

**Project Title:**

West Michigan Regional Liquid Livestock Manure Processing Center Feasibility Study

**Identification of Organizations:**

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West Michigan Livestock Producer Group

West Michigan Livestock Producer Group (WMLPG) is a group of livestock farmers interested in the regional anaerobic digestion concept and who are potential sources of liquid manure. WMLPG is not a formal organization yet and as such, has no address and no Federal ID number.

**Authorized Negotiator and Grant Recipient:**

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**Management Summary:**

Michigan Allied Poultry Industries, Inc is the grant recipient and will be responsible for making sure all financial obligations related to the project are paid for in a timely manner. Charles Gould, Michigan State University Extension-Ottawa County, will be the educational resource and leader for the project. Frazier Barnes and Associates will be responsible for interpreting the information provided to them and summarizing their findings in a report. This report will serve as a decision making tool for the West Michigan Livestock Producer Group as to the appropriateness of moving forward in building a regional anaerobic digestion facility. However, the report will be made available to all livestock producers in Michigan via the web.

The regional anaerobic digestion project will be evaluated on the basis of several key factors that will be provided in the final report. These factors are as follows:

1. Sufficient feedstock availability.
2. Low cost of feedstock (including transportation costs).
3. Value of methane gas produced.
4. Value of co-products produced.
5. Capital and operation cost for regional anaerobic digestion facility.

These key factors will be further analyzed in a financial investment evaluation model. This model will address the following key issues:

1. There must be sufficient return on investment for the project to attract investment capital from regional livestock producers and others.
2. There must be a long-term contract for the primary product, methane gas, to reduce the product market risk to acceptable levels.

3. There must be a willingness by regional livestock producers to commit their livestock manure to this project for a sufficiently long period to reduce the feedstock supply risk to acceptable levels.

**Statement of Problem:**

Population growth into traditional agricultural areas and fields with excess soil phosphorus levels have caused West Michigan livestock producers to examine alternatives to cropland application for marketing and disposing of manure from their farms. In 2003, a study, partially funded by the Michigan Biomass Energy Program, was conducted for West Michigan Co-Gen, LLC to determine the feasibility of converting manure into energy products. The study found that direct fire combustion and gasification combustion technologies were best suited for poultry manure feedstocks (less than 35% moisture content) while other types of processing technologies were better suited to liquid livestock manure feedstocks (greater than 85% moisture content).

The study contains clear recommendations for converting dry poultry manure feedstocks into energy but does not address converting liquid livestock manure feedstocks into energy (liquid manure feedstocks were not included in the scope of the study and therefore not fully investigated). This project is a direct outgrowth of that study and seeks to determine the viability of converting large quantities of liquid livestock manure feedstocks into high quality methane using a centrally located (regional) anaerobic digestion processing plant.

Methane generation from animal agricultural biomass and technologies that improve air quality are priorities identified by the Michigan dairy industry (Gould has survey results). Both priorities would be addressed in this project.

**Work Plan:**

Frazier Barnes and Associates (FBA) will conduct a feasibility study for the West Michigan Livestock Producer Group (WMLPG) to determine the viability of a centrally located (regional) anaerobic digestion processing center to manufacture high quality methane from liquid livestock manure. A regional plant needs to be properly located to minimize the transportation distance from liquid livestock manure feedstock suppliers. This project would determine if a regional plant would have significantly larger economies of scale, lower capital cost, lower operating cost, higher product yields and improved product market access advantages that would offset higher transportation costs as compared to a farm-based anaerobic digester.

The study will focus on the following deliverables. The project team members will provide the deliverables shown below:

- A. Feedstock Availability (Provided by HFB and MSUE)
- B. Technology Factors (Provided by FBA)
- C. Product Market Factors (Provided by ZFS and MSUE)
- D. Financial Factors (Provided by FBA and MSUE)
- E. Management and Business Structure Factors (Provided by FBA)

- F. Recommendations for Commercialization (Provided by FBA with input from other team members)
- G. Written Report (Provided by FBA with input from other team members)

Study Methodology:

- A. Liquid Livestock Manure Feedstock Availability. A regional township-by-township liquid livestock manure feedstock availability analysis will be conducted in the following Western Michigan counties:
  - Ottawa County
  - Allegan County

The survey will reveal the volume of liquid manure produced in each county and the type of liquid manure produced (swine, dairy or beef).

- B. Technology Factors. A survey of anaerobic digestion technologies will be performed to determine all available technologies for this project. To be considered for use the technologies must meet these requirements:
  1. The technology must be an anaerobic digester.
  2. The anaerobic digester must not only be able to produce methane efficiently, but must either come with technologies or be adaptable to other technologies that can manufacture additional value-added products (ammonia, sulfur, compost, etc.).
  3. The selected technology must be designed to handle liquid manure or feedstocks with comparable moisture as liquid manure.
  4. The technology under consideration must be commercializable.

Using the above criteria, all available anaerobic digesters will be narrowed down to three using the following criteria:

1. Lowest capital costs per unit processed.
2. Lowest operating costs per unit processed.
3. Highest product yields per unit processed.
4. Highest value of products (methane, fertilizer) produced per unit processed.
5. Lowest economy of scale.
6. Greatest feedstock flexibility (ability to process multiple types of biomass feedstock).
7. Lowest environmental impact cost for processing plant.
8. Greatest potential electrical power yield.
9. By-product disposal/marketing costs.
10. Site requirements:
  - Proximity to existing biomass feedstock(s)
  - Utility requirements
  - Utilization of existing available infrastructure
  - Size of construction site

- Proximity to end-users of industry
- C. Product Marketing Factors. The two primary products, methane gas and fertilizer co-product(s), will be analyzed for the following:
1. Value of methane gas to regional large natural gas consumers
  2. Market access to regional large natural gas consumers
  3. Value of fertilizer co-products in:
    - Regional markets
    - Markets outside of feedstock procurement region (includes transportation costs)
  4. Federal and State tax credits or production credits associated with the production of “renewable” or “green” methane gas products.
- D. Project Financial Analysis. Pro forma financial projections will be provided for each of the selected anaerobic digestion conversion technologies. These pro forma projections will contain:
1. Feedstock requirements and anticipated transportation costs
  2. Conversion facilities operating costs (two sizes for each selected technology)
  3. Capital costs (two sizes for each selected technology)
  4. Methane and fertilizer product values/markets
  5. Return on Investment analysis
- E. Management and Business Structure Analysis.
- Management Requirements for Liquid Manure Conversion Project
    - General Management
    - Product Sales
    - Financial Management
    - Operations Management (Plant Operators and Maintenance Workers)
  - Business Structure Option Review
    - Producer-Owned (Closed Cooperative)
    - Privately Held Company
    - Closed Coop/Privately-Held Company
    - Other
- F. Project Commercialization Recommendations.
- Discussion of project commercialization steps
  - Recommended conversion technology supplier and facility size
  - Optimal location(s) of facilities
- G. Development of a written Feasibility Study Report for the project will be provided that fully examines all of the study deliverables described in this section.

### **Information Dissemination Plan**

Michigan State University Extension-Ottawa County will take the lead on information dissemination. The project has a projected start date of February 1, 2005. However,

activity related to the project will begin before February 1<sup>st</sup>. The results of the study will be made visible as follows:

1. A meeting will be scheduled for January 2005 to provide livestock producers with basic anaerobic digestion information and inform them about the purpose and objectives of the project. Projected attendance: 50 livestock producers.
2. If this project is deemed feasible:
  - a. A meeting for livestock producers will be scheduled for June 2005 and November 2005 (depending on harvest conditions). The June meeting will be a project update for producers on the Steering Committee. The November meeting will be for all producers where the study conclusions will be presented and a solicitation requested for producer involvement in implementing the study's recommendations for a regional anaerobic digester facility. Projected attendance at the June meeting: 10 livestock producers. Projected attendance at the November meeting: 50 livestock producers.
  - b. An educational program for MSU Extension agents and other governmental agencies that work with livestock producers will be scheduled for November 2005. The format for this meeting is to introduce them to the basics of anaerobic digestion and present them with the study conclusions. We will also discuss what the next steps should be and how to support the growth of regional anaerobic digesters in areas that can use this manure management technology. Projected attendance: 20 agriculture Extension educators.
  - c. An educational meeting will be scheduled with legislators from Allegan, Muskegon, Kent and Ottawa Counties sometime during October 2005 to present the study conclusions. Projected attendance: 5 legislators.
  - d. An educational workshop will be offered to agricultural Extension educators on anaerobic digestion and the study conclusions during the September 2005 Fall Extension Conference. Projected attendance: 20 agricultural Extension educators.
  - e. At least two meetings will be held (most likely in the Thumb region of the state and in Hillsdale County) sometime in early winter 2006 to share the results of this study with livestock producers. These are areas with heavy livestock concentrations. Hillsdale County livestock producers have already been exploring anaerobic digestion technology and want to get involved. Projected attendance in both locations: 50 livestock producers. It should be noted that this meeting is beyond the length of the grant. This is because the intent is to encourage others in the state to duplicate this project. In other words, outreach is ongoing.

3. It is assumed that this project is feasible. However, if the project is not deemed feasible:
  - a. A meeting for livestock producers will be scheduled for either early September 2005 or early December 2005 in Ottawa County, depending on harvest conditions, to present the study conclusions. Options will be discussed and a decision made as to the next step. Projected attendance: 50 livestock producers.
  - b. An educational program for MSU Extension agents and other governmental agencies that work with livestock producers will be scheduled for November 2005. The format for this meeting is to present them with the study conclusions and talk about what it will take to make anaerobic digestion work for agriculture. Projected attendance: 20 agricultural Extension educators.
4. The final report will be posted in PDF format on the MSU Extension-Ottawa County web site at <http://web4.msue.msu.edu/msuewc/ottawa/> no later than January 2006.
5. Articles will be written for submission to the popular farm press, county Extension newsletters, livestock commodity group newsletters (dairy, swine and poultry), county conservation district newsletters, local newspapers (Ottawa, Allegan and Kent), energy newsletters and through the MSU Extension communications department in February and November 2005.
6. One rough draft of a paper will be written and possibly submitted for inclusion to at least one national conference (possibly the 2006 BioCycle Biomass Conference) by December 2005.

If the project is deemed feasible, getting this information into the hands of livestock producers outside of West Michigan will be very important. The intent of this study is to generate information that can be used by other livestock producers to manufacture high quality methane, sort of a “cookie cutter” approach. The way this information will get into the hands of livestock producers is through informational meetings organized by the local agricultural Extension agent, two of which will be held around the state. It is assumed all the information necessary to help move interested livestock producers forward in the direction of anaerobic digestion will be discovered during this project and described in the final report. There should be no surprises.

**West Michigan Regional Liquid Livestock Manure Processing Center Feasibility Study Projected Timeline (Feb 05-Jan 06)**

	D e c 04	J a n 05	F e b 05	M a r 05	A p r 05	M a y 05	J u n 05	J u l 05	A u g 05	S e p 05	O c t 05	N o v 05	D e c 05	J a n 06
Projected start date			x											
Meeting with West Michigan Livestock Producer Group to promote project		x												
Conduct and summarize Allegan and Ottawa Counties Liquid Manure Feedstock Availability survey	x	x	x											
Conduct and summarize Anaerobic Digestion Facility Technical Evaluation		x	x	x										
Conduct Product Market Factors Analysis			x	x										
Develop Project Financial Analysis			x	x	x									
Develop Management and Business Structure Analysis					x	x								
Meeting with West Michigan Livestock Producer Group to present study results							x					x		
Quarterly progress report				x			x			x			x	
Final report released														x
Report posted on web														x
Articles written			x									x		
MSU Extension agents and others program												x		
Legislator meeting											x			
Extension Fall Conference										x				
Write paper and submit for publication												x	x	
Project completion														x

**Prior Experience Disclosure**

Frazier Barnes and Associates, Inc.

Frazier, Barnes & Associates (FBA) conducted a biomass co-generation for the University of Georgia. This project examined the feasibility of co-generating steam and electric power from biomass. The study examined four technologies, direct fire, co-firing with coal, gasification, and pyrolysis. Extensive information on numerous biomass fuels was gathered including fuel composition, availability, transportation costs, and storability. Fuels such as animal waste, wood wastes and energy crops were included in the scope of the work.

Frazier, Barnes & Associates also worked with a group of producers in the Western Michigan region to analyze the feasibility of converting solid animal waste to energy. The scope of work included a thorough analysis of animal populations and the quantity of waste generated in the study region, including poultry litter and the solids from dairy and swine manure. The study area included those counties that are the focus of this proposed anaerobic digestion study (Allegan and Ottawa Counties). The feasibility study determined that the best technologies for converting solid animal waste to energy were either gasification or direct combustion.

FBA is currently working on a biomass conversion to energy study in Western Illinois. This project is partially funded by the Illinois Clean Energy Foundation and focuses on the conversion of biomass to energy to supply the energy requirements of an ethanol plant. The goal of this study is to improve the value of the existing co-products and create additional co-products which have readily available markets. The quantities of corn stover, corn bran, and other regionally available biomass feedstocks are being determined. Five technologies are being reviewed for this study are co-firing, direct combustion, gasification, pyrolysis, and anaerobic digestion.

#### MSU Extension

Charles Gould served as an educational information resource for the West Michigan Co-Gen LLC project. Over the past four years he has attended alternative energy conferences all around the Upper Midwest in an effort to become an information resource for farmers on green power, anaerobic digestion and compost production. While not an expert on the subject, he has a working knowledge of anaerobic digestion.

#### **Project Team Personnel**

*Rod Frazier – Frazier Barnes and Associates (FBA).* Rod Frazier is the President of FBA and has over twenty-five years' professional engineering, operational and research experience in Agribusiness. He has extensive manufacturing and engineering skills developed for renewable fuel production plants, corn fractionation, and oilseed extraction. Mr. Frazier is an industry leader in the research and commercialization of value-added processing technologies and is a frequent speaker at agri-industry conferences, a consultant to University research teams, and an authority on the agricultural food chain process. He received his bachelor's degree in agricultural engineering (with honors) from the University of Illinois, and his masters of business administration, also from the University of Illinois. He is a registered Professional Engineer (P.E.).

#### *Brian Terborg – Zeeland Farm Soya (ZFS)*

Brian is Vice President of Zeeland Farm Soya and the landfill gas project manager for ZFS. ZFS operates the largest soybean processing facility in Michigan. Located in Zeeland, Michigan, ZFS operates an 800 tpd soybean processing and vegetable oil refinery. ZFS has made the commitment to renewable energy supplies by constructing a seven (7) mile pipeline to the Autumn Hills Landfill. This pipeline will be utilized to deliver landfill gas from the landfill to ZFS processing plant where it will be utilized to

supply a cogeneration facility that will produce both steam and electricity. ZFS is a potential consumer of methane from the regional anaerobic digester facility.

*Brandon Hill – Hamilton Farm Bureau (HFB)*

Brandon is a nutrient management consultant and assists HFB clients to develop nutrient management plans. HFB is a \$125 million per year cooperative headquartered in Hamilton, MI. With over 5,000 producer stockholders, HFB is one of the largest agricultural producer-owned businesses in Western Michigan. HFB has a feed mill located in Allegan County that services regional livestock producers. HFB's stockholders have asked them for help in solving manure management problems. Involvement in this project is one way they are trying to address this critical issue.

*Charles Gould – Michigan State University Extension (MSUE)*

Charles is an Extension agent that works with farmers on manure management issues in five counties across Western Michigan.

*George House – Michigan Allied Poultry Industries (MAPI)*

George is the Executive Director of Michigan Allied Poultry Industries, a non-profit trade organization for the Michigan poultry industry. He was involved in the co-gen project that was partially funded by MBEP and handled the fiduciary responsibilities associated with that project.

**Project Time Frame**

The feasibility study shall be completed in twelve (12) months after authorization to proceed has been provided. The projected time frame is from February 1, 2005 to January 30, 2006.

**BUDGET TOTAL**

The cost of the study will be \$60,000. Thirty thousand dollars (\$30,000) will be supplied by a MBEP Grant. The remaining \$30,000 will be supplied as in-kind study services supplied by MSUE, WMLPG and ZFS. Their in-kind contribution amounts will be:

MSUE - \$10,000  
ZFS - \$10,000  
HFB - \$10,000

FBA shall receive \$29,500 for the following study deliverables supplied by the:

- Overall Project Feasibility Study Management
- Technology Investigation and Analysis
- Project Financial Analysis
- Management and Business Structure Analysis
- Project Commercialization Recommendations
- Development of Feasibility Study Report.

The \$29,500 FBA fee will include all travel and related expenses. Michigan Allied Poultry Industries, Inc. shall be compensated \$500 for handling the fiduciary responsibilities of this project.