiesel plants being constructed in many states (including California that has some of the strictest environmental permitting requirements), it is expected that the necessary environmental permits can be obtained if (a) an established technology vendor is selected and (b) a well qualified engineering consultant with first hand knowledge of Michigan permit regulations is retained to ensure the permit process is strictly followed.

Management Feasibility:

A project such as a startup biodiesel facility has three (3) stages, each of which requires a different set of management skills:

- project development phase
- construction phase, and
- plant startup and ongoing operating phase.

The initial project development phase requires (a) commercial skills to negotiate site agreement, technology license, construction contract, market contracts, etc. and to secure the necessary debt, equity, and grant financing, and (b) technical skills to ensure appropriate technology selection and front end process engineering.

The construction phase requires (a) project management experience to ensure construction costs are controlled and change orders are minimized and (b) technical construction skills to ensure the plant is being built to meet all necessary codes and specifications. If this phase is not managed effectively, the company could potentially run out of contingency funds before commencement of operations.

Finally, the ongoing operating phase will require skills in leadership and management, community experience, industry contacts, feedstock supply, commodity hedging, product marketing, process plant operations, environmental and safety management, maintenance, and biodiesel fuel quality control to meet ASTM D-6751 standard. To control costs, certain tasks such as legal and audit should be outsourced.

Total staff for operating the biodiesel fuel production and marketing business is estimated at 17 with an annual salary budget (excluding benefits) of \$775,000. This staffing plan includes three (3) management positions: (a) General Manager, (b) Commercial Manager, and (c) Plant Manager. The management team should be selected to ensure the necessary management skills outlined above are somehow covered by the three team members.