

Developing a Community Manure Digester Model for Wisconsin

Submitted By:

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EXECUTIVE SUMMARY

Introduction

This feasibility study sought to develop business models for jointly owned manure digesters that are applicable to areas of Wisconsin served by the Focus on Energy program. Such development of the model is critical to ensure its applicability throughout the state.

Method

Research conducted for this feasibility study included identifying appropriate potential sites; analyzing the inputs and outputs at these sites, their transportation characteristics and interconnection requirements; and conduct a financial analysis to determine the financial feasibility of a jointly owned manure digester at one or more of the sites.

Results

We identified suitable locations in Pepin County and Buffalo County and analyzed their manure inputs and potential electric outputs as follows:

	Lima Township (Pepin Co.)	Mondovi Area (Buffalo Co.)
Number of Cows	2,000	1,032
Manure Inputs to System	36,000 gals/day	18,576 gals/day
Electricity Generated	5.044 m. Kwh/yr	2.602 m. Kwh/yr

As a result of this analysis, we realized that one of the two sites, Mondovi, did not have sufficient inputs and outputs to justify continued in-depth analysis. For that reason, the feasibility study focused solely on the Lima Township in Pepin County site. With the help of a local manure hauler, we estimated transportation costs to be more than \$150,000 annually.

With the help of Bob Molde of Xcel Energy, we estimated the costs for interconnection to be approximately \$120,000 and identified an appropriate purchase price of \$.0494 per kWh.

Electric generation was estimated on the basis of report on actual results from the Vir-Clar Farm in Fond du Lac presented to the Wisconsin DATCP Biogas Development Group by Biogas Direct, which uses a complete mix digester system.

The study also examined the implications for project economics of higher buyback rates than are currently available from Excel. Two utilities in Wisconsin that participate in Focus offer better rates than Excel. Both Alliant and WE Energies offer an experimental buyback rate for biogas derived electricity that is equivalent to an average rate of 6 cents per kWh.

Discussion

This study determined that a manure digester jointly owned by five farms and located at the Bruner Farm on Hwy 10 in Pepin County, Wisconsin within the Excel service territory would experience a net loss for the first ten years of operation, but after that would generate annual profits.

Furthermore, the financial analysis developed for this feasibility report indicates that the project requires *grant subsidies to make it financially feasible*. Maximum funds from Focus on Energy and the USDA Section 9006 federal grant program, and an additional \$150,000 from the VAPG federal grant program are used to provide a total of \$730,000 (or 34%) of the capital needed for start-up.

If a higher buyback rate for electric generation were available, as is the case with two Wisconsin utilities that offer an experimental rate for electricity from biogas, the project economics improve substantially. Project organizers evaluated two models: one that did and one that did not receive federal subsidies.

Introduction

This project had two major components:

1. The first component of the project was to evaluate the feasibility of a jointly owned manure digester system in Dunn County, Wisconsin, jointly owned by four dairy farms located within a ten-mile radius. An interim report was submitted to Focus on Energy in March 2005 which described the methods and results of this first component of the project, and included the Executive Summary of the draft feasibility report. This component was funded primarily by Wisconsin DATCP's Agricultural Diversification and Development (ADD) program.
 - ◆ Since the completion of the draft feasibility report, performance data has become available from the manure digester system, manufactured by Microgy, located at the 5-Star Dairy in Dunn County. This data has been used to clarify the projected output and financial performance of the jointly owned digester. Now that the feasibility report has been finalized, it has been submitted to DATCP's Agricultural Diversification and Development (ADD) program. *It is also submitted as an addendum to this final report to Focus on Energy.*
2. The second component, funded primarily by Focus on Energy, sought to develop business models for jointly owned manure digesters that are applicable to other areas of Wisconsin. Such development of the model is critical to ensure its applicability to other situations in the state. This report discusses the methods and results of this second component.

Methods

The following activities were conducted for this phase of the research:

- A. Identify appropriate sites in Focus on Energy territory (Mondovi area in Buffalo County and Lima Township in Pepin County) to analyze as potential sites for jointly owned manure digester systems;
- B. Analyze the manure inputs, outputs of digested products, and potential electrical generation at the two sites;
- C. Conduct site-specific transportation analysis at the sites;
- D. Evaluate regulatory and interconnection requirements at chosen feasibility sites;
- E. Assess the advantages and disadvantages of different types and manufacturers of manure digester technologies and determine their applicability to community owned models.
- F. Analyze legal and organizational options for ownership of community digesters and their impact on utilization of the PTC;
- G. Conduct a financial analysis, using the model developed in the Dunn County study, to assess the financial feasibility and performance of a community digester at the site.

Results

Identification of Farms and Interconnection Sites

In order to extend the scope of analysis of the feasibility of a community manure digester for locations in Wisconsin beyond that done for Dunn County, the study team sought to

identify suitable sites in other counties. Because this portion of the study was funded by the Focus on Energy program, which includes only some of the state's utilities, we sought only locations within the service territories of participating utilities.

With the aid of Jim Faust, Extension Agent for Dunn County, we identified potential sites around the state then contacted local Extension agents for more information. Using the following criteria, we identified suitable locations in **Pepin County** and **Buffalo County**:

- ◆ dairy farms of large herd size,
- ◆ located within a few miles of each other, and
- ◆ within the service territory of a suitable utility

In addition to providing information about local dairy farms, the Extension Agents in Pepin and Buffalo counties assisted in surveying the locations and interviewing dairy farmers.

Pepin County

Lima Township in Pepin County was identified with the help of Bob Cropp, Extension Agent for the county. This Township has a concentration of more than 2,600 milking cows among six farms. Some of these farms are in Xcel Energy service territory and could serve as either host of a digester or contributor of manure.

Only five of the six Lima Township farms were interested in the project. These are:

- ◆ Knoepke farm (500 cows)
- ◆ Prissel farm (300 cows)
- ◆ Bruner farm (300 cows)
- ◆ Bauer farm (200 cows)
- ◆ D & D Weiss farm (700 cows)

Total cows = 2,000

Buffalo County

We identified two areas served by Xcel Energy with dairy farm concentrations in Buffalo County: the bluff east of Alma on the Mississippi and around the town of Mondovi. After investigating the Alma bluff area, we decided it has an inadequate concentration of dairy cows and did not pursue this site further.

We selected the Mondovi area for further study since it has upwards of 1,100 cows distributed among four farms. The largest town in the area was situated just at the edge of the town of Mondovi and had generated odor complaints from town residents. Mondovi also is home of Mondovi Foods, which processes chicken and turkey offal into pet food flavoring. This facility has a storage pit for wastes and then landspreads the waste. Our thinking was that this facility could also contribute to or host a digester.

The Mondovi area farms in Buffalo County are:

- ◆ Schmittkneidt farm (482 cows)
- ◆ Heike-Weber farm (100 cows)
- ◆ Castleholm farm (100 cows)
- ◆ Hake-Manfer farm (350 cows)

Total cows = 1,032

Please see the attached spreadsheet that describes the number of cows, bedding materials, manure management practices, and future issues faced by each farm.

Analysis of Manure Inputs, Outputs, and Electrical Generation at Sites

The chart below shows our analysis of the manure inputs and estimated electrical generation at each site:

	Lima Township (Pepin Co.)	Mondovi Area (Buffalo Co.)
Number of Cows	2,000	1,032
Manure Inputs to System	36,000 gals/day	18,576 gals/day
Electricity Generated ¹	5.044 m. Kwh/yr	2.602 m. Kwh/yr

As a result of this analysis, we realized that one of the two sites, Mondovi, did not have sufficient inputs and outputs to justify continued in-depth analysis. We had learned in the previous feasibility study for Dunn County that 1,000 cows are too few to make a project feasible. *For that reason, the remaining analysis concentrates solely on the Lima Township in Pepin County site.*

Transportation Analysis

For the Dunn County feasibility study, we developed a model for transportation analysis that utilized MapQuest to determine hauling distances. Although we were prepared to conduct a similar analysis for this feasibility study, initially we contacted a manure hauler in Durand Wisconsin (Chris Lindstrom of Practical Applications LLP) who had lived and worked in that area all his life. In addition to being personally acquainted with the Lima Township farmers, he has worked with each in the past. Thus he was very familiar with their operations and locations.

Based on his personal knowledge of the area, Chris developed an estimate of what he would charge for hauling manure between the Lima Township farms and the digester, using the following assumptions:

- ◆ Base price of \$65 per hour for hauling.
- ◆ Gasoline is included in that price, up to \$2.00 per gallon. Surcharge of 1% per \$.10 price per gallon over \$2.00.
- ◆ Estimated time per day for hauling is 6 hours.²

Chris estimated an annual fee of \$149,467.50 (calculated with gas at \$2.80 per gallon). Given the high price of gas, we increased his estimate using \$3.00 per gallon, and came up with a total of \$156,585.00. This is the figure we used in the financial projections for the first year of operations, and added an inflation factor for each succeeding year.

¹ Biogas Direct, Wisconsin DATCP Biogas Development Group

² This includes time spent loading and unloading, a problem easily overlooked that has caused cost overruns for some other jointly owned manure projects.

Assessment of Regulatory and Interconnection Requirements

CDS consultant Chris Deisinger contacted Bob Molde of Xcel Energy, who offered his assistance in identifying interconnection requirements and opportunities in Lima Township in Pepin County. Two of the farms, the Bruner and Bauer Farms, are within Xcel service territory and could be the host site for a digester and generator.

The Xcel distribution system in this area is robust and could easily accommodate connection at primary voltage level of gensets equivalent to 1.5 MW or above, which Molde felt should be adequate for the scenarios being considered. A substation would not be required, but protection and switching equipment would be necessary. Because the farms are presently served by single-phase service, an upgrade to three-phase service would be required. Three-phase service is available along Highway 10, which is 1.1 mile to the south of the Bruner Farm and 1.7 miles to the south of the Bauer Farm.

Molde estimated the cost of switching and protection equipment to be in the range of \$50,000 and the cost of running a three-phase line to be \$60,000 to \$70,000 per mile. Locating the generator at the Bruner Farm would require total connection costs of about \$120,000. This is the figure used in the financial analysis for interconnection costs.

Discussions with Dave Donovan of Xcel Energy's Eau Claire office indicate that an appropriate buy back rate would be **\$.0494 per kWh** for connection at primary voltage under the company's PG-1 Parallel Generation Tariff. This rate is an average of the on-peak and off-peak rates. The cost of purchasing a time-of-day meter would be \$278.

Assessment of Different Types of Manure Digester Systems

The purpose of this section of the report is to assess the advantages and disadvantages of different types of manure digester technologies in terms of their applicability to community-owned models. This report will discuss the two primary types of digesters which may be applicable to community owned models, Plug-Flow and Complete Mix. In addition, the discussion includes a brief review of a new and emerging technology that holds promise for future development, the Upright Cylinder Design (UCD).

Note that Covered Lagoon Digesters, probably the most common type, are not discussed in this report. They are a low-technology and lower-cost system that is less appropriate for jointly owned digester systems which must be designed for use by several farms.

Plug-Flow Digesters

This type of digester is usually a long trough with an air-tight cover. A new "plug" of manure is added daily at one end, which pushes the material already in the digester slowly through the system. As the manure progresses through the trough, it decomposes and produces methane that is trapped in the expandable cover. Some type of mechanism – often a gas injection system - is required to mix the manure within a plug-flow digester so that the interior mass of manure moves uniformly through the digester as new plugs are added.

Advantages – Plug Flow

- ◆ They have a much longer track record than other types of digesters and are a relatively simple, proven technology.
- ◆ They are less capital intensive than complete mix digesters and therefore more accessible to greater numbers of farmers.
- ◆ Plug-flow digesters are best for mechanically-scraped manure collection systems (although modified plug-flow digesters have been developed for flush systems).

Disadvantages – Plug Flow

- ◆ Plug-flow digesters are limited to the mesophilic temperature range, which limits their potential for biogas production.
- ◆ A surface layer of fiber begins to form immediately and continues to grow over time, so that the system will eventually require complete cleaning.
- ◆ They are not compatible with sand bedding.

Complete Mix Digesters

This type of digester is a large, vertical, poured concrete or steel circular container. The container is covered to maintain anaerobic conditions and the appropriate temperature. The manure is collected in a mixing pit and fed into the digester by either a gravity-flow or pump system. Manure is mixed periodically within the digester, improving efficiency by creating a more homogeneous mix and minimizing separation of solids.

Advantages – Complete Mix

- ◆ Complete mix digesters can operate at higher temperatures, which enables them to be more efficient and produce more gas than plug-flows.
- ◆ Manure mixing inherent in complete mix digesters adds efficiency and lowers the HRT.
- ◆ Complete-mix digesters can produce enough electricity to sell to another user, generating additional cash flow.
- ◆ Due to the lower solids content required, they can be used with water-flush manure collection systems.

Disadvantages – Complete Mix

- ◆ Complete mix digesters are much more capital-intensive than plug-flow digesters. This is their biggest disadvantage.
- ◆ In addition, they are more visible and have higher energy requirements for operation than do plug-flows.

Upright Cylinder Design (UCD)

Sometimes called an induced bed reactor (IBR), this emerging technology is a cross between complete mix and plug-flow designs, and is intended to mitigate the disadvantages of both. It leverages the natural separation characteristics of manure so that heavy solids flow towards the bottom of the cylinder and lighter solids towards the

top, which improves efficiency. Some researchers believe that UCD holds the most promise for future applicability for different sized farms and economic feasibility.

Advantages – Upright Cylinder Design

- ◆ it can more easily be built in modules to facilitate future sequential expansion,
- ◆ the initial capital cost of the containment cylinder is lower than most systems (<\$300 per cow);
- ◆ shorter construction time and minimal footprint (looks like a silo);
- ◆ adaptable to all bedding systems;
- ◆ its design “enhances opportunity for significant co-digestion of outside organic materials which often dramatically improves economics.” (Ewing)

Disadvantages – Upright Cylinder Design

- ◆ more mechanical equipment and piping, sensors and controls, valves and fittings;
- ◆ it is a new technology so there is minimal experience, research and history to rely on.

Summary of Assessment of Different Types of Manure Digester Systems

The brief analysis of different kinds of manure digesters conducted for this report indicates that overall, the added efficiency and improved biogas production of *complete mix digesters* outweigh the advantages of plug-flow digesters. Although they are significantly more expensive to start-up, the additional production capability of complete mix digesters generates positive cash flow more quickly.

Generating positive cash flow is even more important in a jointly owned digester project than in a singly owned model. The pressure on the project to cash flow and provide a return on investment to the farms is even greater when there are several participating farms. This makes the argument for a complete mix digester stronger, given each farm’s necessity for obtaining a return on their investment in addition to their need for manure management. For these reasons, *we conclude that the complete mix digester is more appropriate for a jointly owned project.*

Although the upright cylinder design holds great promise – and appears to address some of the key disadvantages of both plug-flow and complete mix digesters – it is not a proven technology at this time and therefore is not appropriate for this project.

Manufacturers of Manure Digester Systems

A truly comprehensive review of all manufacturers of manure digester systems was beyond the scope of this project (Kramer identifies over 20 different manufacturers and designers - and many more can be found on the internet). We obtained reliable information on components and pricing for each manufacturer’s system from four different digester system manufacturers. We attempted to limit our research to Wisconsin or Midwest based manufacturers but had to expand it in order to obtain sufficient information to make a good decision for the feasibility study.

It is very difficult to make a direct comparison of systems since each manufacturer seems to have a different configuration and pricing system. We requested information based on the system components identified below, using a hypothetical 2,000 cow operation.

- ◆ Mix/holding tank for manure
- ◆ Holding tank for receiving organic (food) waste used as substrate
- ◆ Digester (complete mix)
- ◆ Effluent tank to receive treated liquid
- ◆ Solids separation equipment
- ◆ Post digesting storage (liquid and solids separated)
- ◆ Electric generator set

The chart below shows estimated costs and the components included in that estimate. Unless otherwise noted, these estimates do not include engineering, construction & installation.

Manufacturer	\$ Estimate	Cost Estimate Includes
American Biogas	\$1.8 million	Turnkey operation includes everything but mix/holding tank
Applied Technologies, Inc.	\$1 million	Does not include post-digestion storage facilities
GHD, Inc.	\$1.5 million	Does not include generator set
MCON Bio, Inc.	\$2.5 million	Danish turnkey operation includes all construction, engineering & installation.

Based on this research and the research conducted previously for the ADD program feasibility study, we estimate that capital costs for purchasing and installing a manure digester system, including a genset and interconnection at the Bruner farm, would be approximately \$2.1 million.

Legal and Organizational Options for Ownership

The legal and organizational options facing these two possible groups of farmers are identical to those faced by the Dunn County farmers. For that reason, we did not repeat the entire analysis for this feasibility study. Rather, we suggest that the conclusion and recommendations would be the same for this study, as follows (quoting from the Dunn County feasibility study conducted for ADD):

CDS recommends that the farms involved in this project form an LLC rather than a cooperative. This form allows owner-investors to structure the business in ways that preserve traditional cooperative values if they so desire, while safeguarding additional flexibility that a cooperative may not provide.

In addition, the LLC form provides additional flexibility if there is a need for outside investors to capitalize the project. As noted above, federal law limits return on investment in cooperatives to 8%. No such limitations exist with LLC's.

Financial Analysis

This section reviews the financial analysis conducted as part of this feasibility analysis, and includes the potential impact of Focus on Energy incentives and financial assistance because the project is located in Focus territory. Below is a short review of the grant and loan programs utilized in the financial analysis.

Focus on Energy can provide an implementation grant to assist in financing a biogas digester system with a capacity greater than 20 kw. However, if the system is designed to both produce electricity and utilize thermal heat produced by the system, then Focus on Energy can provide additional funds up to 30% of the total project cost, up to \$80,000. Because we envision that the system will use its own thermal heat, we calculate a grant of \$80,000 from Focus on Energy in the financial analysis.

Section 9006 is a grant program embedded in the federal Farm Bill. Qualified projects include anaerobic digesters and other renewable energy installations. The money can be used for purchase and installation of equipment and facilities. Grants are limited to a maximum of \$500,000 for renewable energy systems and they can cover up to 25% of total project costs; although 75% matching funds may not include other federal grants. Our scenario in the attached financial analysis assumes the maximum amount, or \$500,000. Member equity was used for matching funds.

USDA Rural Development Value Added Producer (VAPG) grants may be used for planning activities and working capital for marketing value-added agricultural products and for farm-based renewable energy. Eligible applicants are independent producers, farmer and rancher cooperatives, agricultural producer groups, and majority-controlled producer-based business ventures. Grants are limited to \$500,000 per grant, with a 50% matching funds requirement. Our scenario in the attached financial analysis assumes \$150,000. Member equity was used for matching funds.

Narrative to Financial Analysis

The narrative below identifies the major elements of the Sources & Uses, Income Statement, Balance Sheet, and Return on Investment Analysis. Lastly, a summary of the financial analysis highlights the major findings. *The expenses discussed below are estimates only and should not be construed as firm quotes.*

Sources and Uses of Funds (Capital Budget)

All start-up capital costs are identified in the Sources and Uses of Funds statement. The discussion below identifies the source of each estimate. Note that in general, conservative assumptions were used to estimate costs.

Uses of Funds

Capital expenses to start up the proposed digester system would include: a mix/holding tank for raw manure, the digester and post-digesting lagoon, a separator and building, and the generator set. In addition to paying sales tax on this capital equipment, a start-up business would need working capital, legal assistance, and engineering/construction supervision. Total capital expenditures are estimated to be \$2 million.

Sources of Funds

We used five sources of capital to finance the above expenditures:

1. The five dairy farms/members of the LLC, who together supply 30% of the total capital needed, or \$636,000 (\$127,200 each if divided equally among the five participating farms).
2. Focus on Energy incentive grants, which can supply a maximum of \$80,000 for this type of project.
3. Grant funds from the 9006 Farm Bill grant program (see discussion above), which could supply \$500,000 of the total capital needed. Note that member equity is being used as a match for this grant.
4. Grant funds from the USDA Value Added Producer Grant program could supply up to \$150,000 of the capital needed. Member equity is used as a match for this grant also.
5. A commercial loan obtained on the market, which supplies the remaining funds needed, or \$754,000. This is a 10-year loan at 6.5% interest.

Note that CDS made every effort to maximize grants and low-interest loans for this financing package, while minimizing commercial loans.

Income Statement

This section of the financial analysis describes the revenue and operating expenses of the proposed digester. The analysis shows annual results for 30 years.

Revenue

The proposed digester system has two sources of revenue:³

1. Sales of electricity to Xcel Energy. Using production estimates from Biogas Direct and other sources, and applying a generator engine capacity of 95%, CDS estimated the annual kWh electric production of the digester system and multiplied it by the sales price.⁴ An inflation factor of 1% per year is built into the analysis so that revenue rises slightly over time, reflecting increasing cow numbers. Please see the Data spreadsheet for additional details.

³ Note that sales of waste heat can be another source of revenue for some digester systems. However, in this scenario we project that the digester system will use most or all of the waste heat generated, so the benefit will be in energy efficiency rather than additional revenue.

⁴ Electric generation was estimated using results reported from the Vir-Clar Dairy in Fond du Lac in a presentation to the Wisconsin Biogas Development Group by Biogas Direct, the developer. Vir-Clar uses a complete mix system based on German technology that is able to generate about 7.3 kWh/day per cow. By comparison, the Haubenschild Dairy in Minnesota, using a plug-flow digester, reports being able to generate 6 kWh/cow/day with 95% generator availability.

2. Sales of digested solids for bedding, which is estimated to bring in over \$76,000 in the first year of operations.⁵ An inflation factor of 1% is built into the analysis. Please see the spreadsheet called “Data” for additional details.

Expenses

All expense estimates are based on research with vendors existing manure digester systems (although data is often difficult to obtain from private owners), and research conducted for the Dunn County feasibility study.

Operating Expenses include:

Transportation of manure to site: as noted above, CDS obtained an estimate from an experienced manure hauler based in Durand. This is an annual figure, and is projected to rise 1% per year to reflect inflation.

The remaining operating costs were based on research conducted for the Dunn County study, and are calculated to rise at 1% per year.

- ◆ Operations & Management: Estimated at \$35,000 per year.
- ◆ Electrical Usage: Because waste heat will be available through the digester system, electrical usage will only cost \$5,000 per year.
- ◆ Land Lease: \$5,000 per year.
- ◆ Insurance: \$10,000 per year.
- ◆ Maintenance: \$25,000 per year.

Interest Expense: The interest expense on the commercial loan is shown here.

Balance Sheet

This document presents a summary of the assets, liabilities, and equity of the proposed jointly owned digester.

Current Assets:

- ◆ Cash: The operation starts out with cash from working capital as noted in the Sources and Uses statement. The cash on hand adjusts each year to reflect net income or loss of the operation.

Fixed Assets:

- ◆ Capital Equipment: Starting value is the total capital costs of the digester, holding tank, lagoon, separator, genset, and building.
- ◆ Less Accumulated Depreciation: The capital equipment is depreciated by the straight-line method over 15 years, while organizational assets, including the legal costs, are depreciated over two years.

Current Liabilities:

- ◆ Accounts Payable/Accrued Expenses: This is equal to one month’s operating expenses (minus transportation costs).

⁵ This refers only to sales of bedding for the jointly owned manure digester business and does not take into consideration any avoided costs that individual farmers may experience.

- ◆ Current Portion of LT debt: This line shows the annual principle payment on the 10-year commercial loan.

Long Term Liabilities:

- ◆ Note Payable: This reflects the remaining portion of the commercial loan, payable annually.

Owner’s Equity: this is the financial contribution made by the owners.

Retained Earnings is equal to the accumulated net profit in each year of operation.

Return on Investment Analysis

This spreadsheet shows a simplified version of the estimated return on investment for each LLC share, given the financial performance that above analysis projects.

At the top is the total capital investment required by the LLC (\$636,000). If this were split equally among the five farms, each one would be required to invest \$127,200.

During the first ten years of operation (the period in which the PTC is applicable), the primary financial benefit of the project to the farmer/members of the LLC is tax write-offs. The ROI spreadsheet shows the total tax benefit per share, including the PTC and any net operating losses.

The operation shows a net profit starting in year eleven, and the return per share is shown as the profits slowly rise during the 30-year life of the digester. Averages for each 10-year period are shown as well.

Discussion

The primary purpose of this analysis was to develop a business model for jointly owned manure digesters that would be applicable to areas of Wisconsin in Focus on Energy’s territory. The business model developed for this report proposes that five dairy farms in Pepin County create an LLC which would own and operate the manure digester and electric generation set.

Summary of Financial Analysis

The table below provides a summary of the operation’s projected net profit or loss and each LLC owner’s share of profit/loss in selected years, assuming the profits and losses are divided equally among the five LLC owners. Note that the LLC loss per share in years 5 & 10 takes into account the production tax credit.

	<u>Net Profit/Loss</u>	<u>LLC Share</u>
Year 5	-\$47,681	-\$30,530
Year 10	-\$480	-\$22,161
Year 15	\$26,206	\$5,241
Year 20	\$170,431	\$34,086
Year 25	\$198,620	\$39,724
Year 30	\$230,288	\$46,058

The financial analysis developed for this feasibility report indicates that the project requires *grant subsidies to make it financially feasible*. Maximum funds from Focus on Energy and the 9006 federal grant program, and an additional \$150,000 from the VAPG federal grant program are used to provide a total of \$730,000 (or 34%) of the capital needed for start-up.

Although there are numerous financing scenarios that could be created, it is clear that with only five farms investing in the project, grant subsidies are needed to acquire the necessary capital.

Effect of Higher Buyback Rates

Because this project would be located in the Excel service territory, it would receive a set rate of 4.94 cents per kilowatt-hour under that utilities approved tariff structure. However, other Wisconsin utilities that participate in the Focus on Energy program offer significantly better rates for biogas derived electricity. Both WE Energies and Alliant offer experimental buyback rates applicable to farm digester/generator systems. These rates have an on-peak and off-peak component, but in effect the average rate per kWh is 6 cents. The effect of an equivalent rate on the economics of this project was evaluated for a project that did and did not receive federal subsidies.

This additional analysis identified the rate for power generation that would be necessary to make the project profitable from the first year onward with and without the use of subsidies from the federal 9006 and Value Added grants.

The following tables provide a financial summary for the project, if it were to receive 6 cents for each kilowatt hour of electricity generated. The first reports financial results for a project that does not receive federal subsidies, and the second reports financial results for a project that receives grants from the Federal 9006 program and the Value-added program:

6 cents per kilowatt-hour, without federal grant subsidies:

	<u>Net Profit/Loss</u>	<u>LLC Share</u>
Year 5	-\$16,508	-\$24,295
Year 10	-\$60,428	-\$9,979
Year 15	\$96,846	\$19,369
Year 20	\$248,461	\$49,692
Year 25	\$284,814	\$56,963
Year 30	\$325,499	\$65,100

6 cents per kilowatt-hour with federal grant subsidies:

	<u>Net Profit/Loss</u>	<u>LLC Share</u>
Year 5	\$10,211	-\$18,952
Year 10	\$63,469	-\$9,371
Year 15	\$96,846	\$19,369
Year 20	\$248,461	\$49,692
Year 25	\$284,814	\$56,963
Year 30	\$325,499	\$65,100

Conclusions and Recommendations

The critical issues for a potential investor can be boiled down to two questions:

1. Is the proposed project financially feasible?
2. Would it be a good investment?

The answer to the first question appears to be yes – if sufficient grant funds can be obtained to help finance the venture, and if the investors can sustain net losses for the first ten years of operations. The financial analysis indicates that the five farms in Lima Township in Pepin County generate sufficient manure and are close enough to each other to make the proposed jointly owned digester feasible on paper.

However, we were unable to make a financial scenario work without grant funds that make up at least one-third of total capital needed (at the Excel buy-back rate of .0494 kWh).

The answer to the second question is far more complicated. Each farm, of course, must make its own analysis of such an investment opportunity, taking into account available cash, opportunity costs, and the farm’s individual tax situation. Such an analysis for each farm is beyond the scope of this report, but it is a critical component to the success of such a venture.

Our analysis indicates, however, that project economics improve considerably if a better buyback rate were available, as it is in Wisconsin currently in the Alliant and WE Energies service territories. Such a higher rate would more than make up for financing a project without federal grant subsidies. Individual investors would still lose money for the first ten years, but would make money in succeeding years.

Lessons Learned

1. About 2,000 cows is a minimum. Any less than that may be financially shaky.
2. Participating farms must be within a five mile radius of the digester site, or transportation costs start to outweigh the benefits of joint ownership.

3. The manure hauler needs to be part of the team in planning and developing a jointly owned digester system. Since manure hauling is such a major expense it can make-or-break the analysis.
4. Grant funds are needed to contribute $1/3$ to $1/2$ of start-up capital costs if the project is located in the service territory of a utility that pays the standard buy-back rate. If grant funds are not available at that level, financial feasibility may be questionable.