Funding On-Farm Anaerobic Digestion

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Anaerobic digestion of on-farm manure resources offers livestock and poultry producers (farm operators) a unique opportunity to increase on-farm revenue. As energy costs become a larger part of the farm operation budget, farm operators are increasingly looking to energy efficiency and renewable energy projects as a viable option for increasing farm revenues. One such option is anaerobic digestion of animal manure, a waste resource that has considerable potential for generating clean, renewable, domestic energy.

One of the biggest obstacles to widespread adoption of on-farm anaerobic digestion has been its cost. Anaerobic digesters require significant amounts of up-front capital costs (expenditures), in addition to relatively high break-even prices for the electricity and fuel produced from the biogas. (The break-even price is the price at which an operator generates enough revenue to cover all costs.) To help overcome the burden of up-front capital costs, operators of anaerobic digesters may rely on several different funding mechanisms, including grants, cash reimbursements, loan guarantees, industrial bonds, private funding, and other cost-sharing agreements. Many anaerobic digester operators apply for and receive a combination of funding mechanisms (e.g., loan guarantees and grants) to fund their projects.

This fact sheet presents overviews of the various funding mechanisms available to farm operators, as well as case study examples for each.

Grants and Cost-Sharing

There are multiple **grant and cost-share programs** available for farm operators who are interested in anaerobic digestion. With a grant, a federal or state agency provides an award of cash to financially support a farm operator in the purchase and installation of an anaerobic digester. Grant funding may be received before the anaerobic digester is constructed and does not require repayment.

Some examples of programs where federal and state agencies provide grant funding for the construction and operation of anaerobic digesters include the U.S. Department of Agriculture (USDA) Rural Energy for America Program (REAP) and Ohio's State Energy Program. In some cases, federal-level funding sources (i.e., American Recovery and Reinvestment Act of 2009, or ARRA) provide states with grant money that is administered at the state level. For additional information on funding programs available for anaerobic digesters, see the fact sheet *Funding Programs for Developing Anaerobic Digestion Systems* (http://www.epa.gov/agstar/documents/agstar_federal_incentives.pdf), and also the AgSTAR Funding database, Funding On-Farm Biogas Recovery Systems: A Guide to Federal and State Resources (http://www.epa.gov/agstar/tools/funding/index.html).

For cost-sharing, also sometimes referred to as cash reimbursement, farm operators typically purchase and construct the anaerobic digester and then apply for funding after project completion. Cost-sharing and cash reimbursements do not require repayment. An example of cost-share programs would include the USDA Natural Resources Conservation Service (NRCS) Environmental Quality Incentives Program (EQIP).

Photograph courtesy of Tatjana Vujic of Duke University, Duke Carbon Offsets Initiative.

Case Study: Tollenaar Holsteins Dairy

Tollenaar Holsteins Dairy received multiple grants and a cost-share agreement and used a conventional bank loan to fund its complete-mix anaerobic digestion system.

Capital costs

The total capital cost for the anaerobic digester was $1.7 million.

The farm operator received the following:

- A $500,000 grant from USDA REAP.
- A $250,000 cost-share agreement from the USDA's NRCS EQIP.
- A $250,000 grant from the Sacramento Municipal Utility District (SMUD).
- A $200,000 grant from the California Energy Commission.

The farm operator took out a conventional bank loan at an interest rate of 5.3 percent for the remaining balance of the capital cost (loan amount was $500,000).

Operating costs

The annual operating and maintenance costs for the digester are $50,000. The methane gas produced is used to generate electricity, which is sold to the local utility at a rate of $0.06/kWh. The farm operator sells the separated solids as animal bedding and compost and indicates that this operation produces more revenue than electricity sales. The digester's simple payback period is 10 years.

Case Study: Butler Farms

Butler Farms applied for and received multiple grants, a cost-share agreement, and a cash reimbursement to fund its covered lagoon anaerobic digestion system.

Capital costs

The total capital cost for the anaerobic digester was $550,000 to $650,000.

The farm operator received the following:

- A combined grant of $373,780 from the North Carolina State Energy Office and the North Carolina Green Business Fund. (Note: Both grants were administered at the state level, but ultimately, the funds were derived from the ARRA.)
- A $116,480 cost-share agreement from the USDA's NRCS EQIP.
- A $20,000 grant from the North Carolina Farm Bureau Federation's Farm Energy Efficiency Program (FEEP).
- A grant for 30 percent of eligible project cost from the ARRA Section 1603 Program.

The balance of the capital costs (approximately $50,000) were paid out of pocket by the farm operator.

Operating costs

The annual operating and maintenance costs for the digester and end-use equipment are approximately $25,000. End uses for the methane gas produced include electricity generation, which is sold to the local utility, and use of waste heat to heat the digester. The farm estimates that revenue from electricity sales will be approximately $56,000 per year, without codigestion. (Butler Farms estimates that with the planned codigestion, electricity sales could be $130,600 per year.) The project vendor estimated that the simple payback period is 8 to 10 years; however, the farm operator hopes to shorten the payback period with increased biogas from a planned codigestion project.

Loan Guarantees and Industrial Bonds

A federal or state **loan guarantee** is a funding mechanism in which a federal agency guarantees the loan (i.e., full repayment of a loan). Loan guarantees typically lower the cost of financing an anaerobic digester by effectively reducing the interest rate required on a loan to purchase and install the digester. Loan guarantees also allow digester projects to attract a larger number of potential lenders than traditional loans. With the loan guarantee, potential lenders are guaranteed full repayment of the loan, even if the digester operator defaults on the loan.

An **industrial revenue bond** is a funding mechanism that raises capital to build or buy a facility through the issuance of bonds. In these industrial revenue bonds, the state or local entity issues the bonds (but does not actually make the loan), and an investor buys the bond and provides the funding for the loan. The state or local entity actually owns the facility or physical equipment (i.e., anaerobic digester) for the length of the bond/loan. These loans typically have a lower interest rate and longer term length than traditional bank loans. In addition, there may be some property tax relief to the farm operator because the state or local entity technically owns the anaerobic digester for the life of the loan. In some instances, a farm operator himself may buy the bonds to take advantage of the lower interest rate and longer term. The farm operator is required to repay the loan, and ownership of the anaerobic digester is transferred back to the farm operator once the loan/bonds are repaid. In general, projects relying on industrial bonds as a funding mechanism for the construction and operation of an anaerobic digester tend to be larger, regional digesters.

Case Study: Fair Oaks Dairy

To fund its anaerobic digester, Fair Oaks Dairy financed the project using industrial revenue bonds.

Capital costs

The total capital cost for the mixed-plug flow anaerobic digester that Fair Oaks Dairy installed and currently operates was $12 million. The farm operator financed 99 percent of the capital costs using industrial revenue bonds. The loan period for the industrial revenue bonds was 15 to 20 years.

Operating costs

The annual operating and maintenance costs for the digester are estimated to be $600,000. The methane gas is used to generate electricity and as a renewable transportation fuel (compressed natural gas, or CNG). The farm operator uses the electricity onsite and at the dairy visitor center to reduce its purchased electricity. The farm operator recovers waste heat from the genset to heat the digester. CNG from the digester is used onsite to power CNG tractor trailers that deliver milk to processing plants in three states and is sent by pipeline to a CNG vehicle-fueling station.

Other Cost-Sharing Agreements

In **other cost-sharing agreements**, the farm operator and another entity (e.g., an electric utility, other company) share the capital and/or operating costs of the anaerobic digester. In exchange for providing funding, the entity receives a tangible return (e.g., owning the electricity generated) or receives environmental credits, such as the renewable energy credits/certificates (RECs) or the carbon offset credits.

To date, 30 of the 50 states have adopted some form of renewable energy portfolio standard, and to achieve compliance, many electric utilities are starting to buy RECs from renewable energy projects such as anaerobic digesters. In some cases, electric utilities provide project funding through a grant, cash reimbursement, loan guarantee, or some combination of these in return for the rights to the RECs generated by the anaerobic digestion system.

Carbon offset credits are earned for reductions in greenhouse gas (GHG) emissions, such as methane emissions reduced through the installation of an anaerobic digestion system. These credits hold value and can be marketed (i.e., bought and sold) on commodity exchanges, through private transactions, or through credit aggregators. Besides serving as an additional revenue source, carbon offset credits can also provide incentives for outside parties (e.g., electric utilities, corporations with carbon neutrality goals) to provide funding for anaerobic digestion projects that otherwise would not be available.

Case Study: Loyd Ray Farms

Loyd Ray Farms constructed an innovative waste management system that includes a covered, in-ground basin anaerobic digester and an aeration basin. The aeration basin removes pathogens, heavy metals, and nutrients and releases a cleaned water effluent for use on the farm.

Capital costs

The total capital cost for the innovative waste management system was $1.2 million. Funding sources for the project included the following:

- A $115,000 cost-share grant from the North Carolina Division of Soil and Water Conservation's Lagoon Conversion Program.
- A $385,000 cost-share agreement from the USDA NRCS EQIP, through NRCS' Cooperative Conservation Partnership Initiative (CCPI).
- $700,000 from Duke University and Duke Energy as part of a three-party cost-sharing agreement.

The farm operator did not incur any out-of-pocket expenses for system construction, nor is the operator responsible for operation and maintenance of the system.

Operating costs

Google, Inc. and Duke University share the operational and maintenance expenses in return for a portion of the carbon offset credits. End uses for the methane gas produced include electricity generation, which is used onsite to operate the innovative system and provide electricity for 5 barns; approximately $200 per month is saved in electricity costs. Duke Energy receives the RECs over the life of the project. The system is expected to generate carbon offset credits of 5,000 metric tons of carbon dioxide equivalents (CO_2e) per year and produce enough electricity to earn 500 RECs a year. As an added benefit of the cleaned water effluent from the innovative system, the farm is converting its sprayfields into cropland for cash crops.

Private Funding Sources

Because grants and cost-sharing agreements may not cover the full costs, most farm operators interested in anaerobic digestion will have to provide at least some up-front capital to cover the capital cost of the digester. In these situations, farm operators will have to secure funds in a more traditional sense—**private funding**. Private funding or financing may come in the form of equity financing, debt financing, or some combination of both. Each form of private financing provides the up-front capital that is required to complete the purchase of a digester. The terms and conditions of the varying private financing vehicles (instruments) will be subject to the borrower's financial status and any previously agreed-upon cost-sharing arrangements.

Equity financing is the process of raising funds from interested parties who provide up-front capital in return for partial ownership of the company or project (e.g., stock or preferred stock in the company). Debt financing involves securing up-front capital from sources such as banks, credit unions, savings and loan, and other traditional financial institutions that provide the funds in return for an agreed-upon set of terms and conditions for repayment (e.g., time period, interest rate). Some more common means of debt financing involve bank loans, lines of credits, mortgages, and in some cases, issuance of bonds (e.g., municipal bonds). In the case of anaerobic digester projects, equity financing is most common for larger-scale anaerobic digesters, which are most likely to attract larger enterprise investors, such as energy or technology companies.

Case Study: quasar energy group

The quasar energy group complete-mix digester at the Ohio State University's Agricultural Research and Development Center (OARDC) in Wooster, Ohio, was funded through equity financing and grants.

Capital costs

The total capital cost for quasar energy's Wooster, Ohio, digester was $6 million.

In addition, the digester operator received the following:

- A $500,000 grant from USDA REAP.
- A $1,500,000 grant from the ARRA Section 1603 Program.
- A $500,000 grant from the State of Ohio's State Energy Program.

Operating costs

The annual operating and maintenance costs for the digester and end-use systems are $180,000 to $300,000. The methane gas produced is used to generate electricity, which is used onsite and to generate CNG for vehicle transportation fuel. A small amount of CNG is currently used onsite to fuel company vehicles, and the company is preparing to produce more CNG that will be used for a public access fueling station. The digester operator recovers waste heat from the genset to heat the digester. The electricity and CNG are expected to produce enough revenue so that the digester's simple payback period will be 4 to 6 years. The liquid stream (effluent) from the anaerobic digester is used for land application as an agricultural fertilizer on a local farm near the digester, and quasar pays a disposal fee to the farmer.

Find Out More

AgSTAR offers a variety of tools, resources, and events to increase the use of AD systems. More information on AD system funding, development, and operation is available on the AgSTAR website at www.epa.gov/agstar.

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