STEP 3

E³A: Anaerobic Digester Applications for the Farm or Ranch

Steps in the Anaerobic Digester Series

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Determine Economic Feasibility

Courtesy of the Northern Rocky Mountain RC&D.

Once you have determined that anaerobic digestion is technically feasible (Step 1) and have measured your methane generation potential (Step 2), it is important to consider whether the project would be economically feasible.

Many capital costs for building an anaerobic digester can be subsidized by grants or low cost loans. However, before making the large capital investment, it is critical to consider the net operating costs of an anaerobic digester. It is therefore necessary to conduct a detailed financial analysis before purchasing an anaerobic digester.

The purpose of this publication is to provide guidance as to whether an anaerobic digester is likely to be economically feasible for your operation, and whether it would be worthwhile to conduct a detailed financial analysis. Much of the research used to develop this article is based upon observations from the intermountain west, where the arid climate, scarce water resources, and energy policies affect the economic viability of anaerobic digesters. This document should be considered a screening tool as to whether or not an anaerobic digester could be economically feasible at your operation, and whether or not it would be useful for you to conduct a detailed financial analysis.

General Cost Information

According to EPA Ag Star, the capital cost of an on-farm anaerobic digester ranges from approximately $400,000 to $5,000,000 depending upon the size of the operation and technology used. The typical on-farm anaerobic digestion unit costs approximately $1.2 million. Costs vary, depending upon the size of the unit, design, and features. The type of anaerobic digester necessary for your operation (and therefore the cost of the anaerobic digester) varies according to the number of livestock and technical considerations like temperature. Likewise, most digesters are semi-customized by the technology producer, so the capital outlay and operating/maintenance costs will vary. Annual operation and maintenance costs (like maintenance, repairs, parts, labor, and insurance), must also be included when considering the cost of an anaerobic digestion system. The US Environmental Protection Agency AgSTAR website provides a good overview of expected costs and revenues: http://www.epa.gov/agstar/.

The Ag Star website is updated frequently with information about federal and state funding opportunities for anaerobic digestion projects as well. Because of the capital-intensive nature of anaerobic digestion, it is recommended that you thoroughly understand the parameters of any funding programs prior to investing in a digestion system. You may wish to discuss any loan risk associated with a methane digester with your agricultural loan officer to ensure that additional debt will not compromise your ability to access capital for your existing operation.

Courtesy of the Northern Rocky Mountain RC&D.

As part of economic analysis, you should determine the extent to which you will offset costs by generating revenues or reducing energy expenditures over the life of the digester. Utility contracts can vary considerably throughout rural communities. Some utilities have "net metering" policies, where small energy generators (like those with an anaerobic digester), can offset their energy consumption by producing their own electricity. However, the value of this offset will vary by utility. Some utilities will credit net-metered power at the retail rate, meaning that there is a direct offset for every kilowatt-hour of electrical production. Other utilities credit net-metered power at a discounted or wholesale rate. In the case of agricultural operations, you may be assessed a demand charge for electricity. Demand charges are not usually offset in net metering, but can comprise up to half of your electrical expense. Check with your utility regarding their net metering policy. In order to increase profitability, producers should focus on reducing operation and maintenance costs, as well as offsetting energy usage with the anaerobic digester system.

Producers should be wary of relying on anaerobic digestion to generate revenues by selling electricity to the utility. You should discuss this concept with the utility. Be aware that the utility may not be willing to purchase the power. If they are willing, be aware that the price offered is typically a wholesale price. You should also check to see if there are contractual terms that might be problematic for you. Some utilities require a guaranteed amount of power be supplied in a given time period. Others require notice of changes in electrical production. These considerations should be taken into account as you consider possible revenue generation from anaerobic digestion power sales.

While you are in the process of selecting a digester technology, you should outline some of your expected costs and revenues over the life of the digester. Once you contact a technology provider, you can obtain the more detailed information necessary to compute actual costs.

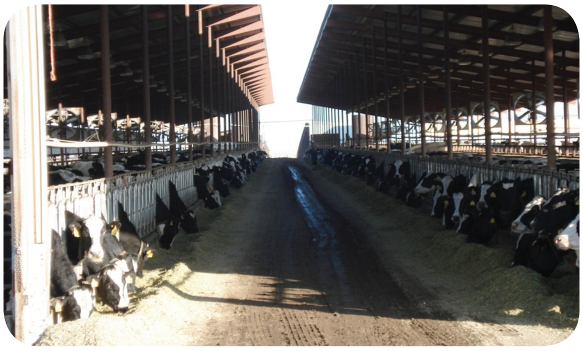
Five Indicators of Economic Feasibility

Although it is important to actually crunch the numbers, there are five indicators that an anaerobic digester might be economically feasible at your operation. As previously stated, these indicators should be viewed as a screening tool. The indicators can help determine whether you should pursue a comprehensive feasibility study of your operation. These criteria have been selected based upon studies conducted in the intermountain west by Keske (2009) and Sharvelle and Keske (2011). If your operation meets at least two of the criteria, it might worth your time to conduct a more detailed spreadsheet analysis of your situation. The indicators are as follows:

1. Operation meets the definition of a Confined Animal Feeding Operation (CAFO).
2. There is a waste stream that could be combined with the waste stream of another operation or business. That is, there is potential for "co-digestion".
3. Operation receives frequent and/or credible complaints about odor.
4. Operation produces swine or chickens.
5. Operation incurs more than $5,000 in average electricity or heating expenditures per month.

Brief Description of the Five Indicators

1. **The operation meets the definition of a CAFO.** CAFOs must comply with state and federal laws governing waste management practices. An anaerobic digester might complement a CAFO's plan for air emissions, nutrient, or waste management.



Bella Holstein in Platteville, Colorado. Photo courtesy of Luke Loetcher.

2. **Co-digestion potential**. When agricultural producers and related industries (eg. food manufacturers) or municipal waste treatment facilities are located nearby, there may be efficiencies that can improve the economic viability of a project.

   Feasibility studies have shown that co-digestion projects might be economically viable in the intermountain west (Stewart Environmental, 2008; Keske, 2009; City of Greeley and Symbios, 2009). If you or your community has an interest in a co-digestion project, it is suggested that you review one of the reports in the reference section for more information.
3. **Operation receives frequent and/or credible complaints about odor.** Anaerobic digestion units can provide a measurable reduction in odor, which can help to improve neighbor relations and mitigate nuisance lawsuits. The financial risk associated with an odor-related nuisance lawsuit can be difficult to estimate because information about damage awards is not readily available. The majority of cases are settled outside of court and insurance companies typically pay a portion of the settlements. Most verdicts and settlements are not publicly reported.

   However, a summary of some recent settlements is provided below, which was originally presented in Keske (2009). The table lists the year, state, type of operation, plaintiff and award amount.

Summary of Financial Awards from Agricultural Nuisance Suits *Claims Awarded in Nuisance Suits*				
Year	State	Award	Plaintiff/Case	Operation
1991	NE	$375,600	Kopecky v. National Farms, Inc.	Swine
1996	KS	$12,100	Settlement—plaintiff/respondent both undisclosed in news article.	Swine
1998	KS	> $15,000	Twietmeyer v. Blocker	Beef feedlot
1999	MO	$5,200,000	Vernon Hanes et al. v. Continental Grain Company	Swine
2001	OH	$19,182,483	Seelke et al. v. Buckeye Egg Farm, LLC and Pohlman	Egg/Poultry
2002	IA	$33,065,000	Blass, McKnight, Henrickson, and Langbein v. Iowa Select Farms	Swine
2004	OH	$50,000,000	Bear et al. v. Buckeye Egg Farm, Anton Pohlman and Croton Farms, LLC	Egg/Poultry
2006	AL	$100,000	Sierra Club, Jones, and Ivey v. Whitaker and Sons LLC	Swine
2006	MO	$4,500,000	Turner v. Premium Standard Farms Inc.; Contigroup Co., Inc.	Swine
2007	IL	$27,000	State of Illinois (Plaintiff). Respondent undisclosed.	Swine

Avoiding a lawsuit and the potential financial liability may help justify the capital expenditure of an anaerobic digestion project.

4. **Operation produces swine or chickens.** Many nuisance claims involve swine or poultry operations. These operations have also involved high punitive damage awards. This history may encourage swine and poultry producers to consider adoption of anaerobic digestion units as a management practice to reduce the risk of a nuisance claims. The exact cause leading up to these nuisance lawsuits is not clearly established; however, it is likely related to the strength and persistence of odor. The history of nuisance lawsuits involving swine and poultry operations indicates that even operations located in rural communities with very few neighbors could still be vulnerable to a lawsuit. An anaerobic digester could be used for conflict mitigation.
5. **Operation incurs more than $5,000 in electricity or heating expenditures per month, on average**. An operation's ability to offset average monthly energy costs affects whether a digester might be economically feasible. At this writing, in the intermountain west, an anaerobic digester might be economically feasible if a producer has the potential to offset a minimum of $5,000 in electricity or heating costs for an entire operation.

Electricity and heating expenditures reflect a specific category of operating expenses that an anaerobic digester could offset. These expenditures include propane, natural gas, and/or electricity. If an operation has more than $5,000 in average energy costs each month, a detailed financial analysis should still be conducted to determine whether those costs could really be offset by implementing a digester. Naturally, the type of digester necessary for an operation will also affect the economic feasibility.

The most cost-effective means of utilizing energy from the digester is in the use of biogas. If your feeding operation is incurring over $5,000 in energy costs per month, the potential exists for many of these expenses to be off-set with use of the biogas – rather than focusing on converting the methane gas to electricity. This is because additional costs are incurred when converting methane gas to electricity. Avoiding such costs will yield a higher net economic impact compared to any potential revenues that might be generated from supplying electricity to the grid (Keske, 2009). As examples of additional costs required for electrical generation, a generator is required to convert methane gas into electricity, making it more expensive to operate. In addition to the extra capital outlay for a generator, operations will need to plan on maintenance, labor costs, and back-up electricity resources. An operation that strictly uses biogas would likely incur fewer expenses.

Low electricity costs make it more difficult to justify a digester investment. Return on investment is longer when electricity costs are low and the value of selling excess electricity produced or offsetting consumption is also lower. In the intermountain west, electricity costs are generally lower than the eastern United States. This is primarily due to relatively inexpensive coal and hydroelectric resources that are available for electricity generation. While the environmental damages resulting from burning coal could be factored into future energy policy, the current price per KWh of electricity is low compared to other regions of the country (Keske, 2011; Keske, 2010; Keske, 2009; Leuer, Hyde, and Richard, 2008). In other western states like California, the KWh price paid by the producer is likely higher than the intermountain west, making the total costs incurred by the operation higher. In this case, it is still important to review the net metering policies and "buy back" prices. Regardless of your location, as part of your economic assessment, you will need to determine your current cost of electricity, as well as the price that you will receive from supplying electricity to the grid.

Electrical generator for an anaerobic digester in Wheatland, Wyoming. Photo courtesy of Catherine Keske

Other Considerations for Economic Feasibility

The intermountain west presents unique environmental issues that might affect economic feasibility for a digester. For example, low humidity and scarce water resources result in low water and high solids content in manure. This means that rock and other solids could cause digester maintenance expenses if not managed properly. Likewise, it is more may be expensive to add water necessary for microbial function, compared to eastern dairies. Most anaerobic digestion feasibility studies that are currently available are relevant to the eastern United States, where electricity prices are relatively higher and water resources are more readily available. As follows are considerations for your spreadsheet analysis:

- Include the cost of water into your spreadsheet.
- Do not count on revenues from green house gas offsets to fund the system. These markets are voluntary in the United States and have shown considerable price volatility and low prices in recent years.
- Review your state guidelines to determine waste transport policies for on- or off-site locations, before calculating potential tipping fees.
- Account for maintenance and labor costs, in addition to the capital outlay of an electricity generator.
- Include the costs of back-up energy systems, in the event that your system is down for maintenance.
- Understand your state and utility company's policies about net metering and energy buy-back programs.
- Be sure to consider all of the costs associated with building, storing and transporting manure. Also, consider the location of the digester relative to utility infrastructure. The cost to tie into the grid, for example, can be high depending on your operation's proximity to the utility infrastructure.
- Estimate your methane generation potential (Step 2) and maintain a realistic perspective of energy costs that you might be able to offset.
- Factor in risk. Prices can vary considerably. Be sure to look at the most likely, and the worst case scenarios.

References

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