

Adding Anaerobic Digestion to Your Dairy Operation— Initial Considerations and Next Steps

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Take Home Messages:

1. Be sure you have the time and resources to manage the operation and maintenance of a biogas system effectively.
2. Be sure that financing a biogas system will not affect the financial stability of your operation or preclude pursuing other financially attractive opportunities.
3. Be sure that your operation is of an adequate size and your manure management system is suitable for biogas production.
4. Use care in selecting a project developer.
5. Be sure that your utility contract does not contain any unreasonable provisions.
6. In seeking debt financing, evaluate the relative merits of short-term versus long-term loan repayment schedules.

Introduction

The addition of anaerobic digestion with biogas utilization or sale (hereafter a biogas system) to a dairy or other livestock operation can significantly reduce odor problems and possibly increase net farm income. In addition, it can substantially reduce the emission of methane, a greenhouse gas with approximately 21 times the heat trapping capacity of carbon dioxide. Anaerobic digestion also may reduce the potential impact of manure after land application on surface water quality by reducing the concentration of oxygen demanding organic compounds and the densities of fecal pathogens such as *M. avium paratuberculosis*. However, the addition of a biogas system will constitute the addition of a new enterprise requiring time for management and skilled labor for operation and maintenance. Below are some things to consider initially and the steps that will be required for project development.

Initial Considerations

Commitment—Many biogas systems have failed or have been only marginally successful due to poor management. A biogas system will require daily attention and routine preventive maintenance. In addition, unexpected problems will occur and must be addressed promptly to avoid the loss of revenue to offset costs. If you are unable to make the necessary commitment of your time or the time of others to manage and maintain a biogas system effectively, adding a biogas system to your operation is not recommended unless you are willing to consider third party ownership and operation, which will be discussed later.

Financial Ability—Although you may be able to partially finance the capital cost of a biogas system through government assistance programs, with the Farm Bill Section 9006 cost share

program as an example, you should expect to have to make a significant capital investment and probably finance the remainder through the assumption of additional debt. Both will affect the financial status of your operation.

With the resulting reduction in available capital and borrowing ability, the ability finance other aspects of the dairy operation, such as an increase in herd size or replacement of outdated facilities and equipment, probably will be reduced. This is an opportunity cost that should be carefully evaluated.

Size—Based on currently available capital cost data, it appears that biogas systems for dairy herds of less than 500 cows have little potential to be financially viable due to the absence of economy of scale. For example, the capital cost per installed kW of electrical generation capacity for a 200-cow operation will be more than \$600 higher than that for a 500 cow operation, and this capital cost for a 500-cow operation will be more than \$900 higher than that for a 1,000-cow operation. However, the minimum herd size required for financial viability will depend to a large degree on the monetary value of the biogas produced, which will be a function of local energy costs.

Manure Management—Frequent manure collection, and only from paved surfaces, is a necessary prerequisite for successful biogas production. At least weekly manure collection is necessary with daily collection more desirable. In addition, the manure must be free of excess bedding and foreign material such as soil and stones. Operations that use sand for bedding will require the removal of as much sand as possible prior to digestion. Otherwise, the sand will accumulate in the digester and reduce biogas production and possibly process stability when the active digester volume falls below a critical level. If your current method of manure management is not suitable for biogas production, you should determine if you are willing and able to make the necessary modifications.

Next Steps

Choosing a Developer—If you have decided to proceed, selecting a project developer is your next step. Choose carefully, and remember that experience and reputation are important. Talk with previous clients, and not only those suggested by the developer. One or more visits to projects that have been in operating for at least a year would be a good idea. Remember Ronald Regan's philosophy about arms control treaties with the USSR—Trust but verify.

If you decide to own and operate the biogas system, insist on a fixed price contract with your developer. In addition, the contract should provide for the delivery of a detailed system operation and maintenance manual and at least 12 months of technical assistance after system start-up. If you decide on a third party arrangement, linkage of your payments to the value of the energy produced is desirable.

Negotiating a Utility Contract—If you decide to own and operate the biogas system, your next step should be to negotiate a contract either with your local electricity provider if you plan to generate electricity using your biogas or your natural gas utility if you plan to process biogas to meet natural gas specifications. Your project developer should provide assistance in the negotiations and ideally should have experience in negotiating contracts with your utility or at least in your state. While your developer may provide valuable assistance in the negotiations,

always remember that the contract will be between you and your utility and be in effect long after your developer has moved on.

If you are going to use biogas to generate electricity, which is the most common use, you probably will be offered one of the three following types of contracts:

1. Sell all-buy all
2. Surplus sale
3. Net metering

Conceptually a net metering contract should be the most desirable because it allows you to maximize the use of your biogas generated electricity on-site. This biogas electricity has the highest monetary value because its value is equal to the energy and transmission charges that you would be paying. Conversely, your payment for biogas-generated electricity delivered to the grid will be based only on the energy delivered and the price being paid by the utility for electricity from conventional sources. This differential can be substantial and ultimately determine project financial viability.

In negotiating a utility contract, be sure to fully understand possible provisions such as avoided cost rate schedules, interconnection requirements, standby charges, etc. If you are offered surplus sale or net metering contract and have multiple points of interconnection with the utility, find out if the utility will wheel electricity from your generator set to other points of interconnection at a nominal or no cost.

The contract you are offered probably will be a relatively short-term, fixed price contract. Be sure that there is a provision clearly stating the terms for renewal and that the terms are reasonable. Finally, recognize that electric utilities generally do not like working with independent power producers, which you will be, and do so only under a legislative or regulatory mandate.

Financing — Before seeking financing, an assessment of the project's financial viability, defined as the ability to service any debt incurred, will be a necessity. Prospective lenders will want to see a demonstration of your ability to repay the loan. In addition, you should expect to recover your capital investment with a reasonable rate of return unless the biogas system will provide the odor control or other benefit necessary to continue your dairy operation and thereby justifying the cost. In performing this assessment, you should consider the biogas system as a separate enterprise with all revenue derived for the energy produced dedicated to the payment of capital and operating costs. In this approach, the reduction in energy cost associated with the on-site use of the biogas produced should be treated as revenue to the biogas system for accounting purposes, as should any revenue from the export of energy off-site. In addition, all labor and repair expenses should be tracked and charged to the biogas system.

In assessing a biogas project's financial viability, the amount of biogas energy that could be used on site will be the most important estimate because it will be the largest source of revenue. Although this estimate can be made from historical energy use records, an energy audit could be valuable for a surplus sale contract in identifying opportunities to maximize on-site use by reducing demand peaks.

Although project developers may be willing to perform this assessment, you should remember that 1) they are not disinterested third parties, and 2) the quality of the assessment depends on the quality of the data and assumptions used. The AgSTAR software program, FarmWare, was designed to assist in performing an initial assessment of biogas project financial viability. It is available at <http://www.epa.gov/agstar/resources.html>.

In negotiating the terms of a loan, you should consider the trade-offs between short and longer-term repayment schedules. Rapid repayment will reduce interest expense, but payments may exceed revenue and result in a significant yearly net loss until the loan is repaid. Conversely, a longer-term loan, ideally over the useful life of the biogas system, will increase interest expense but provide a steady stream of income or a lower annual loss over the life of the project. However, total income will be greater or the total loss will be less over the life of the project with the shorter-term loan, if the time value of money is not considered. If replacement of equipment, such as pumps and engine-generator sets, is treated as a maintenance cost, biogas systems should have a useful life of 20 years. Table 1 illustrates the difference between short and long-term financing.

Additional Resources

In addition to FarmWare, the AgSTAR Handbook, also is available at <http://www.epa.gov/agstar/resources.html>. It provides a more detailed discussion of a variety of biogas project related topics such as negotiating a utility contract and obtaining project financing that have been discussed only briefly here. In addition, this website contains other resources such as a list of project developers and reports of full-scale system evaluations that may be useful in considering a biogas system for your dairy operation.

Table 1. A hypothetical comparison of alternative approaches for assessing the economic viability of a covered lagoon and biogas utilization system assuming a 20-year life.

	Simple Payback (Without Interest)	Payback at 8 % Interest	Financing, 20 Years at 8 % Interest
Annual revenue from biogas generated electricity used on-site	\$93,083	\$93,083	\$93,083
Annual revenue from biogas generated electricity sold	\$37,453	\$37,453	\$37,453
Gross annual income	\$130,536	\$130,536	\$130,536
Annual operation and maintenance cost	\$22,842	\$22,842	\$22,842
Interest	—	\$338,312	\$732,460
Net annual income	\$0 for 6.6 yr & \$107,694 for 13.4 yr	\$0 for 9.7 yr & \$107,694 for 10.3 yr	\$35,755 for 20 yr
Total net income over project life	\$1,443,100	\$1,109,248	\$715,000