Food Waste Co-Digestion at Derry Township Municipal Authority (PA)

Business Case Analysis Case Study

Glossary

AD	Anaerobic digestion
AGP	Aerobic grease pretreatment
CHP	Combined heat and power
DTMA	Derry Township Municipal Authority
ESD	Egg-shaped digester
HSOW	High-strength organic waste
kW, kWh	Kilowatt, kilowatt hour
mg, mgd	Million gallons, million gallons per day
MMCF	Million cubic feet
MOU	Memorandum of understanding
O&M	Operations and maintenance
REC	Renewable energy credit
tpd	Tons per day
VS, VSS	Volatile solids, volatile suspended solids
WRRFs	Water resource recovery facilities
WWTF	Wastewater treatment facility

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Cover photo is an aerial view of DTMA facilities, courtesy of DTMA. Cover design by Evan Odoms.

Clearwater Road Wastewater Treatment Facility, Derry Township Municipal Authority (DTMA), Pennsylvania

About the Utility

- Service area: Township of Derry, portions of Hummelstown Borough and Townships of South Hanover, Lower Swatara, Londonderry, and Conewago
- Operating since: 1977
- Wastewater customers served: 20,000 in 6 municipalities
- Wastewater treatment facilities: Clearwater Road WWTF, and Southwest WWTF (unstaffed satellite facility, 0.6 mgd capacity)
- Employees: 39
- Governance: seven-member Derry Township Municipal Authority Board

About the Clearwater Road WRRF

- Location: Hershey, PA
- Size: 5.0 mgd permitted flow, 3.9 mgd current average flow
- Anaerobic digesters (AD): one 1.2-mg primary egg-shaped mesophilic digester, one secondary digester
- Food waste feedstocks: Fats, oils, and grease (FOG) (enters through headworks), Hershey wastewater solids, Divert food waste slurry, food processing residuals; food waste as share of total AD feedstocks: 35% volatile solids (VS) load, 10-15% of total daily feed to the AD
- Feedstock preprocessing: DTMA pretreats FOG onsite; Divert preprocesses food scraps offsite
- PPL Corporation is the electricity provider, current cost is $0.0632/kWh (2020) for generation and transmission; with distribution charges, the average total cost is $0.07/kWh (2020)
- Biogas use: 270-kW cogeneration engine, boilers
- Biogas production: prior to food scrap addition: 4.5 million cubic feet (MMCF) per month, post food waste addition: 8 MMCF per month; pending additional of two 1-MW combined heat and power (CHP) engines
- Energy (electricity) neutrality: 21% (2014-2018 average), 0% (2019, CHP out of service), 25% (2020)
- Biosolids management: Class B dewatered cake for land application; from 2009 until July 2018, when the thermal dryer went offline due to flooding, DTMA produced Clearwater SteadiGro Class A EQ product, which has a PA Department of Agriculture registration as a fertilizer and was sold for $10 per ton; DTMA is currently evaluating the most cost-effective beneficial reuse option for biosolids management into the future

Drivers and Goals

- Drivers: biosolids management challenges, increasing electricity prices, enhancements to nutrient removal efficiency
- Goals: increase onsite energy generation; keep customer rates low; provide a nearby outlet for community sources of septage, FOG, and high-strength organic waste (HSOW); and continuously improve their environmental footprint through better management of beneficial use opportunities

Summary

The Derry Township Municipal Authority (DTMA) has articulated a threefold mission: (1) to provide cost-effective public service to protect and enhance the water, environment, and quality of life for their local and regional community, (2) to become self-sustainable and decrease dependency on the volatile electric and petroleum markets by using beneficial renewable energy on-site, and (3) to generate increasing amounts of annual cost savings to DTMA and our rate payers. DTMA embodies a "Utility of the Future" outlook, with its dual focus on sustainable practices and on generating revenues by creating business ventures to recover valuable resources. Over time, the utility has incrementally expanded the scale and scope of food waste feedstocks at its primary wastewater treatment plant on Clearwater Road. Primary goals for co-digestion are to provide a disposal option for the generators and to create value from the production of energy and biosolid products enabled by the increasing biogas production.

The Clearwater plant has collected tip fee revenues for hauled waste starting in the 1990s with deliveries of septage and FOG. Following its investment in an egg-shaped digester (ESD) in 2001 to improve wastewater solid management, it started producing biogas. To mitigate operational problems resulting from the acceptance of FOG, the plant implemented a FOG pretreatment system in 2005. As a result, the WRRF was able to greatly expand its acceptance of FOG, becoming the region's primary FOG disposal option. Because of electricity market conditions at the time, it was not cost-effective to invest in combined head and power (CHP), so the additional biogas was directed to a steam-based dryer for biosolids purchased in 2007, enabling production and sale of a Class A EQ fertilizer product, Clearwater SteadiGro. Currently the dryer is out of service and all of DTMA's biosolids are land applied at local farms as Class B biosolids. DTMA is investigating cost-effective and reliable technology options to return to a Class A biosolids operating facility.

Following investments that increased the efficiency of biogas use for managing biosolids, changes in the PA electricity market, and increasing amounts of biogas flaring, in 2010 it became cost-effective for DTMA to invest in a small (270-kW) CHP engine. The engine yielded energy cost savings, though the projected pace of cost savings has not been realized due to substantial downtime as a result of facility flooding and frequent maintenance issues.

With a goal of moving toward energy neutrality, the Clearwater plant began experimenting with accepting other food wastes in 2017 to understand its digester capacity and ability to generate additional biogas. As of the end of 2020, the main feedstocks are: a food scrap slurry from Divert, an organic waste management company; biodiesel/vegetable oil waste; and brewery wastes.

Currently the Clearwater plant is embarking on a $14 million project to expand its capacity for energy recovery and beneficial reuse, which is the first phase of a larger plan to realize a vision of achieving and exceeding onsite energy neutrality through expanded HSOW co-digestion. The scope of the project includes increasing and upgrading biogas storage, conditioning, and conveyance capacity, and constructing a new CHP building that houses two 1,000-kW CHP systems.

A Series of Investments in Energy and Materials Recovery

Investment in Anaerobic Digestion to Treat Biosolids

As part of a long-term series of investments to upgrade wastewater solids management, in 2001 DTMA installed a 1.2-mg egg-shaped anaerobic digester to further process the solids. The digester stabilized the solids and reduced their volume by 55%, yielding Class B biosolids. This improved the environmental impact, and reduced the cost, of biosolids management.

To manage wastewater solids in the early years (1977-1994), the WRRF used a vacuum filter and incinerator to dispose of biosolids during winter months, and used agricultural application of cake during the summer. In 1994, when the incinerator was in need of expensive upgrades to ensure compliance with new air regulations, DTMA shut down the incinerator instead. Through 2001, DTMA relied mostly on landfill disposal (62-70% of biosolids sent to landfill) with the remaining share disposed of via lime stabilization and subsurface liquid injection. This shift in disposal strategy increased wastewater solid management costs substantially.

Adding FOG Feedstocks and Addressing Contamination

First Round of Food Waste Feedstocks

In 1991, the Clearwater plant started accepting trucked-in septage through the facility headworks, but at the time refused grease trap wastes due to concerns about operational issues. In 1995, DTMA began noticing that a high percentage of FOG, originating from restaurants mostly located in Derry Township, was mixed with septage trucked to the plant. At that time, DTMA requested that the haulers dilute the FOG waste to help reduce any operational issues at the Clearwater plant.

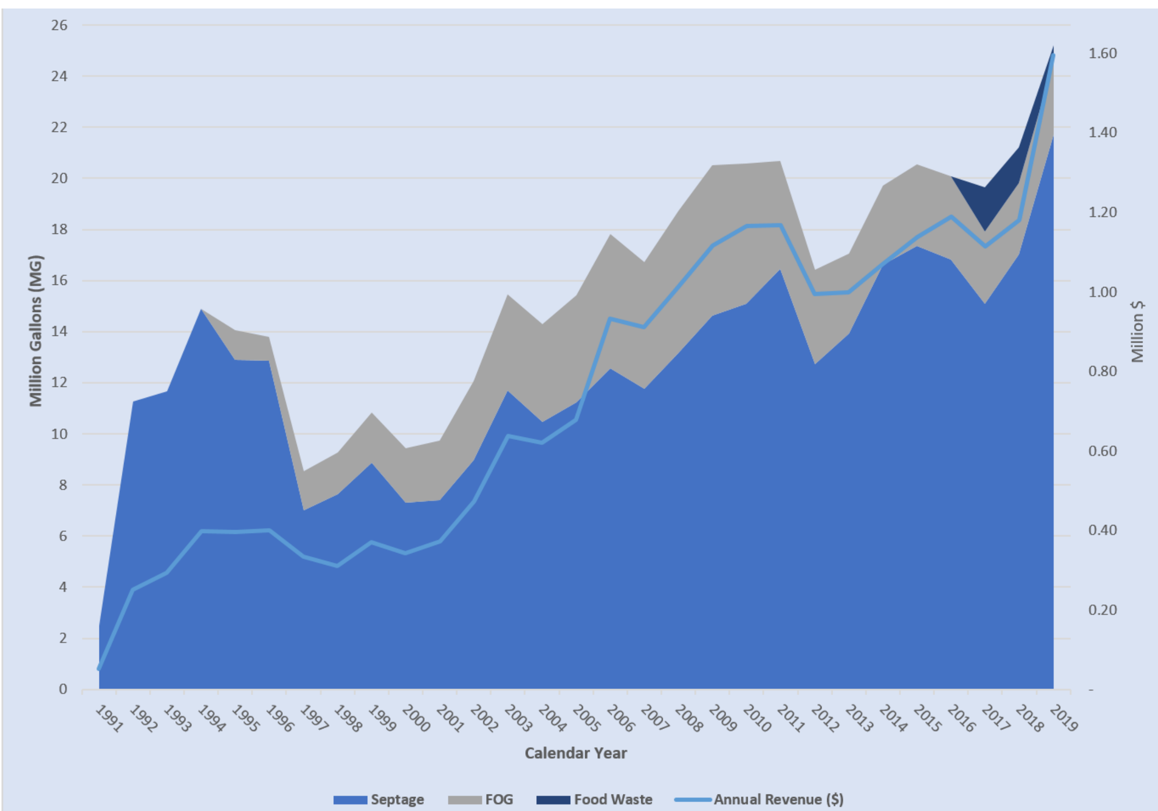

Figure 1. Septage and HSOW annual gallons accepted and annual revenue ($ million). Source: Rehkop 2020.

When the egg-shaped digester was constructed in 2000, the WRRF also constructed a two-lane FOG and septage receiving station to facilitate the acceptance of FOG and septage. The new receiving station used the plant headworks to perform the screening and grit removal of the FOG and septage. Receiving FOG and septage has been a source of revenue that saves ratepayers money, and also makes a contribution to biogas production.

Preprocessing Strategy: FOG Pretreatment and Receiving Station

Accepting FOG initially caused operational issues, including clogging in the primary wastewater solid line and primary clarifiers, which required removing 30-40 cubic yards of grease from primary clarifiers every three months. Also, biosolids produced from the AD were visibly contaminated with grease specks.

Given the abundant supply of FOG in the area, DTMA determined that investment in FOG pretreatment could mitigate the operational issues, and thereby make it possible for them to accept more FOG which could generate more tip fee revenue, as well as substantially increase biogas production (Chin 2009). In 2005, DTMA invested in an aerobic grease pretreatment process (AGP) and located it near the septage receiving station. Trucked-in full-strength FOG is aerated and mixed in a 40,000-gallon process tank for 48-72 hours. Bacteria enzymes and magnesium hydroxide are also added to the FOG for pH control and to accelerate the breakdown of long-chain volatile fatty acids. The pretreated FOG mixed liquor is discharged from the AGP into the headworks with plant influent, which passes through screening and grit removal processes. After settling out in the primary wastewater solids, the pretreated FOG makes a positive contribution to biogas production in the anaerobic digester due to high volatile solids and good alkalinity.

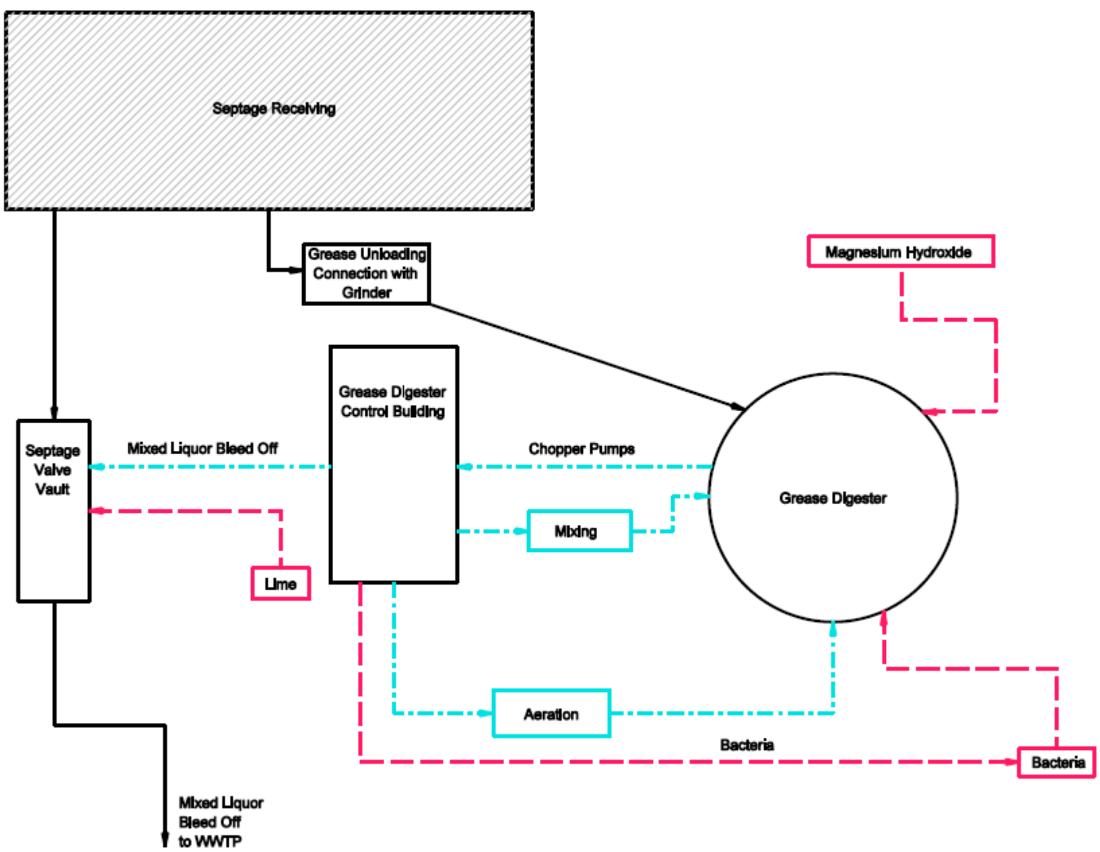

Figure 2. DTMA aerobic grease trap pretreatment process schematic. Source: Schutz 2010.

Having addressed the operational challenges of FOG, DTMA's FOG acceptance program has become the region's primary FOG disposal option. Due to its location near a tourist hub (Hershey PA hosts the Hershey chocolate plant, the Hershey Park amusement park and many other Hershey-related tourist attractions), an ample supply of local FOG is available. Moreover, DTMA is located along a transportation route for FOG haulers and is therefore a convenient disposal option for other generators. Though they do not have contracts with the haulers, DTMA receives a predictable supply of FOG from a consistent set of haulers.

Energy Investments

Thermal Dryer and Centrifuge for Biosolids

With the additional biogas produced from expanding FOG acceptance, DTMA commissioned a study in 2004 to evaluate various energy options. Because electricity prices were still capped at the time in PA, investing in a CHP engine did not make economic sense. Driven by the desire to produce a marketable Class A biosolid product, in 2007 DTMA alternatively invested in a steam-based dryer for biosolids fueled by biogas. The dryer enabled production of a valuable Class A EQ fertilizer product, marketed as Clearwater Steadigro and sold for $10 per ton. In 2008, the installation of a centrifuge that dewatered the biosolids improved the energy efficiency of biosolids production and reduced biogas use by increasing cake solids.

Currently, the dryer remains out of service due to a flood in July 2018 that damaged the dryer's ancillary systems. DTMA is evaluating options to replace the existing dryer with alternate dryer technologies in order to meet the projected design solids loading and to produce a marketable Class A biosolids product.

CHP Investment

As a result of the increased energy efficiency, the Clearwater plant was flaring waste biogas. DTMA was motivated to find a way to create value from this excess biogas. Combined with a 20-30% increase in electricity rates when electric power deregulation occurred, as well as an increased opportunity for Renewable Energy Credits (RECs), the economics of investing in a CHP system to use the excess biogas became more economically feasible than when previously considered.

DTMA chose a Liebherr 270-kW cogeneration engine for their CHP. Because biogas was primarily allocated to biosolids drying, the cogeneration engine size selected was relatively small. The engine was installed in 2010, and the associated heat recovery process for heating three buildings and the digester during cold weather went online in 2010.

Adding Food Waste Co-Digestion Feedstocks

When a 2015 study of the economic feasibility of purchasing a second CHP engine concluded that the plant produced insufficient biogas to support the investment, DTMA conducted a study to assess the feasibility of accepting bulk food scraps as a strategy to expand biogas production. The study concluded that while receiving and treating such waste was feasible and potentially beneficial, the logistics of generator storage, pick-up and transport as well as the difficulty and expense of debris separation were significant if not insurmountable hurdles.

Alternatively, DTMA began accepting hauled waste from various commercial food manufacturers, as well as a food scrap slurry through the Grind2Energy program in January 2017.

Then in early 2017, DTMA received a cold-call from Divert, an organic waste management company, offering to supply a preprocessed food scrap slurry, which would circumvent the logistical hurdles of preprocessing at the plant. In addition to advising firms on how to reduce or donate edible food that is wasted, Divert has moved into supplying an easily digestible food scrap slurry to digesters. The firm collects expired food wastes from nearby grocery stores, removes contamination, and grinds and mixes the organic fraction into slurry suitable for AD in a newly constructed facility in Mechanicsburg, PA. DTMA and Divert initiated a pilot program to test 18,000 gallons/week of the slurry in the WRRF's egg-shaped digester in May 2017.

DTMA did not need to make any infrastructure changes to accept Divert's slurry, which was successfully added to the digester with minimal operational issues. To mitigate the potential for operational upsets, DTMA slowly ramped up additions of the slurry to the digester over the course of the first month. During this time, DTMA monitored volatile suspended solids (VSS) loading and destruction, biogas production, volatile acid to alkalinity ratio, and biosolids dewaterability. Following a successful pilot, DTMA and Divert established a long-term, non-binding Memorandum of Understanding (MOU), outlining the terms of the partnership (DTMA 2017b), which include an agreement to accept up to 2 loads per day.

As of May 2018, Divert was delivering five to ten truckloads (30,000 – 60,000 gallons) per week to the WRRF. In addition, through the Grind2Energy Program, Redner's Food Market supplied 5,000 to 10,000 gallons per month, and Archer Daniel Midlands supplied 10,000 to 15,000 gallons per month of corn syrup processing waste. DTMA also accepted wastes from a pet food manufacturer. Food waste loading to the digester was 12% of total load to the digester and 35% of volatile solids.

DTMA began to experience operational issues with the major on-site beneficial uses of the biogas, including damage to the thermal dryer's ancillary systems as a result of a flood in July 2018, and an extended period of CHP down time from April 2019 to February 2020 due to ongoing maintenance issues and repairs. As a result, the biogas generated from the HSOW feedstocks was not being consumed and was exceeding the capacity of the waste flare. DTMA reduced its acceptance of HSOW feedstocks for a period of 14 months through March 2020, until the CHP became operational. As of December 2020, DTMA was receiving 30,000 gallons per week of Divert's food scrap slurry, 30,000 gallons per month of vegetable oil waste, 20,000-30,000 gallons per week of brewery yeast waste, and 6,000-12,000 gallons per month of pet food waste.

Impacts and Risk Management

Operational Impacts

AD Operations

When co-digestion started, DTMA staff were careful to slowly acclimate the digester to the higher volatile solid loading associated with the new feedstocks. To mitigate the potential risk of overfoaming, DTMA added an additional foam suppressor nozzle to their digester for managing potential digester foaming.

Grease Buildup and Biosolids Contamination

FOG feedstocks (which enter through the headworks) caused grease buildup throughout the WRRF and grease specks in biosolids. With the addition of FOG pretreatment, the plant eliminated the grease buildup within a few weeks, and the grease "specks" in biosolids cake in a few months. However, the addition of the aerobic system required DTMA to solve new issues including scum formation, odor, and foaming issues at the aerobic pretreatment site. To address these problems, WRRF staff added a rock trap and macerator to preprocess the truck discharges at the AGP, upgraded the system's mixing nozzles, and switched pH control from manual addition of lime to automatic addition of magnesium hydroxide.

After three years of various improvements, DTMA's director declared the new system a success. Once DTMA resolved the operational issues posed by the new FOG pretreatment system, it changed its philosophy regarding accepting FOG waste. The WRRF staff began accepting concentrated FOG waste and dedicated grease trap loads in order to improve biogas production at the WRRF's egg-shaped digester.

Biogas Production

The WRRF had, since its inception, accepted wastewater solids from the Hershey Company industrial pretreatment plant and mixed it with the WRRF wastewater solids (primary and waste activated sludge). Once the digester was installed in 2001, the Hershey wastewater solid (in combination with the plant wastewater solids) was fed directly to the digester. The addition of FOG through the headworks also contributed to biogas production; however, WRRF staff found it difficult to quantify the increase in biogas attributable to FOG feedstocks because of all the variables involved in the digestion of wastewater solids.

With the addition of HSOW, biogas production at Clearwater Road WRRF increased approximately 40% during the period May 2017-April 2018 (including the 3-month ramp-up period), relative to Jan 2017-April 2017. At that time, the WRRF was producing 8.0 MMCF per month, an increase from approximately 4.5 MMCF per month. Currently, the WRRF is producing on average 7.5 MMCF per month with the current HSOW feedstocks. DTMA attributed 32% of the WRRF's biogas production to Divert's food waste and 6% to the other added food wastes.

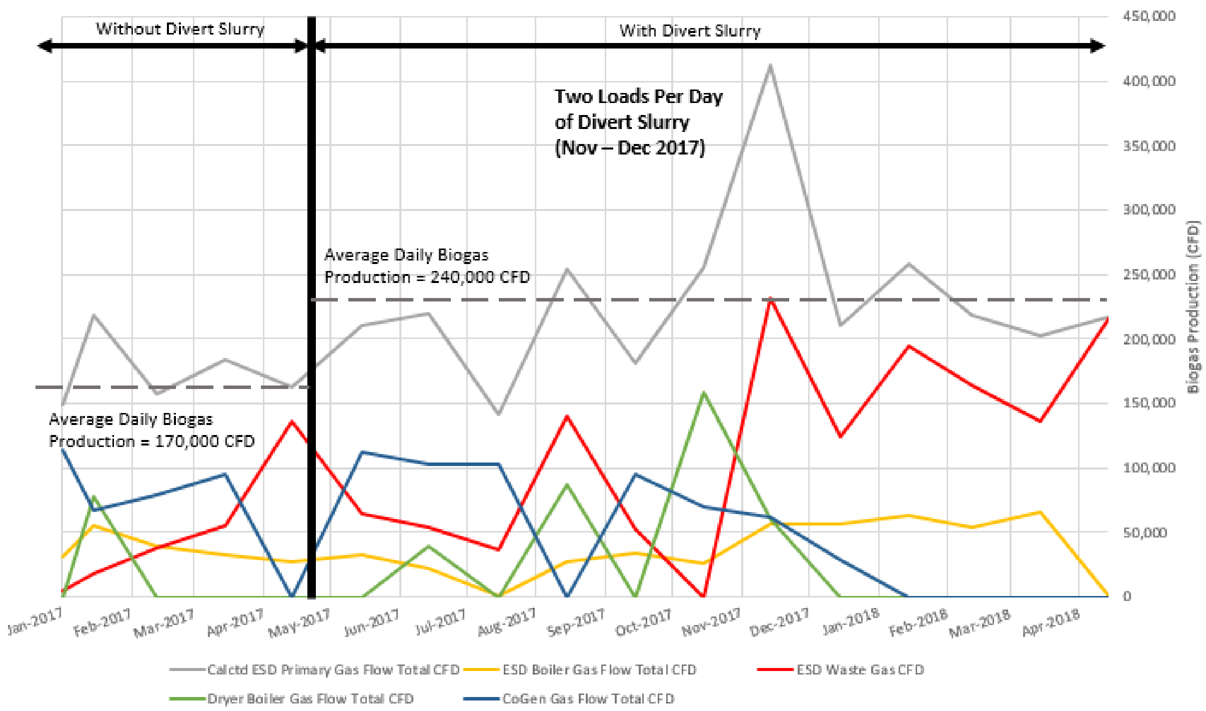

Figure 3. Biogas production, Jan. 2017-Apr. 2018. Source: DTMA.

CHP Generation

For the CHP engine, unanticipated Acts of God, such as a 2011 flood, as well as the combination of extensive maintenance needs and lack of system redundancy, have resulted in considerable downtime and greater flaring of plant biogas. Maintenance issues are exacerbated because any parts required for upkeep of the Leibherr engine, which is produced in Germany, must be shipped across the Atlantic. The WRRF must take the CHP engine offline while waiting for necessary parts for regular maintenance and repairs. The engine also experienced an issue with the air-fuel ratio mixing control.

The extent to which the plant is able to cover its heat and power needs with internal production varies over the year with the amount of time the engine is online. In 2017, it was online most of the time, and the plant was able to offset 25% of its electricity and 100% of its heating needs. The five-year average (2014-2018) for energy neutrality was 21%. CHP was out of service in 2019; in 2020, the CHP engine was fully operational and was able to offset 25% of the electricity costs.

Biosolids Production

FOG was part of the baseline feedstock load (to the headworks) when the AD was installed. As noted above, adoption of FOG pretreatment substantially improved the quality of biosolids.

Thermal Dryer

In the first two years following startup of the dryer, 41% of total biosolids that the plant produced were Class A. The peak yield occurred in 2009, when it produced 1,479 dry tons of Class A biosolids, which represented 98% of its biosolids. The equipment was down for much of 2011 and 2012, due to the impact of Tropical Storm Lee. The 2018 flood also damaged the dryer's ancillary systems, and the dryer remains offline for now. DTMA is investigating cost-effective and reliable technology options for a new biosolids treatment process to produce Class A biosolids within five years.

With the dryer, 29% of biosolids produced by the plant between April 2008 and June 2018 were Class A and were marketed as Clearwater SteadiGro. This product was sold in bulk to farmers for a maximum fee of $10 per ton, and also resulted in savings by eliminating the hauling and land application costs that DTMA incurs for Class B biosolids management.

New Food Scrap Feedstocks

Though new food waste feedstocks increased VS loading by 50% in 2017, biosolids production only increased 15% because food scraps have a higher volatile solid destruction rate than wastewater solids. Biosolid nitrogen content and micronutrient content remained stable with the addition of food waste, while P content was "more consistently high". Biosolid dewaterability and heavy metal content also remained stable. In the early stages of receiving HSOW, DTMA also observed debris in the biosolids as a result of the food waste depackaging process. The off-site preprocessing facility implemented an additional screening or filtration step which drastically reduced the debris.

Regulatory Compliance

DTMA has experienced no issues with regulatory compliance with its National Pollutant Discharge Elimination System (NPDES) permit for effluent or biosolids.

Financial impacts

DTMA investments have been designed to support the core water quality mission of the utility for its effluent and biosolids, and also three areas that bring in revenues and enable them to keep rate increases down: biosolids management/nutrient products, acceptance of high strength organic waste (HSOW) feedstocks, and energy production. We focus on the financials of the investments for feedstock receiving and energy generation.

Anaerobic Digester

The digester cost $3.1 million. With the investment, the plant lowered biosolids management costs, and also produced a more environmentally friendly end product relative to prior landfilling and subsurface injection of lime stabilized wastewater solids.

FOG/Septage Receiving Station and FOG Preprocessing System

The receiving station and preprocessing investments to support the expanded food waste program cost $1.2 million. FOG and septage revenues increased with the installation of the anaerobic digester and the FOG and septage receiving station in 2001 and again with the installation of the FOG pretreatment program in 2005. DTMA Executive Director Bill Rehkop views both septage and FOG acceptance as a valuable business decision. With tip fee revenues from FOG and septage contributing to offset the debt service and plant operating costs over the years, the investment has paid itself off many times.

Expansion of Co-Digestion to Include Food Wastes (Beginning in 2017)
The WRRF did not need to invest in additional equipment for the new food waste feedstocks.

Operating Costs
Because food scraps are added directly to the digesters, the plant experiences minimal additional operations and maintenance (O&M) costs with food scraps, unlike FOG and septage, which are added through the plant headworks. With the 23% increase in biosolids, the plant experienced increased biosolids costs.

Energy Savings
With the additional biogas from HSOW feedstocks during the 2020 operating year, DTMA produced 1,353,527 kWh of energy resulting in $100,000 in electricity cost savings and savings of 20,000 gallons in fuel oil purchases worth $31,500 (2020 pricing).

Tip Fee Revenues
With the MOU, DTMA and Divert mutually agreed to a current tipping fee for food waste slurry of $29.75 per 1,000 gallons, compared to a tip fee of $115.05 per 1,000 gallons of FOG and $39.40 per 1,000 gallons of septage (DTMA's current rate schedule). Surcharges are added for comingled wastes in order to encourage haulers to separate wastes (for example, FOG should be in a separate truck from septage). In addition, DTMA's billing is based on the actual volume capacity of the hauling trucks to encourage full truckloads.

In 2020, the WRRF collected $1.511 million in tip fees from FOG, septage, municipal sludge, and food waste. FOG wastes represented 13% of accepted volume and 33% of tip fee revenues. Other food wastes represented 12% of tip fee revenues and 16% of accepted volume.

CHP Investments
Investment and Operating Costs
The total capital cost for the cogeneration system was $2.2 million. DTMA received a $500,000 grant from the Pennsylvania Green Energy program (financed by the American Recovery and Reinvestment Act and

Figure 4. Leibherr combined heat and power engine. Source: DTMA.

The Department of Energy), and financed the remaining $1.7 million through municipal bonds issued by the Authority and guaranteed by the township. Between 2010 and 2018, DTMA has spent $207,722 in CHP O&M and $100,384 in biogas treatment equipment O&M.

Energy Savings

The engine was projected to produce 1,500,000 kWh/year in electricity, or 20% of the WRRF's energy consumption. DTMA estimated that they would save $150,000 in electricity costs using an estimated price of $0.10 per kWh. In addition, DTMA projected that they would save 20,000 gallons of number 2 fuel oil due to heat provided by the CHP, resulting in $47,000 in savings using an estimated price of $2.635 per gallon. Based on the $1.7 million cost to the WRRF, the payback period was estimated to be eight years.

As a result of the operating issues, in 2018 – eight years after the installation of the engine – only about 50% of the cost of the engine ($688,135) has been recouped and the projected payback period is now estimated to be 20 years. It should be noted that the original engine was destroyed in the 2011 flood and the replacement unit was not installed and fully operational for more than six months.

From CHP installation in 2010 through 2018, DTMA has saved $199,742 in fuel costs and $724,564 in electricity costs. In 2017 specifically, the WRRF saved $120,000 in electricity costs (at $0.0791/kWh) and $27,975 in no. 2 fuel oil savings due to heat recovery (using a fuel cost of $1.59 per gallon). Between installation in 2010 and 2018, the DTMA has received $71,935 in RECs.

In hindsight, DTMA notes that equipment redundancy may be just as important in the energy production system as it is in the rest of the plant operations. If WRRFs can demonstrate to decision makers that engine redundancy can result in significant cost savings by increasing equipment runtime and reliability, utility boards may be more amenable to the necessary increased upfront investment to achieve energy neutrality.

Major Expansion for "Sustainability into the Future"

DTMA has articulated a vision of expanding the scope of its recycling resources and generating revenues by increasing high-strength organic waste (HSOW) digestion, producing valuable biosolids, and progressing toward net-zero energy usage at the WRRF. Currently the Clearwater Road WRRF has excess AD capacity that could be used to expand co-digestion; however, the energy infrastructure does not have the capacity to beneficially use additional biogas, and its dewatering infrastructure does not have the capacity to manage additional biosolids. To remedy these limitations, DTMA is embarking on a $14 million Energy Enhancement investment project that will increase energy recovery from anaerobic co-digestion of municipal biosolids and food wastes at the WRRF. The project is the first phase of a larger plan to realize its vision.

The scope of the Energy Enhancement Project includes upgrading and increasing biogas storage, conditioning, and conveyance capacity, and constructing a new CHP building that houses two 1,000-kW CHP systems. The installation will immediately enable production of 1 MW of electricity and 2.2 million British thermal units per hour (MMBTU/hr) of heat from renewable energy, initially supplemented by natural gas. This will be sufficient to provide all electricity for the WRRF, and will result in reduced flaring, plus an annual savings of $400,000 ($.07/kWh) in electricity and $44,000 ($2/gallon) in fuel oil bills at the WRRF. This increase in energy capacity will make possible the acceptance of an additional 10,000 gallons per day of HSOW.

Construction on the project will start in spring 2021 and conclude in spring 2022. The contract for the project is a traditional design-bid-build format. The plan is to purchase a service contract that provides for major and minor maintenance at specified time periods; the contract cost will be based on kWh produced,

Figure 5. **DTMA's egg-shaped digester**. Source: DTMA.

which provides incentives for keeping the equipment running. DTMA will maintain a contract with their electricity supplier, which will include a minimum purchase requirement.

To finance construction, the DTMA Board authorized issuance of Sewer Revenue Bonds for the amount of $10 million. The balance will be paid from potential grant opportunities, operating reserve funds or future borrowing.

The long-term plan, which has a 10-year planning horizon, includes expanding anaerobic digestion and HSOW receiving capacity sufficient to receive an additional 300,000 gallons per week from local food producers and grocery stores or other HSOW feedstocks. In addition, DTMA may look to advance its thermal drying facilities for Class A biosolids production and to incorporate side stream treatment for nutrient removal from the centrate.

Lessons Learned

Create Value and Manage Risks

DTMA's mission statement reflects its commitment to public service that protects and enhances the community's water, environment, and quality of life and that is cost-effective and self-sustainable. To this end, it has sought out business opportunities to create value from excess capacity in its facilities by accepting HSOW feedstocks and recovering renewables to generate cost savings.

Over time, DTMA has become the region's primary FOG disposal option, due to a prime location in a tourist-heavy part of PA and on a transportation route for FOG haulers. Subsequently, it expanded its co-digestion program to include food processing residuals and, when Divert provided the opportunity, food scrap feedstocks. It currently is expanding energy production capacity in order to create value from expanded co-digestion, moving toward its goal of onsite energy neutrality.

DTMA sees financial risk management as an essential element of the new project, which it considers to be a business opportunity beyond its core activity of wastewater treatment. To mitigate the risks, DTMA has developed a financial forecast and hypothetical borrowing scheme under their current rates to determine their borrowing capacity to fund the future projects with municipal bond proceeds. The projects must provide an additional revenue stream to ensure that the project will pay for itself and/or be self-sustaining, and not become a burden on their ratepayers.

To manage operational risks from co-digestion, DTMA has taken the strategy of slow ramp-ups of new feedstocks, and careful monitoring to detect any issues. To manage operational risks in energy production, DTMA has learned the value of redundancy in energy systems despite the high upfront costs.

Replicability

The DTMA example demonstrates that, with a leader and staff motivated to create new business opportunities and a location with ample feedstock sources, a small plant can successfully co-digest and create multiple business and partnership opportunities for co-digestion in a state without strong policy incentives for renewable energy production, greenhouse gas reduction, or food scrap diversion. DTMA seeks to challenge the idea that resource recovery is only viable at a large scale, and to provide a model for other small to mid-size municipalities across the country.

DTMA has key requisites for a successful co-digestion project: the WRRF must have a business mindset, it must have access to a sufficient scale of HSOW feedstock for which it can charge a good market price, it must have enough site space for vehicles to deliver feedstocks and for other equipment needs, and it must have a visionary Board that will approve projects that are beyond the core wastewater competency but that make economic sense for the Authority's ratepayers.

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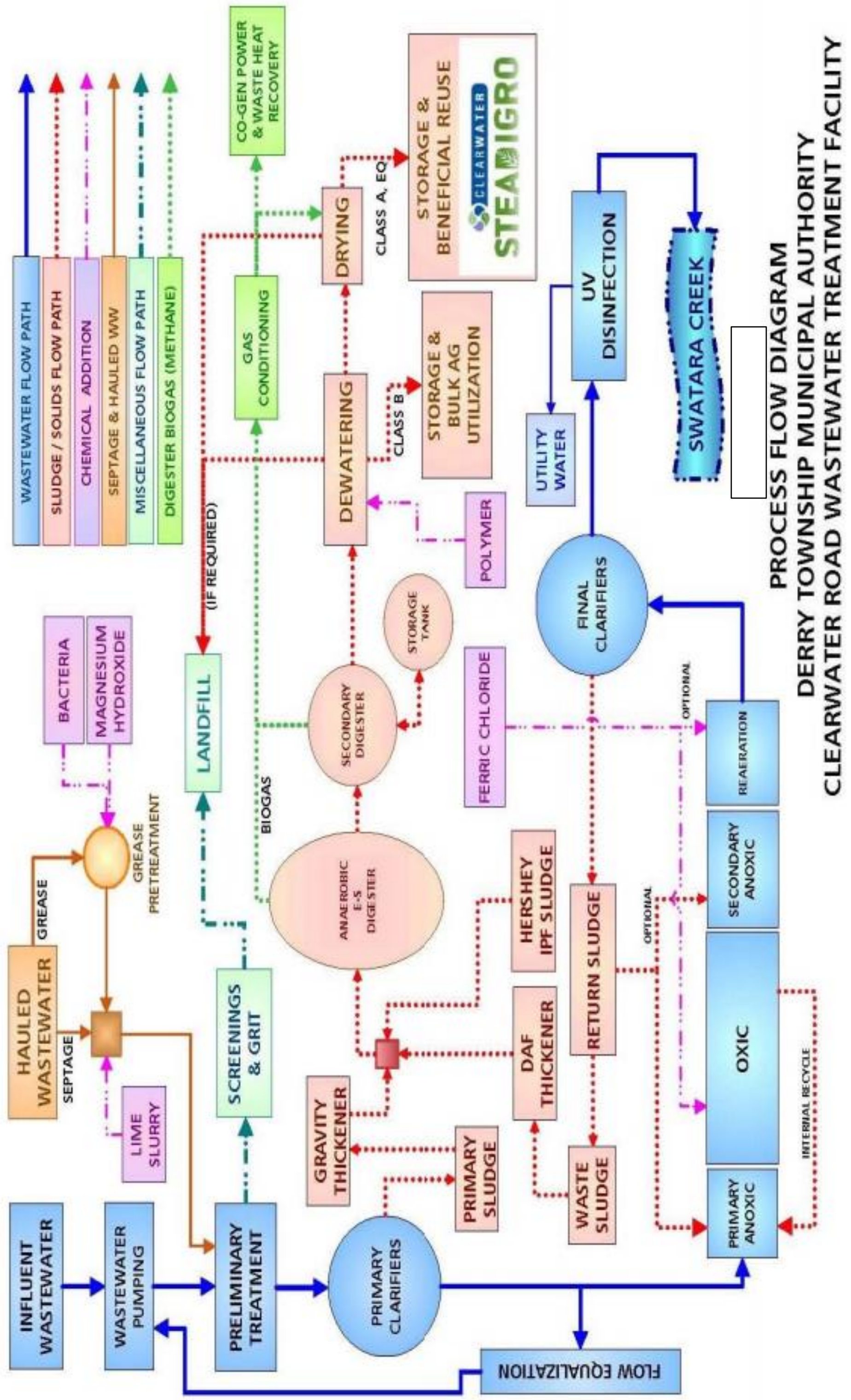

Figure 6. DTMA process flow diagram. Source: Rehkop 2018a.

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