New York State Energy Research and Development Authority

Anaerobic Digester Business Model and Financing Options for Dairy Farms in New York State

Final Report

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The New NY WORKS for Energy

nyserda
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Final Report

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Acronyms and Abbreviations

CHP	combined heat and power
IRS	Internal Revenue Service
LLC	limited liability corporation
NYSERDA	New York State Energy Research and Development Authority
PPA	power purchase agreement
RECs	renewable energy credits

1 Introduction

1.1 Background

Anaerobic digester systems are a potential means of reducing costs and increasing revenues on farms throughout the U.S. via the energy and co-products they produce. However, there have been a number of challenges for digesters for livestock operations in the U.S. Some of the most important challenges for farmers planning to install anaerobic digester systems are the profitability of the system and the ability to secure financing for the projects. Digester systems are exposed to a number of risks, and not all of these risks are fully managed by existing business model and finance options. Key risks include construction risk, technology risk, interest rate risk, margin risk, management risk, and counterparty risk.

The value of the energy, co-products, and other revenues from digester projects vary greatly from one state to the next, depending on market factors and available incentives. However, very few digester systems are installed without incentives or some other targeted financing structure. There has been a healthy discussion within the dairy and digester industries on which factors are most critical in assuring the sustainability and profitability of digester systems, and which alternatives might improve on current options for business and financing structures.

The New York State Energy Research and Development Authority (NYSERDA) provides two main types of incentives within its anaerobic digester system funding program: capacity incentives and performance incentives. Capacity incentives are provided at digester startup, and performance incentives are provided annually based on the digester's ongoing energy production. However, NYSERDA is beginning to shift resources more toward financing assistance and away from incentive funding.

In addition to potential shifts in public incentive funding availability, a number of innovative options exist within the private sector to finance renewable energy. Although some of these options have been applied to anaerobic digester systems at dairies, most financing options have been primarily used for other renewable energy sources such as solar.

1.2 Objective and Methodology

NYSERDA is charged with expanding clean energy production in New York State and has on-going programs that have supported the development of anaerobic digestion projects as an important source of clean energy. In an effort to address the challenges of profitability and securing financing for anaerobic digester projects, as well as the risk factors project developers continue to face, NYSERDA contracted Informa Economics (Informa) to investigate alternative business and financing structures for anaerobic digestion projects. The goal of understanding these alternative financing structures is to facilitate greater anaerobic digester project development in New York State. This report analyzes three financing structures, and includes additional discussion is included on how NYSERDA programs can be tailored to match each of these structures. Further, specific attention is focused on the ways the alternative business and financing structure function to reduce risk exposure for digester owners and financers of digester projects.

This study builds on a previous study, *Portable Digester Systems for Small- to Mid-sized Dairy Farms in New York*[1], conducted by Informa for NYSERDA and the Innovation Center for U.S. Dairy in 2013. The 2013 study focused on how the portability of a digester system could impact financing availability and addressed a number of other challenges and opportunities for digester systems.

This report also addresses the key risks in considering potential business and financing models that were identified in the 2013 report, including:

Construction risk.
- Risks associated with being on time and on budget.

Technology risk.
- Risks associated with the performance of the various technologies used in the system to process waste, engine generator set, anaerobic digester, processing of outputs, and other associated equipment.

Interest rate risk.
- Risks associated with variation in interest rates during the time period in which the project is financed could increase the overall cost of the project.

Margin risk.
- Risk on the value of inputs (tipping fees) and the value of outputs (electricity, RECs, digester fiber, nutrients, etc.).

Management risk.
- The risk of having the expertise and ability to manage the digester system at its full potential, and any impacts on the management of the overall farming operation.

Counterparty risk.
- Risks associated with the numerous other parties to the transactions, such as lenders, financers, utilities, state entities, equipment providers, food waste providers, any contracted operation and maintenance, and buyers of outputs.

[1] NYSERDA. 2013. "Portable Digester Systems for Small- to Mid-sized Dairy Farms in New York," NYSERDA Report 14-06.

Of these risks, margin risk is perhaps the most critical for securing financing for digester projects because it has the closest and most direct tie to the ongoing profitability of the projects.

This study is based primarily on information compiled from interviews with individuals in the digester manufacturing, installation, and financing business. These individuals all have personal experience with the financing of digesters. Many have worked extensively with the various federal and state incentives available for digesters on farms. Examples of the types of interviewees include:

- Digester project developers.
- Farm credit banks.
- Equipment financing companies.
- Engine generator set suppliers.
- Alternative financing providers for renewable energy.
- Manufacturers of digester system components.
- Managers of third-party owned digester projects.

2 Alternative Financing Structure 1: Third-Party Ownership

2.1 Description

Anaerobic digesters can lower costs and improve manure management for dairies, but dairies sometimes lack the technical expertise and time to manage digester systems. Further, financing a new digester system has the potential to prove burdensome for overall farm cash flow and balance sheets.

One alternative is third-party ownership of anaerobic digester systems, where a third-party investor is involved with the financing and ownership of a digester system. The third party may also have further involvement in the operation of the digester, although involvement is not a necessity. Third-party ownership means that although a dairy is providing manure, and is often receiving some form of benefit from the digester such as bedding, electricity, or other negotiated benefits, the farm is not the owner of the digester system. For example, the third-party could be an individual or group of outside investors, a digester project developer, or an equipment leasing entity.

For third-party ownership, several basic components of ownership are needed. Third-party business models typically require:

- A lease or arrangement for the land on which the facility sits.
- A manure supply agreement between the dairy farm and the digester owner.
- Performance guarantees from the digester operator and manufacturer for the period of time the digester will operate.
- Revenue agreements are strongly preferred by most third-party owners. This would include agreements for any sources of revenue for the digester, such as electricity, fiber (bedding), tipping fees, and environmental credits. The Innovation Center for U.S. Dairy has noted that off-take or revenue agreements with creditworthy companies provide added assurance of revenue being sufficient to pay the debts associated with the digester project.

As described in the 2013 study, *Portable Digester Systems for Small- to Mid-Sized Dairy Farms in New York*, some third-party ownership systems may be targeted at portable digester systems, particularly those with lease financing. However, third-party ownership is not limited to a particular type of financing or a particular size system and has also been used in large and permanent systems.

2.1.1 How Risks Are Addressed

Rather than directly reducing the risks associated with anaerobic digesters, third-party ownership transfers risk from the farm to the third party. The farm still has some risk exposure but that risk is much less than if the farm owned the digester system. Rather than shouldering the entire cost of the anaerobic digester project, the farm's risk exposure becomes limited to the expected increased revenues and reduced costs from the digester project.

The specific adjustments in the farm's risk exposure will depend on the particulars of the arrangement with the third-party owner. The farmer is no longer directly exposed to the costs of construction risk and technology risk, but the farm still faces the opportunity cost of a delayed project or underperforming technology. Depending on the agreement with the third-party owner, the farm may face reduced electricity and bedding availability from the digester if the system is underperforming or completely down.

Often, the farm does not incur any debt financing, and thus, is not exposed to interest rate risk. In many cases, the third party or a separate management company operates the digester, which further reduces the farm's management risk.

Third-party ownership increases the counterparty risk to the farmer. The farmer is reliant on the third-party for the financing as well as expertise to design and operate the digester. Giving up ownership of the digester also means the farmer has generally given up decision-making authority. Thus, it is extremely important in third-party ownership situations that the third-party has prior knowledge and experience with operating digesters.

2.2 Options for Business and Financing Structure

2.2.1 Leasing

A lease can be structured through a traditional lender, but in many cases, traditional lenders (such as banks or farm credit associations) require additional capital as security for a digester system, and they are unwilling to enter into a lease agreement. In contrast, equipment leasing companies provide financing for either the entire digester generation system or for the engine generator set, which is a large component of overall system cost. Actual pricing of systems can vary dramatically depending on the components and scale of the project.

Key characteristics of lease agreements include:

- Lease financing tends to be on shorter terms than a loan for outright ownership. Leases for digester systems may be for five years, or up to seven years in some cases.
- Farm lessees are responsible for fixed monthly payments to the lessor, but they often have full responsibility for the operation and maintenance of the digester and for marketing of the products and co-products.
- Industry contacts indicate leases may be structured with the option of a buyout at the end of the loan. This buyout may be priced at, for example, 20 percent of the value of the original investment. In some cases the value at the time of the buyout must be decided through an independent assessor. A buyout is typically financed by a local bank or farm credit association for three to five years, depending on the financial situation of the farm. This shifts the risk of the digester system from the lessor to the new owner and their financial institution.

The financial assessment of farms applying for leases rather than loans for anaerobic digester systems may impose different, although not necessarily more stringent, financial standards. For example, because there is no collateral for the loan beyond the digester system, the cash flow of the farming operation, both with and without the digester, becomes much more critical to the terms of the lease. This is compounded by the shorter repayment period for most leases as compared to loans.

Additional financing considerations may be available, depending on the third party and the ownership structure. Some third-party owners in the digester industry suggested digester projects must be able to cash flow without organic substrates. Renewable energy credits (RECs) were viewed similarly. One interviewee commented that, "Unless you have a contract, the value is at risk and cannot be considered guaranteed income for the project."

One additional benefit of a lease, depending on how it is structured, is the ability to allow the lessor to use the tax benefits of depreciation of the asset while it is owned. This is one of the drivers for the typically shorter terms for leases compared to loans. The tax savings the lessor gains from depreciation of the asset are partially transferred to the digester lessee via reduced monthly payments. Some industry contacts indicated that in the case of any tax benefits received by a third party, around 85 percent of that value would be returned to the digester owner, though this value could change depending on the lease structure. This is a significant incentive to lease a system, if the farm itself cannot use the tax benefits of depreciation of the digester system.

A few key types of leases may be considered for anaerobic digester projects. Each type has its own benefits and drawbacks and is more or less appropriate, depending on the particular situation. Leases are generally classified by the U.S. Internal Revenue Service (IRS) as tax leases or nontax leases. In a nontax lease, the lessee obtains the full benefits of ownership, including depreciation. In a tax lease, the lessor is the owner of the equipment for federal income tax purposes and receives the rights to the tax benefits of ownership, such as depreciation and tax credits. There is a tax benefit to the lessee of being able to claim the full lease payment as a business expense. At the end of a tax lease, the farmer (lessee) would have three options:

- Extend the lease for another year.
- At the lessee's expense, return the system to the lessor. (This is viewed as extremely unfavorable to the farm, because of the time and expense required, and it is also viewed as extremely unfavorable to the lessor, who does not want ownership of the broken and worn out pieces of the system.)
- Negotiate a fair market value price and purchase the system. (Residual values are very low and the resale market is extremely thin, or nonexistent, for digester systems, so the price is often based on a market system appraisal. Residual values are often between 5 and 20 percent of the original investment cost.
    - This option is the one most often used for leased anaerobic digester systems.

The Financial Accounting Standards Boards (FASB) also classifies leases as either 1) capital leases or 2) operating leases. For capital leases, the basis of the transactions is the purchase of equipment in the form of an equipment lease. Capital leases are treated the same as a purchase, and the equipment is shown as an asset and a liability on the lessee's balance sheet. For operating leases, the lessee does not acquire the asset, does not use the asset for most of its useful life, or does not pay a significant portion of the cost during the lease term. Operating leases are treated as pure rentals and are not shown on the lessee's balance sheet. Contacts in the equipment leasing business suggest anaerobic digester leases are more likely to be capital leases than operating leases.

Although leases are common for many types of farm equipment and are readily available from most farm equipment dealers, the majority of digester manufacturers do not offer their own financing for digester systems. Only a few digester manufacturers provide their own financing of systems. More often, the financing of digesters as a lease would be through a separate equipment leasing company. The system and system component manufacturers may be highly involved in the financing process, however, as the financing is required in order for them to receive payment for their system. Further, there are fewer options for leasing the engine generator set rather than the entire anaerobic digester system.[2]

2.2.2 Power Purchase Agreement

Power purchase agreements (PPAs) are common in other areas of the renewable energy sector, particularly for solar electric systems (also known as solar photovoltaic (PV) systems). There are two parties to a PPA: the installer/ owner of the system, and the property owner. In a PPA, the third-party developer owns, operates, and maintains the solar system in exchange for the property owner allowing the solar electric system to be sited on their property. The site owner then purchases the services provided by the third-party owner, rather than purchasing the solar electric system themselves. The net result is typically lowered electricity cost for the site owner, while the third-party owner gains via electricity sales revenues and benefits from tax credits.

[2] The engine generator set is the component of the anaerobic digester system with the greatest resale value and is the most transferable from one system to another. However, depending on the maintenance of the system and whether there is a scrubber for hydrogen sulfide, the resale value even for the engine generator set may still be quite low with a large amount of lost capital.

One engine generator set manufacturer indicated that some private groups were interested in being third-party investors in anaerobic digester systems. Some of these investors intend to earn margins on each stage of the full project. That is, they wanted to make margins on the financing, project engineering, equipment purchases, electricity production, and system management. By making margins on each stage, they can better justify their participation in the early stages of project development, and they can also ensure the performance and profitability of the system by having an ongoing involvement with the project throughout its useful life.

2.2.2.1 PPA Lessons from Solar

Solar PPAs are often put in place for up to 20 years to reduce electricity costs for homeowners in exchange for placing a solar electric system on their property. Feedback from interviews suggests that the typical reduction in electricity cost for a PPA for a residential solar electric system is around 10 to 15 percent of the total energy cost. Further, the demand side of energy consumption is unaffected by the PPA.

One of the driving factors for PPA agreements for solar energy is the tax credit structure. The third-party owner of the system has cash available to cover the cost of the system, as well as an ability to use the tax credits. For example, in many PPAs with third-party investors, the investor would set up an LLC and buy 99 percent of the shares in the LLC, and the photovoltaic system installer would purchase the other 1 percent of share in the LLC.

Owners would typically hold the system for at least six years to capture the full tax benefits. After the original investors in the solar electric system have fully captured the tax benefits, mezzanine buyers, who are annuity investors seeking a set rate of return over a fixed period, typically purchase the system. The best time for this mezzanine investment in a solar electric system is immediately after the original investors have fully depreciated the system, and it is of little remaining value to the original investor but still has significant useful life remaining. This is an important consideration for potential options for anaerobic digesters, which also have useful lives beyond the period over which they could be depreciated by the original third party investors.

In some cases, there are negative tax implications for the parties to the lease if a set price for the buyout is included in the original terms of the lease. In these cases, an alternative means is used to end the lease. Most often, this is done via a transaction at a price based on an appraisal by a third-party appraiser.

For solar electric system PPAs, it is unusual for the residential owner of the property where the system is located to purchase the system at the end of the original lease term. If the system still works, the property owner will most often choose to extend the lease. If the system is not working, most leases include provisions in the lease to decommission the system and return the site to its original state.

2.2.2.2 Takeaways on PPAs for Anaerobic Digester Systems

Many similarities exist between solar electric and anaerobic digester systems, but the differences are also substantial and not to be ignored.

Anaerobic digester systems have far more moving parts, both in terms of the actual mechanics of the renewable energy system as well as the reliance on a number of inputs and off-takes in order for the system to operate efficiently and the financial returns to be as positive as expected. Thus, PPAs with third party ownership of the anaerobic digester system should include additional guarantees on system performance or guaranteed savings for the farmer, as well as clear delineation of responsibilities for operation and maintenance of the system.

The use of PPAs with third party ownership of an anaerobic digester system is an effective way to transfer a portion of the risks identified by banks and other lenders from the farmer to the third party. By not owning the system, the farmer is no longer fully exposed to the risk of problems with construction, technology, management of the system, and margins. The third party investor has most of the funds at stake and assumes whatever interest rate risk is in place. However, the farmer still faces counterparty risk. There is some indirect risk from all of the counterparties involved in the digester inputs and off-takes, but the most direct risk is associated with the third-party owner of the system with whom the farmer has the PPA.

In contrast to the PPAs for solar electric systems, it is unusual for a farm to have enough electrical load to use all or even a large majority of the electricity produced by a digester system. For most solar systems, the majority of the electricity produced can be used on-site, and is thus valued at what is generally a retail electricity rate. Most farm digester projects can benefit from net metering, but only the portion used on-site has the potential to provide a retail value for the electricity while all excess power that goes onto the grid would provide a much lower wholesale electric rate value. In addition, most farms must pay demand charges regardless of net-metering which can effectively reduce the retail value for power used on-site to a value closer to wholesale electric rates. One alternative that could provide slightly better value for the electricity produced could be a electricity wheeling arrangement in which excess power is wheeled to another utility customer with a large load. It should be noted that NYS policies regarding net metering and wheeling are under review and may change.

Compared to a lease, a PPA with third-party ownership of the anaerobic digester system removes much more of the risk of the digester system from the farmer. However, in most cases, it also removes more of the opportunity for profit. For example, a digester system with a PPA may reduce the cost of electricity and provides free bedding from the digester fiber for the farmer, while the third-party owner retains the majority of the revenues, expenses, and risk.

Whether a PPA with third party ownership of the anaerobic digester system is the preferred arrangement for a farm will depend on the specifics and structure of the agreement. Arrangements could be structured to be more beneficial to the farmer, or more beneficial to the third-party owner. Which arrangement is preferred also depends on how the

farmer views the purpose of the digester. If the digester is viewed as a means of reducing costs for the dairy cattle and milking operations, then a PPA with third party ownership of the anaerobic digester system may be a very effective way to reduce those costs and provide some reliability that the costs will be reliably and uniformly reduced. However, if the farmer views the digester as a new profit center for the farm and expects to make substantial returns in exchange for the investment and involvement in the project, a PPA with third party ownership of the anaerobic digester system may remove too much of the risk and potential returns from the farmer for a mutually agreeable arrangement to be reached.

2.2.3 Examples of Third-Party Ownership

A number of examples of third-party ownership for anaerobic digesters are already in place, including some within New York. There are many examples of third-party ownership, including:

- CH4 Biogas formed Synergy Biogas, LLC to build, own, and operate an anaerobic digester at Synergy Dairy in Covington, NY. Synergy Dairy leases the site for the digester system to Synergy Biogas, LLC and supplies manure to the digester. Manure from more than 2,000 cows supplies the digester system, along with additional organic substrates.
- Desert Hills Dairy in Nevada had a digester installed on-site by DVO Inc. to digest waste from approximately 10,000 head. In this case, the third-party owner of the anaerobic digester system is a subsidiary of Carbon Bank Ireland Ltd., a carbon credit trader with plans to build additional digesters in China. Construction of the Desert Hills digester began in 2012 as Nevada's first anaerobic digester project.

2.3 Benefits

Anaerobic digesters are a complex biological and mechanical system, which many dairy farmers lack the available time or expertise to operate at peak performance. By utilizing a lease or PPA, dairy farmers have the opportunity to reap some of the benefits of anaerobic digestion of manure while avoiding some of the challenges of anaerobic digester system ownership.

Equipment leasing contacts suggest for moderately leveraged farms with a strong cash flow outlook, leasing may be a strong option because the equipment itself can be used as the collateral rather than the other farm assets.

The extent to which the lease or PPA differs from ownership of the system depend on the terms of the arrangement, as well as the mechanism in place for operation and maintenance of the digester and whether it is the responsibility of the dairy farm or of a third party.

The capital investment required for an anaerobic digester can be formidable to a dairy farm, on the order of millions of dollars and the leveraging of key farm assets as collateral to finance the digester project. Leases and PPAs provide alternatives, as they often do not require leveraging of farm assets and in the case of PPAs, do not require large cash investment to start the project.

2.4 Constraints

Leases have somewhat different requirements for financing compared to traditional lender financed purchases of anaerobic digester systems. Leasing companies look more critically at the cash flow of the farm operation and the expected cash flow of the anaerobic digester project.

A leasing company is not involved in the financing of the overall farm operation, and in many cases there are few assets available of significant value to secure the loan that are not already leveraged for other farm financing.

Leases for anaerobic digester systems often have shorter terms than traditional loans for purchase of systems. Loans of around five years are common, and require the farm to pay back the cost of the digester system even more rapidly. This requirement can place additional strain on the cash flow situation of the farm.

Although a large number of traditional lending institutions are available to finance traditional purchases of digester systems, only a few companies providing opportunities to lease digesters systems who are willing to develop PPAs with farmers.

PPAs require a dairy farmer to give up many of the potential financial rewards of a digester system in exchange for the third party taking on the majority of the risk of installation and operation of a system.

With a PPA, the farmer is not in control of the management of the digester system and loses some (or all) of the authority over how the system is operated.

2.5 NYSERDA Interface

While there are a number of projects financed by third party ownership of the digester system with a PPA or other similar type of agreement, the number of projects financed as leases is much smaller. For third-party ownership with PPAs, the interface with NYSERDA is relatively simple and does not require a change in the structure of how incentives are provided. The incentive is provided to the project owner, and it is expected that the improvements in the financial outlook for the digester project are partially or fully passed to the farmer in the way of improved terms to the revenue sharing or PPA.

If NYSERDA wishes to incentivize additional digesters as third-party owned systems, providing funding exclusively for systems with a third-party ownership structure is one means to promote additional projects. Alternatively, rather than targeting funding at these projects, funding programs can be made more flexible to allow greater participation by third-party owners in applying for and securing incentives.

Based on the three options presented that are available for leased systems at the conclusion of the lease, there are strategies NYSERDA could use to help ease the transition of ownership at the conclusion of the lease, as well as ensure that systems that are functioning well and producing electricity and profits for the owners continue to remain in operation. One example of how this might work for the end of a lease would be a funding program by NYSERDA in which a project developer is funded for a certain number of projects, and at that time NYSERDA also sets a portion of that funding aside as a fund to cover the cost of decommissioning a project. If the developer concludes all the leases and does not use the set aside a decommissioning fund, that fund could be returned to the project developer. This is just one case of how a program might be structured to handle the end of a lease for systems with third-party ownership.

For the leased systems, the specifics of the incentive terms may require adjustments, because the farmer operator is not the owner. However, the general principles of NYSERDA's current funding incentives are applicable to leased systems as well. One possible change to consider is adjusting the length of the payment period for the performance incentives, since the length of the lease is almost always shorter than the 10-year period for current performance incentives. Further, because there is no large upfront payment, the capacity incentive may be better used over time to help reduce the periodic lease payments, or at the conclusion of the lease term when the farmer typically buys out the leasing company for the appraised value of the anaerobic digester system.

Another alternative to consider is that because the system will be leased, there may be less of a need for upfront payments, and more payments spread throughout the full life of the system. Because the benefits of a tax lease to the lessee are based on the equipment lease payments and the benefits to the lessor are based on the amount of the capital investment, payments may need to be structured as rebates to lease payments or timed to assist with financing for the buyout at the conclusion of the lease. Other fine tuning may be necessary to appropriately match with a lease financed system, depending on the terms of the lease.

3 Alternative Financing Structure 2: Partnership with Organic Substrate Provider

3.1 Description

Under this structure, the owner of the anaerobic digester system has a more extensive contract with the provider of additional organic substrates, such as a food processor that produces significant amounts of food waste, for the digester. For financial institutions, one of the major risks for anaerobic digester systems is the "margin risk" for the margins earned from the operation of the system. These margins are based on the pricing of all inputs and outputs of the systems. Many systems are sized according to expected energy production with up to 50 percent organic substrate included. Further, financial analysis of system feasibility suggests some systems are only profitable if additional organic substrates are added beyond the manure produced on the farm. If the off-farm organic substrate becomes unavailable, the full project may begin to lose money.

By partnering with the organic substrate provider, the owner of the anaerobic digester system may be able to add more certainty to the expected returns and, by providing more assurance to the lender of the expected cash flows and profitability of the anaerobic digester system, is able to secure better terms for the system financing. Although additional negotiations and changes may occur, there is the opportunity for arrangements with the organic substrate provider to increase the value of the electricity provided through development of a net metering or wheeling arrangement.

Contacts in the manufacturing and financing of digesters suggest food waste generators can be hesitant to sign long term contracts for off-take of food waste. Fluctuations in their business can impact the volume of food waste generated, and fluctuations in other commodity and energy markets can impact the value of their food waste for other purposes and the cost of tipping fees for disposing of food waste. Many in the digester business indicate that contracts longer than one year for food waste are rare, with contracts up to three years even more rare. This is far shorter than the 8 to 15 year lifespan of most digester systems.

Examples of how a digester owner and operator might partner with an organic substrate provider include:

- Establishing a LLC for shared ownership of the digester. The value of this arrangement might be based on the value of the electricity production contributed by the additional substrate, or instead, based on the value contributed towards the initial installed cost of the digester and ongoing maintenance and operations.
- Negotiating a contract for shared revenues from the digester electricity output or other revenue. The primary benefit from adding additional organic substrate to a digester is a result of the additional methane production from the energy contained in the organic substrate. There may be some additional benefits from the added nutrients as well.

- The food waste provider and digester owner may not have to be in a direct partnership in order to have a mutually beneficial relationship. Setting a contract for a minimum volume of food waste, with a mechanism for periodic adjustments to the value of tipping fees, is another option to guarantee volumes of food waste for the anaerobic digester while still allowing food waste suppliers to adjust their tipping fee expenses.
- Creative farmers and food waste providers may develop additional solutions beyond these possibilities that meet the criteria of providing additional certainty for the output and profitability of the digester and incentivizing an ongoing supply relationship between the owner of the digester and the food waste provider.

3.1.1 How Risks Are Addressed

In the absence of additional organic substrates from food waste or other materials, many anaerobic digesters on dairy farms would not be able to generate the cash flow needed to pay back the costs of the system within a reasonable time frame. To reduce the risk of an inadequate supply of additional organic substrate, a partnership or other arrangement with the food waste provider may provide additional incentives to both parties to ensure the digester receives enough food waste to be profitable. This arrangement not only eliminates risk, but it also provides contractual obligations to both parties to ensure there is a good faith effort to continue providing the additional organic substrate to the digester.

3.1.2 Example of an Organic Substrate Partnership

New Chester Clean Energy in Wisconsin is an example of how a creative partnership can be used to facilitate an anaerobic digester project. The project is a collaboration between New Chester Dairy; Brakebush Brothers (a frozen chicken products manufacturer), and Clean Energy North America (the builder of the digester system). Clean Energy North America is building the anaerobic digester on New Chester Dairy's land. New Chester Dairy will provide dairy manure. Brakebush Brothers will provide chicken offal for the digester and will be the offtaker of the biogas, which will be piped 16 miles to the Brakebush's plant and burned to generate up to 80% of Brakebush's energy load with waste heat used to heat Brakebush's hot water. The energy will be generated "behind the meter," without the involvement of a utility. The digester will be owned by a third party (Clean Energy North America), although Brakebush owns a minority stake.

3.2 Benefits

There are benefits for the digester owner, whether it is the farmer or a third-party owner, in having additional certainty in the supply of organic substrates and the expected production of energy and other co-products. They are better able to plan for future cash flows and potential financing needs.

A number of financial institutions indicated that without a long term supply contract for organic substrates, they did not consider any potential additional revenue from adding organic substrate in the digester project income statement projections used for setting the financing terms.

The additional certainty provided by a guarantee of food waste inputs into the anaerobic digester system can reduce margin risk enough for a lender to provide financing, or to provide better rates for financing.

Consistency is pivotal to high performance of anaerobic digester systems, and the microbial environment within the digester is sensitive to variations in inputs. Having both the owner of the anaerobic digester system and the provider of food waste vested in the performance of the system has the potential to provide benefits in terms of both digester performance and efficiency.

There is the potential for the organic waste provider to also be involved in the financing and/or ownership of the digester system, and thus have gains from a tax standpoint from making the capital investment in the system. The structure of such an arrangement would depend on the particular organic waste provider and their interest and abilities to provide financing or participate in ownership. For example, a private business provided food waste may be able to participate in the ownership of the digester system or provide the system financing. Dairy cooperatives may also be able to be engaged in a mutually beneficial ownership or financing structure with the farmer.

3.3 Constraints

Arrangements between anaerobic digester owners and food waste providers other than organic substrate supply contracts are uncommon at this time. Lending institutions are still hesitant to consider the full value of these guarantees when deciding on financing terms for the anaerobic digester system until there is a track record of successful arrangements.

The digester owner is expected to transfer some of the benefits of digester ownership and positive returns to the food waste provider in order to secure a long term relationship for food waste inputs for the anaerobic digester system. The net returns for the owner could be lower than without the long term relationship (but they are less at risk).

Finding the right food waste supplier to partner with a digester system will be a major challenge in development of this business model. All suppliers of food waste will not be willing to negotiate partnerships or relationships of this length of time, when they can currently sell food waste on spot prices or on short term contracts. Promoting the sustainability and environmental benefits of the project, as well as the potential benefits to both the dairy farm and the food waste supplier, will all be critical in securing a willing food waste partner.

3.4 NYSERDA Interface

To incentivize these arrangements for partnership or cooperation with food waste providers, NYSERDA could consider providing incentives specifically for digesters with a partnership or long term supply relationship between the digester owner and the food waste provider. The incentives could be provided to the farm, jointly to the farm and food waste provider, or solely to the food waste provider. Making the payments dependent on the continued partnership between the digester owner and the food waste provider may be a useful mechanism to 1) incentivize the partnership of food waste providers and digester owners and 2) reduce the likelihood that food waste providers will seek alternative off-take contracts for their food waste, leaving behind farms with anaerobic digesters without food waste inputs and potentially lower efficiency and lower energy production. These incentives should be structured so as not to unfairly penalize either the food waste supplier or the dairy if the contract is broken by one of the parties.

4 Alternative Financing Structure 3: Cluster Financing

4.1 Description

In spite of strong efforts by digester project developers, lenders, farmers, and investors, there remains a risk that anaerobic digester projects will not perform as well as expected. Clustering anaerobic digester projects has the potential to reduce risks to investors of digester project failure or poor performance. Interviews indicate geographically clustered projects must include a minimum of five digesters to take advantage of the efficiencies gained in construction costs and in the expenses of operation and maintenance.

Although digester projects can be physically clustered to simplify management and provide additional expertise for management of several digester systems by an individual or a team, some of the risks of digester systems may be addressed by grouping projects without having them in close physical proximity. Through clustered management and/or clustered financing, digesters can take advantage of some of the benefits.

There are a number of potential options to structure a clustered digester financing. For example:

- A cluster of anaerobic digesters can be owned by a single investor and managed as a unit. In this case, the single investor is self-insuring against the risk of digester project failure.
- A group of investors, perhaps without the individual capital to invest in several digester projects, who join as a group to develop several digester projects in an area.
    - Having several investors would require this structure to have clear and delineated leadership and decision-making process in order to manage the range of interests and opinions on how the projects should be managed.
    - One option for groups of investors in a set of 10 to 20 projects is to set aside a “loss pool” to cover any systems that are unsuccessful. By pooling their risk, the group is self-insuring against potential losses.
    - For group investment, several steps are necessary:
        1. Obtain leases for each digester site.
        2. Complete a manure supply agreement with each farm.
        3. Complete a revenue sharing agreement.
        4. Complete any service contracts, either for the power generation unit only or for the entire system

- Clustering the incentives from a government or nonprofit entity for a group of digester projects developed by a single digester project developer. Such a clustering of incentives would ensure a certain number of projects meeting a minimum set of criteria will receive incentives.
    - For example, a project developer could apply for NYSERDA incentives for five to ten projects, providing information on the basic digester technology, engine generator set, and other implementation of the projects. Once the project developer is pre-approved for incentives for a certain number of projects, the developer would then find several dairies that are good matches for digester projects. The state funding entity would sign off on the projects, simplifying the process to secure incentives for the digester company and eliminating one of the major uncertainties (availability of additional incentives) of the financing process.

Note that in general, a combination of lease financing and financing of a cluster of anaerobic digester projects was not viewed as feasible. Equipment leasing companies expressed a requirement of having a single lessee. The lessee can be a LLC or another group organization, but there must be a lessee who is ultimately responsible for making the lease payments for the full lease term.

4.1.1 How Risks Are Addressed

Clustering the financing for anaerobic digesters on farms could address a number of risks for the digester systems. By grouping funding for digesters as a cluster, the risks of failure of a single digester are spread across a number of projects. Companies that finance anaerobic digesters already are in the business of spreading these risks by financing a portfolio of digester projects rather than a single system.

For third-party investors, aggregate risks across major risk categories are also spread among the cluster of projects. The failure of one digester is unlikely to cause an investment to fail if it is just one of several anaerobic digester projects. .Construction risk has the potential to be reduced for each individual project as each project may have a different degree of challenges with being on time and on budget.

Technology risk can be reduced or amplified by clustering projects. For generally reliable systems, a single technology is unlikely to have the same failure in all the digesters in the financing cluster. However, an unproven system might have a failure that impacts all systems in the cluster, and rather than having a single expense to the financing group for one problem, the problem has to be addressed in all systems. Exposure to interest rate risk would depend on the financing of the system. Perhaps the most critical risk, margin risk, is impacted by reducing the risk of negative margins for the cluster of digesters as a whole. However, any agreements for the entire group of digesters (for inputs or off-take of digester products and co-products) are equally at risk for the entire group of digesters.

4.2 Benefits

Financing a group of digesters spreads risk over several projects. Failure of a digester project for an investor in a single system can be financially catastrophic, while failure of one of many digester systems owned by an investor or group of investors may result in lost income but is unlikely to cause business failure.

Projects financed as a cluster may also be able to take advantage of other economies of scale, such as lower construction and operating costs, and more leverage in negotiating with utilities, food waste suppliers, and buyers of other digester products.

Providing a block of financing for a set of digester projects provides incentives to digester project developers to get systems approved, installed, and operating. The process of applying for and securing financing can be time consuming and challenging, and the guarantee of the availability of funds may incentivize farmers who may otherwise be unsure of proceeding with a digester project to take the next step toward installing a project.

4.3 Constraints

Financing several digester projects requires a much larger capital investment than financing only a single project. The value at risk is also much larger if multiple anaerobic digester projects turned out to be unsuccessful.

Some risks are not offset by having multiple digester projects. For example, regulatory impacts on anaerobic digester projects may impact all digesters equally. Similarly, shifts in the market for electricity or digester co-products could reduce the value of the outputs of all digester systems in the cluster, depending on the contract and off-take structure for those outputs.

Handling a cluster of digesters may require additional coordination and planning throughout the decision-making process, and it may also require a more complex business structure if the digesters are to be managed as a group as well.

There may be some resistance from some financing entities. One equipment leasing company interviewed suggested they would prefer not to finance a group of projects together. They already build a portfolio of digester projects as a part of their normal business practice and risk mitigation strategy, and they did not believe it was necessary to cluster the financing for projects for them to receive the same benefits of a portfolio of projects.

4.4 NYSERDA Interface

Clusters of digesters can be developed with assistance from NYSERDA, but they can also be developed independently by third parties. Investors in a group of digesters could have each digester project apply individually for incentives, and those that receive incentives will likely provide stronger cash flows than those that do not receive incentives.

However, NYSERDA is in a unique position to approve financing for a cluster of digesters as a unit. Digester project developers and equipment manufacturers have perhaps the strongest incentives of any of the parties to a digester project to get projects approved and operational. By providing reputable digester project developers using

reliable equipment and technologies with a set amount of funding to spread over a number of projects, funding is applied to those projects as needed, with a secondary check by NYSERDA to ensure that projects with longevity beyond the incentive period are implemented. This structure for clustered financing may also provide a means of incentivizing projects that may not proceed without additional incentives.

Digester project developers reported significant hurdles in the project development stage. Some digester system manufacturers created internal project development teams to help shuttle projects from the idea stage through to start up. Others reported the expense and inefficiencies that were common during the project development stage, when hundreds of thousands of dollars could be spent in planning, permitting, and applying for financing only to have the project fall through or switch over to another digester system manufacturer at the last minute. One possible strategy to handle this issue would be through a pre-approval process. Pre-approval vendor lists are already in use in some programs at NYSERDA, but additional steps are possible within the anaerobic digester program to 1) ensure farmers are aware of all vendor options in the early stages of the project, and 2) help mitigate the likelihood of farmers switching among project developers late in the development process.

Securing financing for a group of projects may alleviate some of the risks during the early stages of project development. It would also provide additional certainty for farmers who are unsure of whether their project would qualify for funding. Finally, such a program would reduce the likelihood of farmers switching among digester project developers late in the game, increasing the overall cost of project development for the industry. An application process for the cluster of incentive financing, as well as secondary approval of individual projects would need to be set up. Performance incentives would likely remain an important tool for cluster financing because it would incentivize the digester manufacturer to ensure the projects it develops are strong candidates for anaerobic digestion of waste. Additional development of this concept would also require a determination of whether incentives are better paid to the farmer or to the project developer.

Overall, cluster financing appears to have strong potential to reduce or alleviate some of the current challenges and risks within the anaerobic digester industry in New York State. It would provide additional funding to those with the strongest incentives to develop digester projects and perhaps shorten the time from approval of financing to project start up and also has the potential to increase the number of operational anaerobic digesters in New York State.

5 Additional Discussion on Financing Anaerobic Digesters

There are several financing and business models beyond the three highlighted in this report. Further, a number of interviews provided the following useful insights and suggestions on financing relevant to NYSERDA's goal to improve the utilization of its funds for financing digester projects.

A number of interviewees suggested the core challenge with digesters is not the availability of financing; rather, it is the economics of electricity and energy in the U.S. Since natural gas prices began dropping dramatically in mid-2008 and remained well below levels of the previous decade, the cost of fossil-fuel based electricity production has fallen. Thus, the rate farmers or other owners of anaerobic digester systems can earn for electricity production from the methane produced by digesters is quite low relative to the cost of production (in the absence of state initiatives to increase the price paid for renewable electricity). Many of the system developers interviewed believe the underlying fundamentals of the energy market are a much greater challenge than the ability to secure funds to invest in anaerobic digester systems with high returns.

Interviewees suggested investors are willing to invest in anaerobic digester systems, if the return is sufficient. Some individuals interviewed noted the challenges in the length of the time frame for digester project development. It is challenging for companies in the anaerobic digester business to invest resources to develop a project over one to two years only to have the project fall through. Companies can only afford this to happen occasionally. Interviewees noted that anything NYSERDA could do to help shorten the project development phase and to streamline the process would be useful to the overall industry. For the interface with NYSERDA, pre-approval of digester systems may speed the process for both farmers' decision making as well as potentially shortening the approval process for funding from NYSERDA.

Multiple interviewees on the system development side mentioned the challenge of "dying systems." Systems that received strong initial financing or were constructed when the renewable energy investment tax credit was available are reaching an age of five to ten years old, and the additional costs necessary at that age for maintenance, engine overhauls, and other periodic maintenance exceed the expected value of that investment. One possibility is to establish financing to keep some of these digester systems operational, particularly for systems that have operated efficiently and are generally well-maintained. Leases would be out of the question because there would be minimal resale value, but people in the industry with expertise to retrofit the systems could potentially keep them in operation. A number of arrangements could be proposed, but they might include the option of buying the system from the farmer at a low price and instituting a power purchase agreement for the farm. A logical buyer might be someone with the expertise to overhaul the engine generator set and maintain an older digester system.

One anaerobic digester system manufacturer believed that without additional incentives, a number of systems would not remain operational through the full useful life of the equipment.

For some investors, the scale of a single digester project is too small for the scale of investment they are interested in making. One engine generator set manufacturer indicated they had investigated seeking a block of financing from the major banks to provide financing of digesters. In spite of their best efforts to educate banks on the digester systems and their reliability, the scale of the projects was too small for the very large major banks to be interested in providing financing in the end. One investor mentioned the banks they had talked with wanted a scale of investments values at $25 million or more, which is much larger than most anaerobic digester projects on farms.

One suggestion from third-party owners was the importance of helping farmers through the first initial hurdles to digester construction. For example, the costs tied up in the grant writing and permitting stage can be on the order of $60,000, and this is often viewed by the farmer as a risky investment if grants or permits are not approved. If NYSERDA were to offer grants under $100,000 at this stage, it could be helpful in getting many farmers past one of the early investment hurdles to the stage of deciding to proceed with a project.

One equipment leasing company expressed a strong preference for grant financing over tax incentives due to the restrictions tax incentives can put on their customer base. For example, municipalities that install digester projects are nonprofit and cannot earn the same tax benefits as for-profit businesses. For farms that may experience a year of a net operating loss, they also would be unable to benefit from a tax incentive, whereas they would be able to receive the benefits of incentives structured as grants. In the end, tax incentives can limit the digester system owners who can benefit from the incentive. The leasing company emphasized that they preferred to work with grants going directly to farmers rather than to equipment manufacturers, at least in part because the leasing companies contracts and arrangements were already in place with the farmer.

Other alternative sources of financing discussed include financing for carbon reduction credits, including mandatory (primarily those who must meet California's compliance standards) and voluntary compliance programs. These programs can follow the verification standards to meet annual compliance in a mandatory market. Alternatively, they can make a forward purchase of carbon emission reductions at the time a new project is built for the expected reductions over the life of the project. This option provides upfront funding for a digester project at the time of the most significant capital outlays.

The market and financing options for solar energy are extensively developed. Options already available in solar financing include many of those proposed here for use in anaerobic digester systems. Solar companies like to provide financing for solar energy projects via a wide range of options, including:

- Take-Out Financing. This refers to an instance where an investor buys an entire renewable energy project for a negotiated sum.
- Co-Development. Installers interested in co-developing a project with another developer may partner based on their own strengths in project development and management and partner with another developer.
- Tax Equity Financing.
- Debt Financing. There are several companies that have become involved in debt financing. For example, one solar company has developed a $100 million solar debt fund targeted at financing mid-sized digester projects that have traditionally been more challenging to finance. Funding is available in the form of construction loans, term loans, and construction/term loans. These projects ideally have a medium size and a long-term agreement with the off-taker.
- Renewable Energy Credits financing. RECs are aggregated and financed, with project owners having the ability to sell RECs through multi-year fixed rate contracts, spot market transactions, and upfront lump sum payments. [3]

One ongoing comment among many in the industry was the challenge of the lost capital of investing in anaerobic digester projects. The lack of value at the end of a project, or even shortly after digester start-up, increases the risk of a project and results in a reduced ability to recoup value from an investment if the digester project is not successful. Means of addressing the residual value of the project are still challenging.

One suggestion from an engine generator set manufacturer was a funding program specifically for scrubbers for the biogas produced by the digester. These are sometimes viewed as an unnecessary expense by some project developers, but they can have a meaningful impact on extending the useful life of an engine generator set and can also improve the residual value if a scrubber has been used because there is less corrosion and damage to the engine components. (NYSERDA has a funding program to provide funding for existing digester projects to fund the addition of a hydrogen sulfide scrubber, and the comments received from the industry suggest this program is one they view as valuable to digester projects.)

Interviewees and analysis suggest that anaerobic digester projects can also be financed through project-based financing. This type of financing, as opposed to the traditional balance sheet lending that many farmers are more accustomed to, uses only the project itself as the guarantee on the loan for the anaerobic digester system. Project financing can be a more restrictive financing method and require additional loan security measures, such as a debt service reserve, budgeted revenues, and a maintenance fund held in reserve by the lender. Project financing may not be the best option for financing projects for borrowers with strong balance sheets, but it is a viable option for farmers or third-party project developers with projects with strong cash flow and an interest in only risking the value of the digester project itself.

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[3] Note that current NYSERDA programs claim the REC credit on the electricity produced from the digester.

In addition, interviews and analysis show project lending matches some of the same needs as equipment leasing, where the primary collateral for the financing is the equipment itself. These financing options are good matches for strong cash flow projects who may not qualify for traditional lending or prefer not to risk their assets to secure financing for the digester project.

Project lending also has some of the same challenges as traditional lending, such as a preference or requirement for long term supply and off-take agreements, according to interviews and analysis. Other challenges include vetting new technologies and understanding how projects will be managed.

6 Conclusions

A number of business model and financing structure options are available to address the risks associated with anaerobic digester systems. These options can be targeted toward the particular project and financial situation of each farm and proposed digester project. Some of these options are well-tested in other areas of renewable energy or in equipment finance, and need only small modifications to fit well with anaerobic digester projects.

Three models business model and financing options were described in detail in this study: third-party ownership, partnership with a food waste provider, and cluster financing of digesters. Each of these three models are well-suited for a unique set of circumstances. Additional financing options beyond these three are available in the industry, and include project financing, carbon credit financing, and financing targeted at particular project planning steps or equipment components.

Third-party ownership of digester projects has a strong foothold in the anaerobic digester market. PPAs and third party ownership of digester projects are more common than leases for digester equipment and address a different set of strategic challenges. PPAs are common in the solar industry, and a number of lessons can be learned from that application. PPAs shift risk, but also revenues, from the farmer to the third-party investor. However, there can still be cost savings to the farm, and PPAs with reliable third-party partners make these savings available to farms without risking the full value of a digester system. Additional consideration must be used in developing PPAs for digester systems, because unlike solar systems, digesters have a significant amount of electricity production that will not be used on site. Leases offer an alternative set of financing options for projects with strong expected cash flow but less strength in the farm or investors' balance sheet.

Shared ownership with a food waste or other organic substrate provider is not a well-developed practice in the industry, but it is viewed as an option with potential. Implementation of this type of project will require active leadership by project developers to match suppliers of food waste with nearby dairies in a way that is mutually beneficial and provides more longevity and certainty for the digester project than the industry-standard one year supply contract for food waste. Much like projects with third-party owners, the farmer or other investors must be willing to negotiate a revenue sharing or shared ownership agreement with the food waste provider in exchange for eliminating some of the digester system margin risk. Food waste providers already aligned with the dairy industry are a good place to begin looking for partners, and initiatives by NYSERDA to promote these types of partnerships may expedite these agreements.

Cluster financing can be used within the digester industry to self-insure an individual or group of investors against the risk of digester system failure. This is similar to how a traditional lender or leaser of equipment would self-insure by building a portfolio of digester projects. In contrast, the clustering of financing from an outside grant or incentive source is not a common practice. Still, doing so directly addresses the challenges of uncertainty in the

planning phase, as well as the time delays in project start up. Approving a cluster of incentives for a single developer provides the grant funding to the group with the strongest incentive to build digesters: anaerobic digester project developers. In creating this incentive, additional checks and balanced are needed to ensure the projects are finance-worthy and have strong business plans and expected returns.

Business models and financing options beyond these three types are available, and they provide solutions to particular situations. The industry has generally been creative in financing projects in spite of some remaining challenges in ensuring lenders understand the digester technology and the reliability of expected returns. One of the underlying challenges remaining is the low value of electricity. This challenge relates more to the economics lof digester systems than a challenge in the availability of financing. One ongoing challenge for anaerobic digesters will be the valuation received for electricity production, and how to best market electricity produced from anaerobic digesters.

A number of alternative business model and financing options offer creative solutions to problems and challenges that have been noted by those in the anaerobic digester industry. Further, NYSERDA is in a position to leverage knowledge of these options to assist farmers and businesses who are interested in installing digester systems to generate renewable energy. Although no single program can solve all of the challenges of installation of anaerobic digesters on dairy farms, the options presented here make the development of renewable energy a possibility for some farms and business partners who may not otherwise have been able to develop and operate an anaerobic digester system.

NYSERDA, a public benefit corporation, offers objective information and analysis, innovative programs, technical expertise, and funding to help New Yorkers increase energy efficiency, save money, use renewable energy, and reduce reliance on fossil fuels. NYSERDA professionals work to protect the environment and create clean-energy jobs. NYSERDA has been developing partnerships to advance innovative energy solutions in New York State since 1975.

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Final Report
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