Office of the New York State Comptroller

Division of Local Government
& School Accountability

Ithaca Area Wastewater Treatment Facility

Energy Cost Savings

Report of Examination

Period Covered:

January 1, 2013 — December 31, 2015

2016M-234

Thomas P. DiNapoli

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State of New York
Office of the State Comptroller

Division of Local Government
and School Accountability

October 2016

Dear Facility Officials:

A top priority of the Office of the State Comptroller is to help local government officials manage government resources efficiently and effectively and, by so doing, provide accountability for tax dollars spent to support government operations. The Comptroller oversees the fiscal affairs of local governments statewide, as well as compliance with relevant statutes and observance of good business practices. This fiscal oversight is accomplished, in part, through our audits, which identify opportunities for improving operations and Special Joint Committee governance. Audits also can identify strategies to reduce costs and to strengthen controls intended to safeguard local government assets.

Following is a report of our audit of the Ithaca Area Wastewater Treatment Facility, entitled Energy Cost Savings. This audit was conducted pursuant to Article V, Section 1 of the State Constitution and the State Comptroller's authority as set forth in Article 3 of the New York State General Municipal Law.

This audit's results and recommendations are resources for local government officials to use in effectively managing operations and in meeting the expectations of their constituents. If you have questions about this report, please feel free to contact the local regional office for your county, as listed at the end of this report.

Respectfully submitted,

Office of the State Comptroller
Division of Local Government
and School Accountability

Introduction

Background

In December 1981, the City of Ithaca (City) and the Towns of Ithaca and Dryden (Towns), located in Tompkins County (County), entered into a joint sewer agreement to construct the Ithaca Area Wastewater Treatment Facility (Facility). In accordance with the agreement, the City and the Towns (Owners) began operating the Facility in 1987. The agreement established a Special Joint Committee (Committee) composed of eight members[1] responsible for the general oversight of Facility operations. These responsibilities include developing and monitoring the annual budget approved by the Owners.

The Owners are responsible for billing the residents of their municipalities for sewer, and the Committee is responsible for billing the septic haulers based on the gallons of waste dumped at the Facility. The City is responsible for the Facility's financial administration, and the City Controller is the chief fiscal officer. The Committee appointed a Chief Operator and a Superintendent, who are responsible for managing the Facility's daily operations. These responsibilities include reporting to the Committee; developing the preliminary budget; reviewing and approving purchases, disbursements and payroll; and maintaining the Facility's energy production and consumption records.

The Facility accepts and treats sewage produced within the County. In addition, the Facility accepts various types of waste from septic haulers such as grease, sewage, leachate, whey, industrial and municipal sludge, glycol and distillery waste. The Facility's 2016 budgeted appropriations totaled approximately $3.7 million, funded primarily by the Owners based on their respective ratios of water consumption from the prior year and revenues collected from septic haulers. From 2013 through 2015, the Facility treated an average flow of sewage totaling approximately 6.5 million gallons per day.

The Facility uses an anaerobic digestion process[2] to convert waste to biogas which can be substituted for natural gas to supplement the Facility's electricity and natural gas purchased from a local energy supplier. Before burning the biogas to generate kilowatt-hours (kWh) of electricity, the Facility further cleans the biogas using a digester gas clean-up skid (skid) to remove unwanted contaminants. The Facility

[1] Four from the City, three from the Town of Ithaca and one from the Town of Dryden

[2] During anaerobic digestion, organic materials are processed in an airtight container by microorganisms, which break down the materials into biogas.

paid an average of $0.09 per kWh for electricity and $0.72 per therm[3] for natural gas during our audit period.

Objective

The objective of our audit was to determine if Facility officials achieved energy cost savings through the production and use of biogas. Our audit addressed the following related question:

- Did Facility officials achieve energy cost savings?

Scope and Methodology

We examined Facility operations for the period January 1, 2013 through December 31, 2015.

We conducted our audit in accordance with generally accepted government auditing standards (GAGAS). More information on such standards and the methodology used in performing this audit are included in Appendix B of this report. Unless otherwise indicated in this report, samples for testing were selected based on professional judgment, as it was not the intent to project the results onto the entire population. Where applicable, information is presented concerning the value and/or size of the relevant population and the sample selected for examination.

Comments of Facility Officials and Corrective Action

The results of our audit and recommendations have been discussed with Facility officials, and their comments, which appear in Appendix A, have been considered in preparing this report.

The Committee has the responsibility to initiate corrective action. A written corrective action plan (CAP) that addresses the findings and recommendations in this report should be prepared and forwarded to our office within 90 days, pursuant to Section 35 of General Municipal Law. For more information on preparing and filing your CAP, please refer to our brochure, *Responding to an OSC Audit Report,* which you received with the draft audit report. We encourage the Committee to make this plan available for public review in the Facility Clerk's office.

[3] A therm is a unit of heat energy equivalent to 100,000 British thermal units (BTU), or approximately 147 cubic feet of biogas.

Energy Cost Savings

The Owners and the Committee are responsible for operating and maintaining the Facility in a cost-effective manner. To help meet these responsibilities, it is important that Facility officials pursue avenues that will help manage and control energy costs. These efforts can help reduce expenditures and reduce the amount of greenhouse gas emissions that are released into the environment. The cost of energy purchased for use in the Facility can be reduced by implementing renewable energy technologies.

According to the United States Environmental Protection Agency (EPA), the most common renewable energy technologies include solar (e.g., photovoltaic and solar thermal), wind, biogas (e.g., landfill gas/wastewater treatment digester gas), geothermal, biomass, low-impact hydroelectricity and emerging technologies (e.g., wave and tidal power).[4]

We commend Facility officials for achieving a net total of $211,000 in energy cost savings during our audit period. From 2013 through 2015, the Facility produced 119.6 million cubic feet of biogas. The Facility used 87 percent of this amount to generate 4.1 million kWh of electricity and 53,000 therms of heat energy instead of purchasing these resources from the local energy supplier. The Facility flared[5] 15.6 million cubic feet, or 13 percent of the biogas produced, in a controlled manner when the production of biogas exceeded the Facility's demands or storage capacity.

Electricity Production – From 2013 through 2015, the Facility used 10.9 million kWh of electricity and purchased 6.8 million kWh at a cost of approximately $627,000 from the local energy supplier. During this same period, the Facility used 96.1 million cubic feet of biogas to produce 4.1 million kWh with a value of $375,000, based on the average retail cost per kWh from the local energy supplier during our audit period.[6] To generate electricity, the Facility incurred $202,000 in direct costs relating to maintaining the skid and the electric cost to operate the microturbines, which are used to covert the biogas.

Heat Production – From 2013 through 2015, the Facility used 280,000 therms of energy to provide heat and hot water. The Facility purchased

[4] https://www.epa.gov/sites/production/files/2015-08/documents/onsiterenewables508.pdf

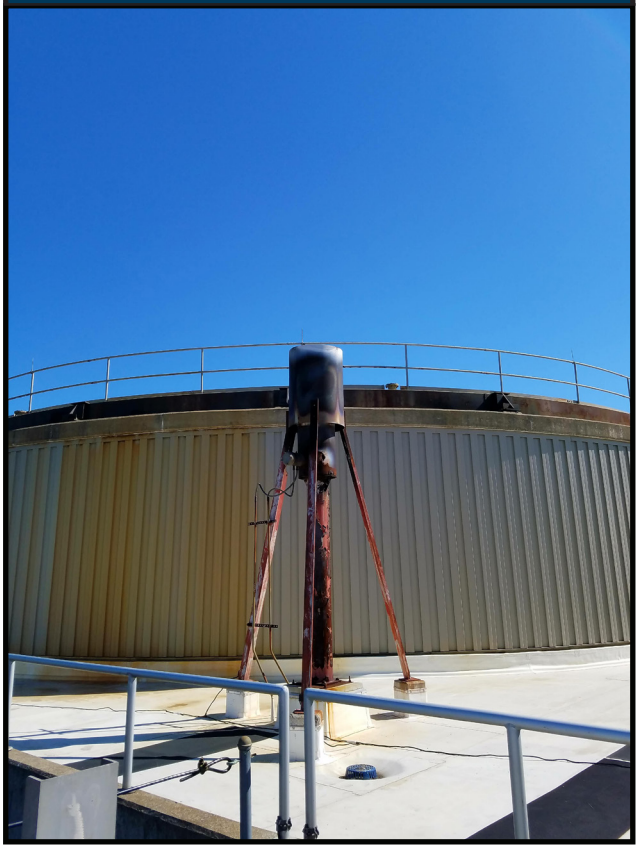
[5] The Facility must flare, or burn off, excess biogas in a controlled manner when the production of biogas exceeds the Facility's demands or storage capacity.

[6] See Appendix B for information on our methodology.

226,000 therms of natural gas from the local energy supplier at a cost of approximately $163,000. During this same period, the Facility converted 7.8 million cubic feet of biogas into 53,000 therms of energy, with a retail value of $38,000, which was used to heat the building and for hot water. Additionally, the microturbines generated additional therms of energy as a byproduct during the combustion of biogas that were used for heating.

Biogas Flaring – During our audit period, the Facility flared 15.6 million cubic feet of biogas, or 13 percent of the biogas it produced, with a retail value of $76,000 when converted to therms of natural gas equivalent or $59,000 when converted to kWh. The Facility does not have the capacity to always use all of the biogas it produces because, among other factors, the heating system is turned off during the warmer months. In addition, the current flaring system configuration requires a constant flare of biogas. Facility officials were aware of this inefficiency and plan to upgrade the system.

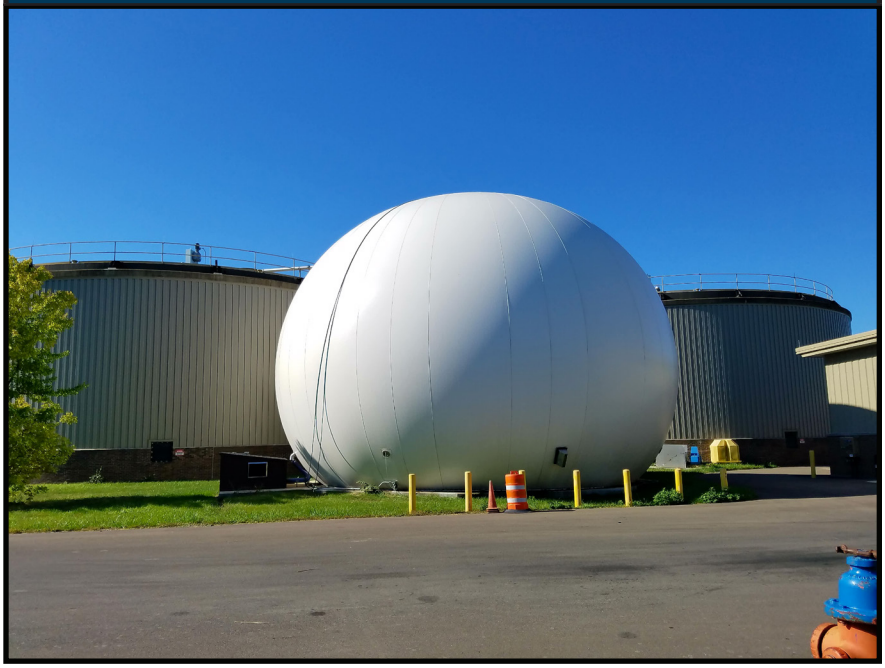
Biogas Flaring System



During our audit period, Facility officials completed several energy performance improvements. Officials replaced the aging cogeneration system with four microturbines for electricity generation (along with systems supporting the equipment associated with recovering waste

heat from these units). They also installed a skid, a new methane storage bubble and more efficient mixers to improve capacity and efficiency and replaced aging boilers with high-efficiency units.

Secondary Digester, Methane Storage Bubble and Primary Digester



As a result of these energy performance upgrades, the Facility realized a 40 percent increase in biogas production from 2013 through 2015. The Facility's electricity demand from the local energy supplier declined by 814,000 kWh (31 percent) during this period. Further, the Facility produced 37 percent of its total electricity needs, resulting in a net savings of $173,000. Although the Facility flared 13 percent of the biogas it produced, it was able to realize a net savings of $38,000 in therms of energy used for heat and hot water (based on the average retail cost of natural gas from the local energy supplier) during our audit period.

The electricity generated and the heat produced when the biogas is burned reduces greenhouse gas emissions by reducing the amount of energy that must be purchased. Further, the Facility captures the solids during the wastewater treatment process and uses them in conjunction with the waste from the septic haulers to produce the biogas. Moreover, Facility officials are pursuing plans to collect food waste from a local college and received a $100,000 grant from the New York State Energy Research and Development Agency to examine the benefits of food waste collection. This initiative, if implemented in conjunction with upgrades to the current process, could further increase the Facility's energy production and consumption.

The Facility used 104 million cubic feet of biogas to produce 53,000 therms of natural gas equivalent and 4.1 million kWh of electricity used by the Facility during our audit period. Because this energy was reused rather than released into the atmosphere and the local energy supplier did not have to provide this energy, the Facility reduced greenhouse gas emissions by 3,156 metric tons of carbon equivalent (MTCE).[7] The energy produced by the Facility is equivalent to the energy needed for powering 466 homes annually, taking approximately 667 passenger vehicles off the road or saving approximately 355,201 gallons of gasoline from being consumed.

Recommendations

The Committee should:

1. Continue to pursue areas that would generate additional cost savings through expansion of waste stream collections and system upgrades.

2. Address weaknesses in the current flaring system and implement its plan to reduce the amount of biogas flared.

[7] A measurement used to compare the emissions from various greenhouse gases.

APPENDIX A

RESPONSE FROM FACILITY OFFICIALS

The Facility officials' response to this audit can be found on the following pages.

ITHACA AREA WASTEWATER TREATMENT FACILITY

TOWN OF ITHACA CITY OF ITHACA TOWN OF DRYDEN, OWNERS
525 THIRD STREET
ITHACA, NEW YORK 14850
(607)273-8381
FAX (607)273-8433

October 13, 2016

H. Todd Eames, Chief Examiner
Office of the State Comptroller
State Office Building, Suite 1702
44 Hawley St.
Binghamton, NY 13901-4417

Subject: Draft Audit Response and Corrective Action Plan

Mr. Eames,

The Ithaca Area WWTF is pleased to provide our response to the Draft Audit regarding Energy Cost Savings Report of Examination for the Ithaca Area WWTF (2016-234) and associated Corrective Action Plan (attachment #1). It was a pleasure to work with both [redacted] and [redacted] with regards to our energy projects. These projects are the cornerstone for our facility's development into the future.

The Draft Audit review meeting held on September 21, 2016, delineated the details of the report to Daniel Ramer, Chief Operator at IAWWTF, two Special Joint Committee members Wade Wykstra (chairman) and MaryAnn Sumner (Town of Dryden) and myself. The evaluation of our energy savings is very helpful and aligns with other work we have been doing to understand energy intensity and energy production at the Facility. As members of the US Department of Energy Better Buildings and Better Plants program we are constantly re-evaluating and benchmarking our programs.

The two recommendations in the report also align with projects we are working on to further the effectiveness of our energy production programs. We are also working with the vendors of our microturbines to try and get a handle on the value of the heat generated by the combined heat and power system. This value was not included as part of the audit due to the physical complexities of our heating systems and how the natural gas boilers and biogas cogen heat are comingled as part of that system.

In conclusion, we have no exceptions or additions to this Draft Audit and agree with its findings. We thank you again for the creative Audit and the recommendations.

Sincerely,

Steven P. Thayer
City of Ithaca Controller

ATTACHMENT 1
Corrective Action Plan

Recommendation 1. Continue to pursue areas that would generate additional cost savings through expansion of waste stream collection and system upgrades.

Response

1. IAWWTF is working with Cornell University to develop facilities for removing sand from dairy cow manure generated on campus at the Teaching Dairy Barn. The sand removal facility is currently in design and scheduled for construction start in late 2016 with operation starting in spring of 2017. Once completed the facility will generate approximately 40,000 gallons of manure for delivery to IAWWTF Trucked Residuals Center. Dairy Cow manure is a very good substrate for generating biogas under anaerobic digester conditions.
2. IAWWTF is pursuing food waste from both Cornell University and Tompkins County Solid Waste. The delivery of food waste to the plant is a complicated project and will yield results but will likely take a number of years to accomplish.
3. Current capital planning is evaluating new equipment for processing residuals generated by the normal plant operations that will allow for the collection of more outside the plant substrates while increasing digester efficiency and gas production. An initial engineering evaluation will be completed by late 2016.

Recommendation 2. Address weaknesses in the current flaring system and implement its plan to reduce amount of biogas flared.

Response

1. IAWWTF has analyzed what changes need to be made to eliminate the full time flare. Changes would require the use of an automatic pilot system which would eliminate the full time flaring currently utilized. We have completed a cost analysis. The only remaining hurdle is to determine if the flare needs to be moved due to changes in building code requirements. We hope to have this figured out during early 2017 with modifications completed by the end of 2017.

APPENDIX B

AUDIT METHODOLOGY AND STANDARDS

To achieve our audit objective and obtain valid evidence, we performed the following procedures:

- We interviewed Facility officials regarding the collection and treatment of municipal and industrial wastewater and the use of this wastewater to generate biogas, kWh of electricity and therms of energy.

- We calculated the total amount of biogas used by the microturbines to generate one kWh of electricity, the biogas used by the boilers for heat and hot water and the total amount of biogas flared during our audit period to determine the amount of biogas the Facility produced.

- We reconciled the total biogas produced per the Chief Operator's data to meter readings of the total cubic feet of biogas produced and used by the microturbines, the total biogas used by the boilers and readings of the amount of biogas flared during our audit period to determine the accuracy of the Chief Operator's production data.

- We compared the energy formulas used by the Chief Operator to convert biogas to BTU and therms of energy to the energy conversion formulas available on the EPA website to determine if the conversions were reasonable.

- We calculated the rate at which biogas was converted to kWh based on meter readings conducted when all four microturbines were operating. We then calculated a similar rate using the Chief Operator's formula to determine the accuracy of the Chief Operator's conversion rate.

- We read meters to determine the kilowatts produced by two of the four microturbines and compared this reading to the kilowatt output per the Chief Operator's formula. We further compared the readings to the kilowatt output per the manufacturer's specification of these microturbines to determine the accuracy of the kilowatt output used in the Chief Operator's formula to calculate kWh production.

- We converted the cubic feet of biogas produced and used to generate kWh of electricity and to therms of heat energy and, using the average cost per kWh and average cost per therm, calculated the retail value of kWh and therms produced by the Facility. We also converted the cubic feet of biogas flared to the therms of natural gas equivalent and to kWh of electricity and calculated its retail value.

- We obtained total consumption and costs of kWh of electricity and therms of natural gas purchased by the Facility during the audit period. We judgmentally selected three months of this data and traced the consumption and costs for these three months to their respective invoices. We used this total cost to calculate the average delivery and consumption cost per kWh of electricity and per therm of natural gas for the scope period.

- We calculated the equivalent MTCE saved from entering the environment by using the amount of kWh and therms of natural gas equivalent produced using the biogas that the Facility generated during our audit period and the EPA Greenhouse Gas Equivalencies Calculator located at https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator.

We conducted this performance audit in accordance with GAGAS. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objective. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objective.

APPENDIX C

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