

New York State Energy Research and Development
Authority

FLEXIBLE TECHNICAL ANALYSIS - TOWN OF SAUGERTIES

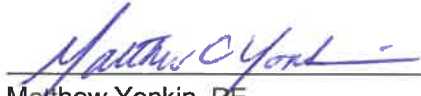
Glasco Wastewater Treatment Plant, Saugerties
Town Hall, Frank D. Greco Senior Center

May 13, 2019

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FLEXIBLE TECHNICAL ANALYSIS - TOWN OF SAUGERTIES

Glasco Wastewater Treatment Plant,
Saugerties Town Hall, Frank D. Greco
Senior Center



Matthew Yonkin, PE
Program Manager

Prepared for:

Vernon Benjamin
Special Operations Coordinator
Town of Saugerties
Saugerties, NY 12477



Paul F. Cannone, PE, CEM
Project Manager/Senior Energy Engineer

Prepared by:

Arcadis of New York, Inc.
855 Route 146
Suite 210
Clifton Park
New York 12065
Tel 518 250 7300
Fax 518 371 2757



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Scott Burger, BEAP
Energy Engineer

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ECM Calculations

ACRONYMS AND ABBREVIATIONS

AHU	Air Handling Unit
BMS	Building Management System
CH ₄	Methane
CO ₂	Carbon Dioxide
CCF	Hundred Cubic Feet
CCU	Compressor/Condenser Unit
CSC	Climate Smart Community
DWH	Domestic Water Heater
DX	Direct Expansion
ECM	Energy Conservation Measure
EPA	Environmental Protection Agency
Gal	Gallon
HID	High Intensity Discharge
HP	Horsepower
HVAC	Heating, Ventilation, and Air Conditioning
kW	Kilowatt
kWh	Kilowatt-hour
LED	Light-Emitting Diode
MBH	Thousand British Thermal Units
MMBtu	Million British Thermal Units
MGD	Million Gallons per Day
N ₂ O	Nitrous Oxide
NYSERDA	New York State Energy Research and Development Authority
OM	Operational Measure
PV	Photovoltaic
RTU	Rooftop Unit
SCADA	Supervisory Control and Data Acquisition
VFD	Variable Frequency Drive

EXECUTIVE SUMMARY

Arcadis of New York, Inc. (Arcadis) completed an energy evaluation study for the Town of Saugerties (Town) at three sites as follows:

1. Glasco Sewer District Wastewater Treatment Plant (WWTP) – 234 Hudson Street, Glasco, NY 12432
2. Saugerties Town Hall (Town Hall) – 4 High Street, Saugerties, NY 12477
3. Frank D. Greco Senior Center (Senior Center) – 207 Market Street, Saugerties, NY 12477

The goal of the study was to assist the Town of Saugerties Climate Smart Task Force in the ongoing implementation of actions to reduce greenhouse gas emissions and adapt to the effects of climate change through the Climate Smart Community (CSC) program. Working closely with Town personnel, Arcadis developed the study by analyzing data provided by the Town and completing thorough audits at each site. As part of the scope of work to determine the technical and economic feasibility of energy savings opportunities, Arcadis identified eight energy conservation measures (ECMs) and three operational measures (OM) across all three sites. The specific breakdown of each ECM and OM are shown in Table 1. Implementation of the measures presented in this study provide the Town the opportunity to accumulate additional points in the CSC program and to develop a plan to incorporate these actions into future Town upgrades and plans.

ECMs and OMs were separated into two categories: low cost/no cost or capital improvement. Low cost/no cost measures were defined as measures with implementation costs less than \$1,000, and capital improvement measures were defined as measures with implementation costs greater than or equal to \$1,000. Additionally, any ECMs or OMs with simple payback periods of eight years or less were recommended by Arcadis for implementation.

Implementation costs include material costs and assume in-house labor to complete the work. Demand (kW) reductions were calculated based on annual unit operational hours in conjunction with the annual energy consumptions savings. Table 1 summarizes the ECM and OM recommendations, costs, and savings. Based on the ECMs and OMs shown in Table 1, ECM 1, ECM 2, and OM 1 for the WWTP, ECM 1, ECM 3, ECM 4, and OM 1 for the Town Hall, and ECM 2 and OM 1 for the Senior Center are recommended. These recommended measures would lead to a reduction of 24,306 pounds of carbon dioxide (CO₂) equivalent per year.

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Table 1: ECM and OM Breakdown

Location	ECM/ OM	Description	Measure Status	Demand Savings (kW)	Electric Savings (kWh)	Natural Gas Savings (CCF)	Fuel Oil Savings (Gal)	Total Energy Savings (MMBtu)	Cost Savings (\$)	Project Cost (\$)	Payback Period (Years)	lbs CO ₂ Removed
WWTP	ECM 1	Replace inefficient lighting with LED equivalent lighting	R	1.08	7,866	0	0	26.84	\$922	\$1,905	2.1	2,318
	ECM 2	Install a condensing instantaneous natural gas water heater and reduce the temperature setpoint	R	0.00	0	-86	98	4.64	\$295	\$1,000	3.4	1,170
	OM 1	Reduce the Control Room thermostat setpoint	R	0.00	0	135	0	13.95	\$127	\$-	0.0	1,614
Town Hall	ECM 1	Replace inefficient lighting with LED equivalent lighting	R	8.27	36,115	0	0	123.22	\$3,070	\$19,950	6.5	10,643
	ECM 2	Implement occupancy sensors in breakrooms, conference rooms, and lavatories	NR	0.00	1,365	0	0	4.66	\$116	\$1,969	17.0	402
	ECM 3	Implement outdoor air boiler temperature reset controls on the Weil-McLain Ultra S4 boilers	R	0.00	0	29	0	3.04	\$27	\$150	5.5	351
	ECM 4	Install a vending machine miser on the refrigerated vending machine	R	0.00	2,050	0	0	6.99	\$174	\$200	1.1	604
	OM 1	Turn off the lobby lighting in the Helsmortel Wing	R	0.00	1,699	0	0	5.80	\$144	\$-	0.0	501
Senior Center	ECM 1	Replace inefficient lighting with LED equivalent lighting	NR	2.10	4,585	0	0	15.64	\$770	\$6,300	8.2	1,351
	ECM 2	Install a vending machine miser on the refrigerated vending machine	R	0.00	2,050	0	0	6.99	\$344	\$200	0.6	604
	OM 1	Reduce the DWH temperature setpoint	R	0.00	0	4	0	0.37	\$4	\$-	0.0	43

Notes: (1) R = Recommended, NR = Not Recommended
(2) CO₂ Emission Factors: Electricity – 0.2947 lbs/kWh, Natural Gas – 12 lbs/CCF, No. 2 Fuel Oil – 22.51 lbs/Gal¹

¹ U.S. EPA – Emission Factors for Greenhouse Gas Inventories, Last modified March 9, 2018.

DESCRIPTION OF PROJECT OBJECTIVES AND APPROACH

The objective of the Flexible Technical Analysis study is to complete energy evaluations for the Town to determine the technical and economic feasibility of reducing the energy usage of the Town through energy efficiency and conservation measures. The facilities analyzed as part of the study include the WWTP, the Town Hall, and the Senior Center. The following is the specific list of tasks that Arcadis performed as part of this energy evaluation for the Town:

1. Task 1: Review Existing Utility Information
2. Task 2: Data Collection
3. Task 3: Complete Site Audit
4. Task 4: Energy Evaluation
5. Task 5: Energy Report

FACILITY DESCRIPTION

Glasco Wastewater Treatment Plant

The WWTP was constructed in 1985 alongside the banks of the Hudson River. The site consists of three buildings, the Main, Grit, and Blower Buildings as noted in Figure 2. The WWTP has a permitted capacity of 0.424 million gallons per day (MGD) under SPDES Permit NY0145564. During the period from August 2017 to July 2018, the average influent flow rate treated by the WWTP was approximately 0.185 MGD. The WWTP is a secondary treatment plant with primary treatment provided by comminution, grit collection, and primary settling. Secondary treatment is provided by trickling filters and secondary settling. The WWTP's effluent is chlorinated before discharge to the Hudson River. Primary and secondary sludge are processed in an aerobic digester which uses coarse bubble diffusers for aeration, and biosolid dewatering is handled by a belt filter press prior to landfill discharge.

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Figure 1: Glasco WWTP Main Building

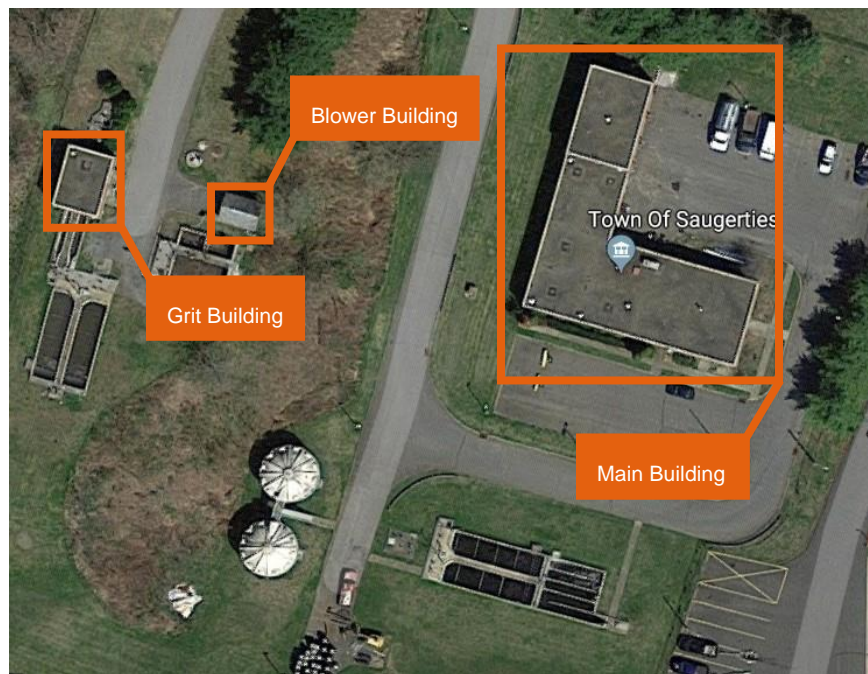


Figure 2: Birds-eye view of Glasco WWTP site

The Main Building is an 8,700 square feet single-story steel framing, masonry and brick construction with a basement pump room area. The first floor houses the administrative office, laboratory, belt filter press, and ancillary heating and cooling systems for occupant comfort. Since the WWTP sends wastewater samples to a third-party laboratory for sample testing, the onsite laboratory no longer serves its intended purpose. The basement area contains the sludge pump, recirculation pumps, booster pumps, and plunger pump. The Main Building has windows that are aluminum framed, double pane, which were replaced in

2011. The facility roof is original to the Main Building's construction, and roof insulation could not be observed during the walkthrough; however, discussions with operations staff estimate that the roof insulation is tapered and has not been upgraded since the WWTP was originally constructed in 1985. No visible breaks in the building envelope or thermal boundary layer were observed around exterior doors and windows. The administrative operations are staffed Monday through Friday from 8 AM to 4 PM. The process operations run 24 hours a day, seven days a week.

The Grit Building is 650 square feet constructed of masonry and brick. The Grit Building houses the original grit separation equipment, which has since been decommissioned. This building has a hazardous classification and does not have any windows. Also, all necessary equipment is rated explosion-proof. Since the grit separation equipment is no longer operable, this building only serves as storage space; however, there was no evidence of visible gaps in the building envelope.

The Blower Building is 192 square feet constructed of masonry block. The purpose of the Blower Building is to house the two blowers which provide aeration to the aerobic digesters in conjunction with the coarse bubble diffusers. The Blower Building has a small opening in the wall for an intake fan. The fan is no longer operated; however, the opening is maintained for make-up for the blower. Since the Blower Building is not heated or cooled, the building was not analyzed further for building envelope improvements.

Equipment Description

Heating and Cooling

Heating

The Main Building utilizes a hot water heating system utilizing a natural gas-fired boiler, circulation pumps, and a hot water supply and return circulation system. The heat source is provided by a boiler located in the Boiler Room. The boiler is a Weil-McLain model that originally became available to the facility, and the boiler was converted to natural gas as the fuel source. The boiler is rated at 882 thousand British Thermal Units (MBH) input and 720 MBH output, for an efficiency of 81.6 percent. During the walkthrough, the boiler water temperature setpoint was observed to be 176 degrees Fahrenheit. The air handling unit (AHU) in the boiler room utilizes a heating coil fed by the boiler's constant speed circulator pumps to provide heat to the administrative office, kitchenette, men's and women's locker rooms, and laboratory. A thermostat located in the administrative office is set to approximately 68 degrees Fahrenheit. Also, it was observed during the walkthrough that the administrative office utilizes a supplementary electric space heater with an integrated thermostat set to 72 degrees Fahrenheit. The maintenance and control rooms on the first floor of the Main Building utilize hydronic fan coil unit heaters for heating. Due to the mounting heights of the fan coil units, their specifications were not observed during the walkthrough. Based on a wall thermostat in the control room, the room temperature setpoint is below the 50-degree Fahrenheit setting. However, the fan coil unit in the control room was operating during the audit despite the space temperature in that area being noticeably warmer than the sub-50-degree temperature setpoint. This is likely due to the wall thermostat being mounted on a masonry block interior wall which is colder than the surrounding air temperature.

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The Grit Building is heated by three electric unit heaters. Since the Grit Building currently serves as storage space, the unit heaters are not used unless staff are working in the building.



Figure 3: Picture of the Main Building boiler (left) and Grit Building unit heater (right)

Cooling

The rooftop unit (RTU) described above also provides the required cooling to the Main Building. The unit could not be observed during the audit, but conversations with WWTP staff confirmed that the capacity of the unit is nominal 10 tons. Based on the thermostat located in the administrative office, the building cooling setpoint is approximately 77 degrees Fahrenheit.

Air Distribution

The primary source of ventilation for the Main Building is RTU and AHU. Dedicated supply and return ducts serve each room that is heated and cooled by the RTU and AHU. Additionally, the laboratory has a dedicated fume exhaust hood. Since the laboratory is not used to test samples, the exhaust hood is no longer utilized. The belt press filter room also has a dedicated exhaust fan; however, the fan is not used, and the doors of the building are left open for odor control.



**Figure 4: AHU in the Main
Building boiler room**

Controls

The WWTP does not utilize a central control system, such as a supervisory control and data acquisition (SCADA) system or building management system (BMS). The majority of systems and equipment on site are manually operated with the exception of the digitally-controlled thermostats.

Lighting

Interior

All lighting within the three buildings are manually operated via wall switches. No occupancy sensors were observed to control lighting. The majority of the WWTP buildings utilize four-foot, two-lamp T8 recessed troffer fixtures and four-foot, two-lamp T8 pendant fixtures. The exception is the pump room beneath the control room in the Main Building uses metal halide fixtures. The Grit Building's hazardous classification requires the use of explosion proof fixtures, where the fixture types are metal halides. The Blower Building utilizes four-foot, two-lamp T12 surface-mounted fixtures. Staff at the WWTP are prudent to turn off light fixtures in all rooms and buildings that are unoccupied upon exit of the room, other than emergency lighting which operates 24/7.



Figure 5: Metal halide light fixture in the pump room

Exterior

The majority of outdoor lighting is inoperable, with the exception of two wall-mounted incandescent fixtures at the entrance to the Main Building and the single metal halide fixture at the garage. All outdoor light fixtures are controlled by photocell sensors for dusk-dawn operation. The exception are the light fixtures at the entrance to the Main Building which are manually operated by a wall switch.



Figure 6: Light fixtures by the Main Building front door

Domestic Water Systems

Domestic Water

Domestic water is used in the lavatories, men's and women's locker rooms, kitchenette, and laboratory.

Domestic Hot Water

One Bock 32E 32-gallon, maximum 104 MBH fuel oil-fired domestic water heater (DWH) provides all the hot water needs for the Main Building. The WWTP staff are interested in replacing the existing fuel oil-fired DWH with a comparable natural gas unit. The hot water temperature setpoint could not be determined during the site visit.



Figure 7: DWH in the Main Building boiler room

Process Systems

Belt Filter Press

The belt filter press is located in the Main Building and was replaced approximately six years ago. The current belt filter press provides biosolid dewatering prior to solids transportation to a landfill. One 10 horsepower (HP) sludge pump moves sludge from the aerobic digester through two polymer mixing tanks to the belt filter press. A separate 1.5 HP polymer pump fills the polymer mixing tanks for continuous mixing. Four motors (one 1/3 HP, one 1 HP, one 2 HP, and one 3 HP) drive the belt filter press conveyor systems,

and a 5 HP booster pump uses wash water to clean the conveyor belts as needed. The belt filter press is typically operated two days a week from 7:30 AM to 2:30 PM, or seven hours.



Figure 8: Belt filter press in the Main Building

Sludge Pump

The sludge pump is located in the basement of the Main Building. The sludge pump is rated at 3 HP and operates 24/7 to pump sludge from the secondary settling tanks back to either the primary settling tanks or directly to the aerobic digester.

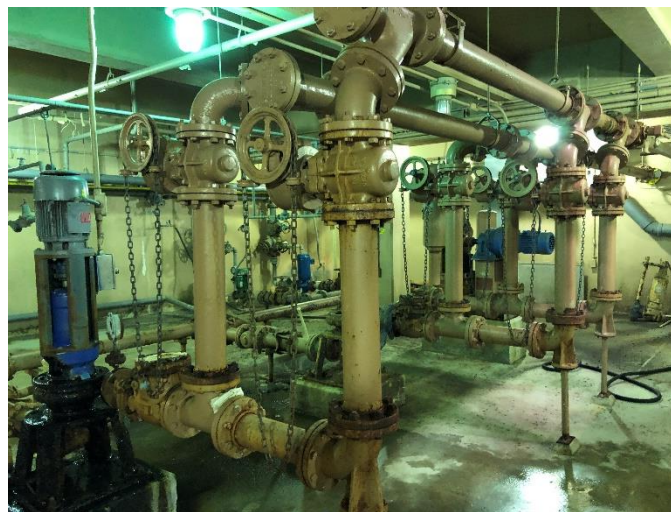


Figure 9: Sludge pump in the pump room

Recirculation Pumps

Three recirculation pumps are located in the basement of the Main Building. Each pump is 5 HP, and one pump operates 24/7. The other pumps are used as backup in case additional pumping is needed or if the main pump is down for maintenance. The recirculation pumps recirculate some of the trickling filter effluent

through the trickling filters for a second pass to increase dissolved oxygen and ensure adequate wetting of the plastic media.



Figure 10: Recirculation pumps in the pump room

Booster Pumps

The WWTP utilizes two booster pumps in the basement of the Main Building. One pump is rated at 5 HP and the second pump is rated at 15 HP. Prior to the replacement of the belt filter press approximately six years ago, one of the booster pumps operated to boost water pressure in conjunction with the old belt filter press for cleaning the conveyor system. The new belt filter press includes an integrated booster pump so the booster pumps in the basement are used less frequently. The operation of these pumps is for hand held hoses by WWTP staff around the site.



Figure 11: Booster pumps in the pump room

Plunger Pump

The WWTP uses a plunger pump located in the basement of the Main Building. The purpose of the plunger pump is to operate when the sludge streams are too thick for the existing sludge pump. Due to the relative diluted consistency of the sludge stream through the plant, the plunger pump is rarely operated.

Blowers

The Blower Building contains two 15 HP blowers which provide aeration using coarse bubble diffusers in the aerobic digester. One blower operates 24/7, and the second unit is only energized during periods of hot weather for odor control or when the main blower is taken offline for maintenance.



Figure 12: Blower #1 in the Blower Building

Grit Equipment

The grit separator in the Grit Building is no longer used. The Grit Building is used for storage only.

Standby Generator

The Main Building contains a 155-kW diesel-fired standby generator during power outages. The generator is tested regularly and utilizes a block heater for engine startup during cold temperatures. The block heater was recently replaced, but when temperatures are warm enough, WWTP staff manually unplug the block heater to reduce energy use.



Figure 13: Standby generator in the control room

Utilities

Electricity and natural gas supply and distribution for the WWTP is provided by Central Hudson. Additionally, fuel oil is provided for domestic hot water (DHW) generation only. Arcadis requested three years of historical electric, natural gas, and fuel oil usage broken out on a monthly basis from the Town of Saugerties. Fuel oil invoices were not provided by the Town and therefore fuel oil consumption was not included in the WWTP's energy use breakdown. The Town of Saugerties provided summarized data for 2017 that included the electricity consumption, electricity cost, natural gas consumption, and natural gas cost. During the walkthrough, WWTP staff provided monthly bill printouts from Central Hudson, which included monthly electricity consumption and consumption costs, demand and demand costs, and gas consumption and consumption costs. This printout contained data from February 2017 to January 2019. Estimates were made for January 2017 based on the provided billing data. The electric consumption and electric provided by WWTP staff was used as the baseline for this analysis. A summary of the utility accounts are included in Table 2.

Table 2: 2017 Annual Usage Summary

Description	Usage	Rate	Total Cost
Electricity Consumption	185,200 kWh	\$0.116/kWh	\$21,506
Electricity Demand	483 kW	\$9.13/kW	\$4,413
Natural Gas Consumption	7,089 ccf	\$0.942/ccf	\$6,681
Fuel Oil Consumption	98 gallons	\$2.16/gal	\$212
TOTAL			\$32,812

*Note: Fuel oil invoices were not available so the usage, rate, and total cost were estimated based on hot water usage and 2015 NYSEDA fuel oil rates escalated to 2017 dollars.

Electricity Use

The electricity consumption and costs did not match the original data provided by the Town. As a result, the monthly breakout of utility data provided by WWTP staff for 2017 was used for energy baselining and energy analysis. Based on average state-wide electricity price estimates provided by the New York State Energy Research and Development Authority (NYSEDA) for 2017, the average annual electricity rate for industrial customers in New York State was \$0.059/kWh². The blended electricity rate (including consumption and demand costs) at the WWTP was \$0.116/kWh, which is 96 percent greater than the state average.

² <https://www.nyserda.ny.gov/Researchers-and-Policymakers/Energy-Prices/Electricity/Monthly-Avg-Electricity-Industrial>

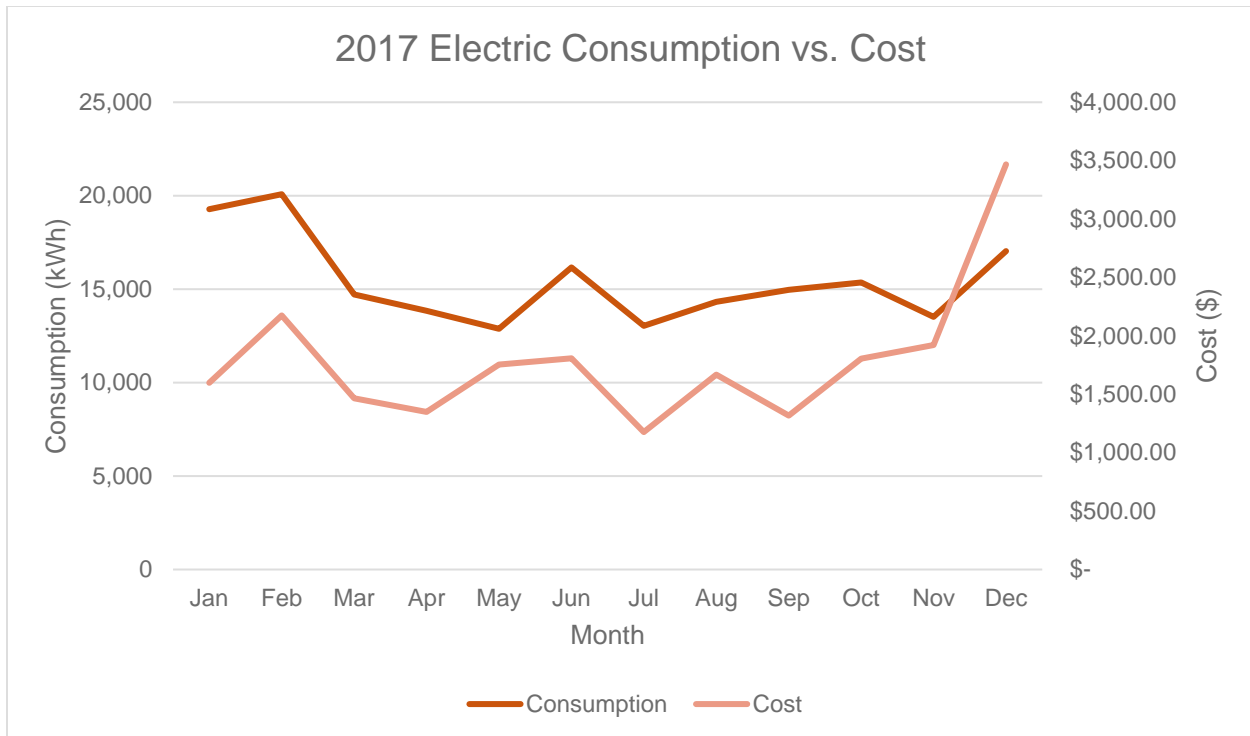


Figure 14: WWTP 2017 Electricity Consumption vs. Cost

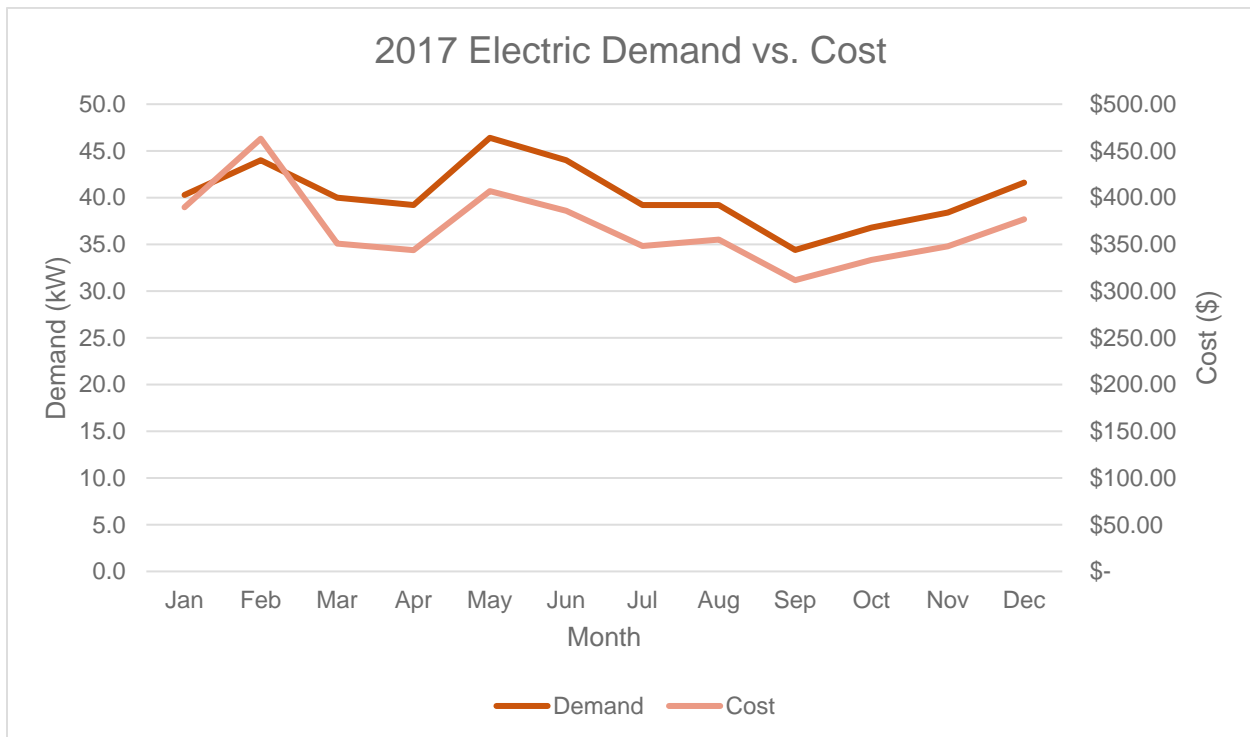


Figure 15: WWTP 2017 Electricity Demand vs. Cost

Natural Gas Use

Monthly natural gas consumption for the WWTP for an entire year was provided for 2017 and 2018. To remain consistent in the analysis of all three buildings in this study, only the utility data from 2017 was used for energy baselining and energy analysis. Based on average state-wide natural gas price estimates provided by NYSERDA for 2017, the average annual natural gas rate for industrial customers in New York State was \$0.717/ccf³. The natural gas rate at the WWTP was \$0.942/kWh, which is 31 percent greater than the state average.

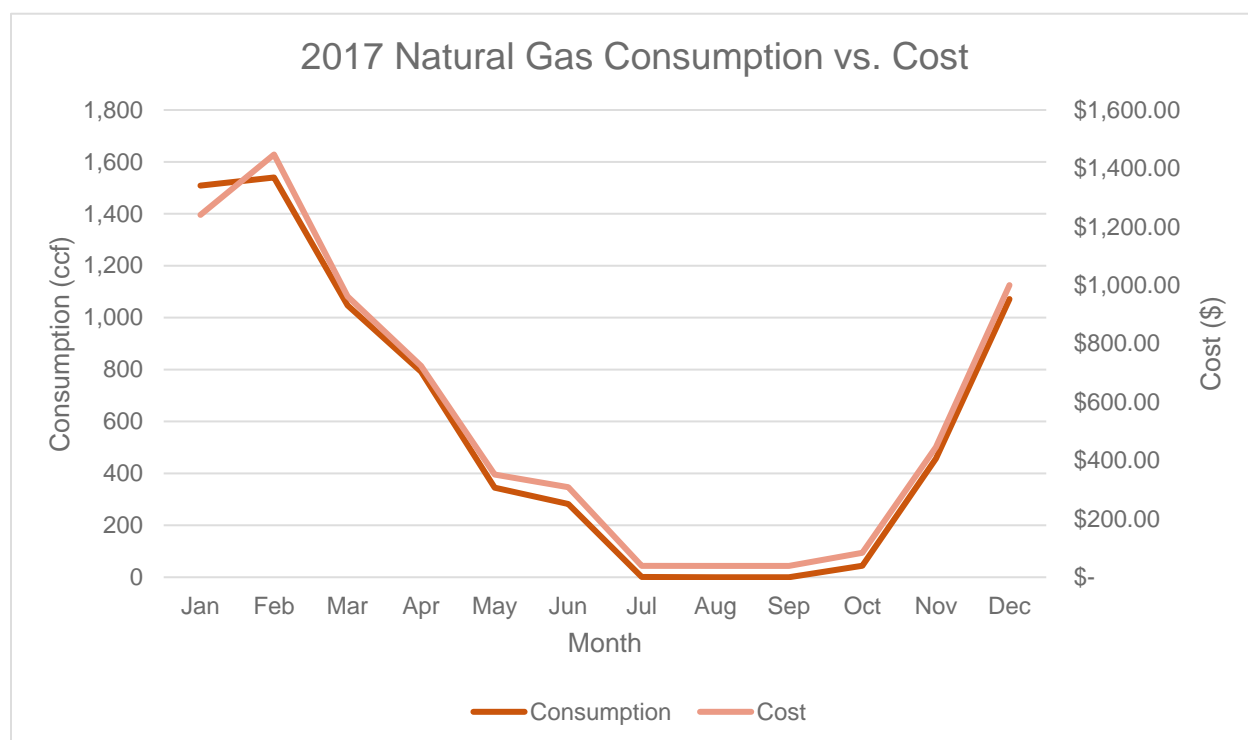


Figure 16: WWTP 2017 Natural Gas Consumption vs. Cost

Fuel Oil Use

Fuel oil delivery data was not provided for the WWTP. The only fuel oil-consuming system on site is the DWH. Since fuel oil invoicing data was not provided by the Town, analyses of fuel oil consumption and cost were not completed. However for the purposes of analyzing the DWH for improvements, it was estimated that the WWTP staff consume approximately 15 gallons of hot water per day for handwashing and manual dish washing.

³ <https://www.nyserda.ny.gov/Researchers-and-Policymakers/Energy-Prices/Natural-Gas/Monthly-Average-Price-of-Natural-Gas-Industrial>

Energy Use Breakdown

Figure 17 displays the energy use by each system which was broken out through analysis. Utility bills, equipment sizes, use patterns, and benchmark breakdowns were used to develop the chart. The largest consumers are process-related equipment, such as pumping and aeration, which represent approximately 82 percent of the overall annual energy consumption. The other largest consumer is the lighting, which accounts for 10 percent of annual energy use.

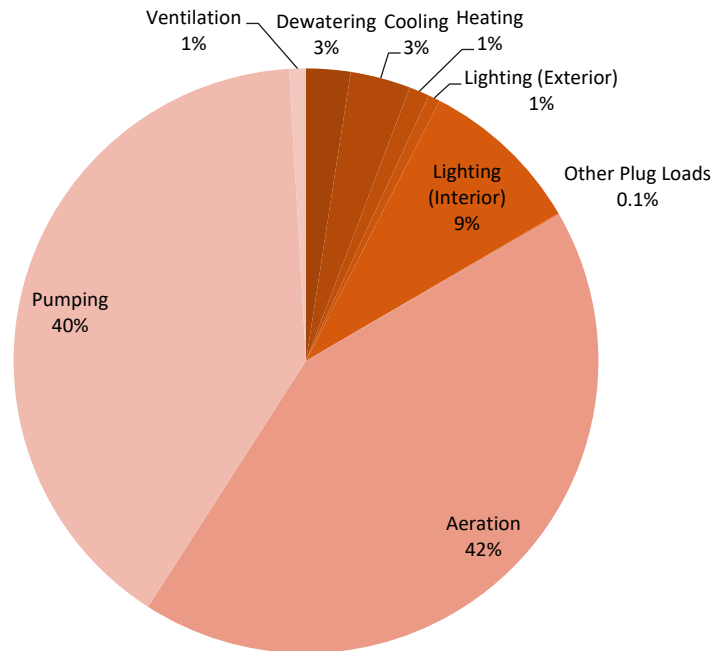


Figure 17: WWTP Combined Fuel End-Use Breakdown

Saugerties Town Hall

The Town Hall is comprised of two wings, the Donlon Wing which is the original building, was constructed in 1932 and the Helsmortel Wing, which was constructed in 2000. Due to the Town Hall's age and the addition of the Helsmortel Wing, the building is segmented with variable footprints. The Donlon Wing is a combination of single-story and two-story sections, and the Helsmortel Wing consists of a single-story section of the Town Hall. The total Town Hall area is 26,062 square feet, and the Donlon Wing is of masonry construction with steel framing while the Helsmortel Wing is a manufactured building. Despite the age of the Donlon Wing, there were no observable thermal breaks in the building envelope and there were no complaints from building occupants of comfort issues.



Figure 18: Saugerties Town Hall exterior

Equipment Description

Heating

Due to the various ages of the Town Hall's construction, the heating systems are a mix of various technologies and energy types. Table 3 and Table 4 provide the breakout of heating systems within the Donlon and Helmsmortel Wings, respectively, along with the areas served by each unit. With the exception of the Bosch boiler which provides domestic hot water during the summer months, the Town Hall thermostats prevent the other boilers from operating during the summer months.

FLEXIBLE TECHNICAL ANALYSIS - TOWN OF SAUGERTIES

Table 3: Donlon Wing heating system summary

System Type	Heat Distribution Method	Quantity	Fuel Type	Manufacturer	Heating Capacity	Area(s) Served
Boiler	Forced hot air	1	Natural Gas	Weil-McLain	175 MBH	Town Clerks
Boiler	Forced hot air	1	Natural Gas	Weil-McLain	175 MBH	Court Room/Court Clerks/Court Restrooms
Ductless Mini-Split	Forced hot air	1	Electric	Mitsubishi	N/A	Court Room/Court Clerks/Court Restrooms
Boiler	Baseboard	1	Natural Gas	Bosch	151.6 MBH	Supervisor's Office/Conference Room
Boiler	Forced hot air	2	Natural Gas	Weil-McLain	299 MBH	Police Station/Lobby/Tax Collectors
Ductless Mini-Split	Forced hot air	1	Electric	Mitsubishi	N/A	Tax Collectors

Table 4: Helsmortel Wing heating system summary

System Type	Heat Distribution Method	Quantity	Fuel Type	Manufacturer	Heating Capacity	Area(s) Served
Boiler	Radiant floor	1	Natural Gas	Utica	200 MBH	Assessors/Building Inspectors/Conference Room
	Forced hot air	Same as above	Same as above	Same as above	Same as above	TV23

During the walkthrough, it was observed that all of the thermostats had heating setpoints between 68 degrees Fahrenheit and 74 degrees Fahrenheit depending on the space.



Figure 19: Weil-McLain 299 MBH boilers (left) and Bosch 151.6 MBH boiler (right)

Cooling

Cooling for the Town Hall is mostly provided by direct expansion (DX) compressor/condenser units (CCUs); however as shown in Table 5 and Table 6, there are some spaces that utilize ductless mini-splits or window air conditioning units as supplemental sources of cooling other than the primary DX CCUs. The building cooling setpoints could not be observed during the walkthrough.

FLEXIBLE TECHNICAL ANALYSIS - TOWN OF SAUGERTIES

Table 5: Donlon Wing cooling system summary

System Type	Cooling Distribution Method	Quantity	Fuel Type	Manufacturer	Cooling Capacity	Area Served
DX	Forced air	1	Electric	Unknown*	60 MBH	Town Clerks
DX	Forced air	2	Electric	Heil/Concord	60 MBH**	Court Room/Court Clerks/Court Restrooms
Ductless Mini-Split	Forced air	1	Electric	Mitsubishi	N/A	Court Room/Court Clerks/Court Restrooms
Window A/C	Forced air	2	Electric	Frigidaire	6 MBH**	Supervisor's Office/Conference Room
DX	Forced air	3	Electric	Concord (1), Air Ease (2)	72 MBH	Police Station
DX	Forced air	1	Electric	Unknown*	36 MBH	Lobby/Tax Collectors
Ductless Mini-Split	Forced air	1	Electric	Mitsubishi	N/A	Tax Collectors

*Unit manufacturer could not be confirmed during the site visit

**Estimated

Table 6: Helmsmortel Wing cooling system summary

System Type	Cooling Distribution Method	Quantity	Fuel Type	Manufacturer	Cooling Capacity	Area Served
DX	Forced air	1	Electric	Champion	48 MBH	Assessors
DX	Forced air	1	Electric	Same as above	48 MBH	Building Inspector
DX	Forced air	1	Electric	Air Ease	48 MBH	Conference Room, TV23
Ductless Mini-Split	Forced air	1	Electric	Fujitsu	N/A	TV23



Figure 20: Building inspector (left) and planning board/conference room (right) CCUs

Air Distribution

The primary sources of ventilation for the Town Hall are AHUs that provide heating and cooling to the spaces. Dedicated supply ducts serve each room that is heated and cooled by the AHUs; however, exhaust air is collected at each floor and ducted to the common exhaust shafts to be exhausted the outside. As shown in Table 7 and Table 8, there are some spaces that utilize ductless mini-splits as supplemental sources of cooling other than the primary AHUs in that space. Additionally, there are exhaust fans in lavatories throughout the Town Hall that are manually operated via a wall switch and exhaust directly to the outside. The police station locker rooms have exhaust fans that are controlled by occupancy sensors.

Table 7: Donlon Wing ventilation system summary

Quantity	Unit Type	Manufacturer	Area Served
1	AHU	Unknown	Town Clerks
2	AHU	Unknown	Court Room/Court Clerks/Court Restrooms
1	Ductless Mini-Split	Mitsubishi	Court Room/Court Clerks/Court Restrooms
2	Window A/C	Frigidaire	Supervisor's Office/Conference Room
3	AHU	Unknown	Police Station
1	AHU	Unknown	Lobby/Tax Collectors
1	Ductless Mini-Split	Mitsubishi	Tax Collectors

Table 8: Helsmortel Wing ventilation system summary

Quantity	Unit Type	Manufacturer	Area Served
1	AHU	Advanced Distributor Products	Assessors
2	AHU	Advanced Distributor Products	Building Inspector/Conference Room
1	AHU	Advanced Distributor Products	TV23
1	Ductless Mini-Split	Fujitsu	TV23

Controls

The Town Hall does not utilize a central control system, such as a BMS. The majority of systems and equipment on site are manually operated with the exception of the digitally-controlled thermostats.

Lighting

Interior

The majority of the lighting fixtures serving the Town Hall are manually operated by manual wall switches. Most of the rooms utilize four-foot, two-lamp or two-foot, two-lamp T8 recessed troffer fixtures. The areas that have different lighting include the lobby and hallway of the Helsmortel Wing and the court room in the Donlon Wing. The lobby and hallway utilize T8 fluorescent wall wash fixtures, compact fluorescent lamps, and high-bay fixtures. The court room in the Donlon Wing utilizes a mixture of decorative pendant fixtures, wall sconce fixtures, and track lighting. The light fixtures are typically operated during normal operation of the Town Hall, with the exception of the police station light fixtures which operate 24/7.

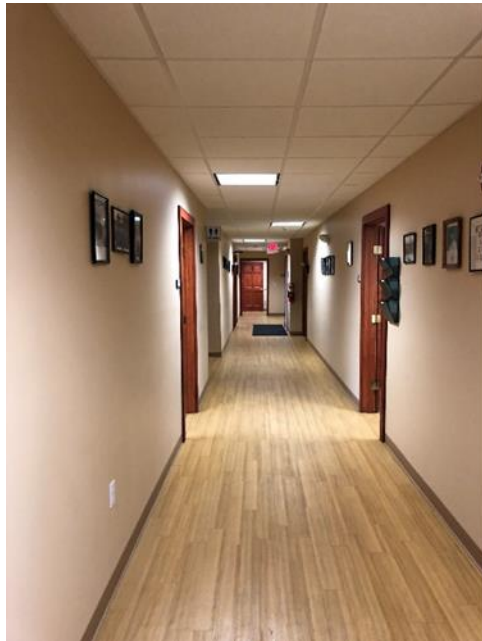


Figure 21: Light fixtures in the second floor of the police station (left) and court room (right)

Exterior

All outdoor light fixtures at the Town Hall are high-intensity discharge (HID) wall packs that are controlled by photocell sensors for dusk to dawn operation.



Figure 22: Exterior light fixture on the
Helsmortel Wing

Domestic Water Systems

Domestic Water

Domestic water is used in the lavatories, locker rooms, and kitchen.

Domestic Hot Water

The Bosch boiler shown in Table 3 also provides domestic hot water for the Town Hall. Additionally, there is an electric instantaneous water heater that serves the Helsmortel Wing. The hot water temperature setpoint for the Bosch boiler could not be determined during the site visit. However, the hot water temperature setpoint on the instantaneous unit was set to “Ideal”, which equates to 125 degrees Fahrenheit based on the manufacturer specifications.



Figure 23: Instantaneous water heater for the Helsmortel Wing

Additional Systems

Security IT Center

The police station operates a small Security IT Center in the technology room on the second floor to support police security systems. Due to the protection of sensitive information, no data was recorded or photographed in the technology room.

Utilities

The Town Hall's electricity and natural gas supply and distribution is provided by Central Hudson. Arcadis requested three years of historical electric and natural gas usage broken out on a monthly basis from the Town of Saugerties. The Town of Saugerties provided monthly data for 2017 that included the electricity consumption, electricity cost, natural gas consumption, and natural gas cost. A summary of the utility accounts are included in Table 9.

FLEXIBLE TECHNICAL ANALYSIS - TOWN OF SAUGERTIES

Table 9: 2017 Town Hall Annual Usage Summary

Description	Usage	Rate	Total Cost
Electricity Consumption	391,028 kWh	\$0.085/kWh	\$33,071
Natural Gas Consumption	9,297 ccf	\$0.807/ccf	\$7,503
TOTAL			\$40,574

Electricity Use

Monthly electricity consumption for the Town Hall was only provided for 2017. Based on average state-wide electricity price estimates provided by NYSEDA for 2017, the average annual electricity rate for commercial customers in New York State was \$0.147/kWh⁴. The electricity rate at the Town Hall was \$0.085/kWh, which is 42 percent less than the state average.

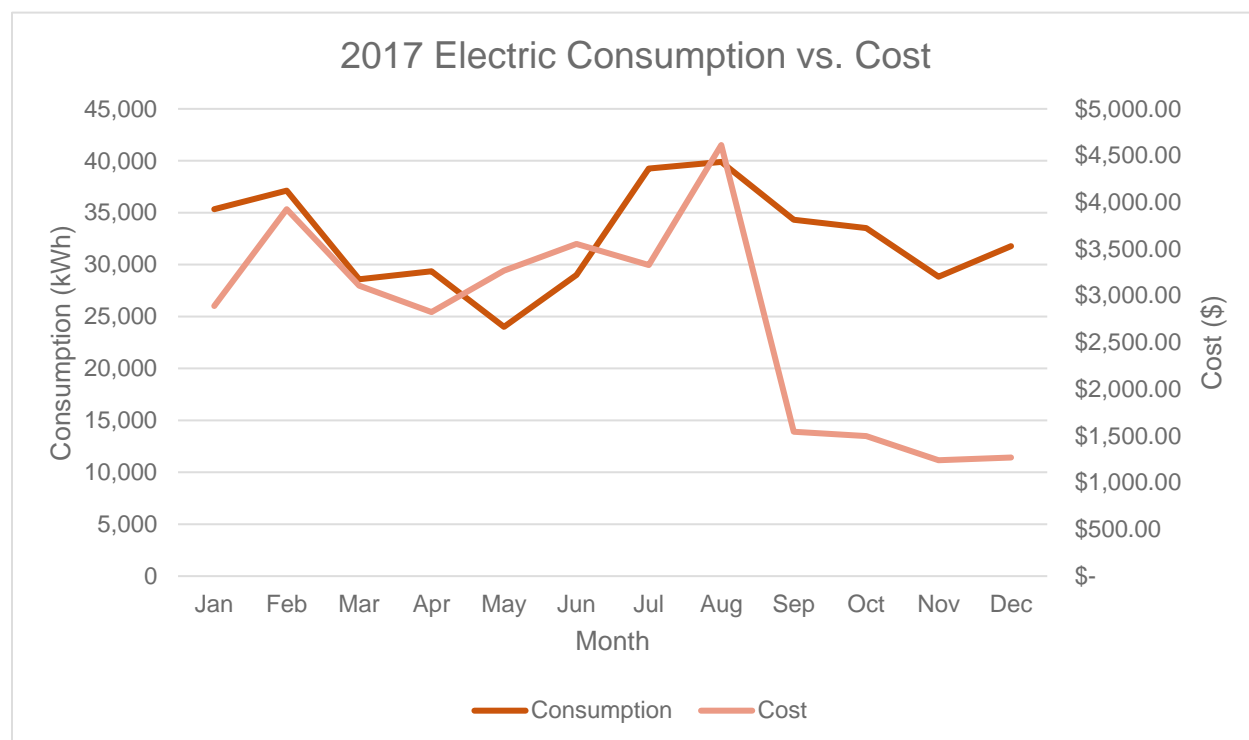


Figure 24: Town Hall Electricity Consumption vs. Cost

Natural Gas Use

Monthly natural gas consumption for the Town Hall was only provided for 2017. Based on average state-wide natural gas price estimates provided by NYSEDA for 2017, the average annual natural gas rate for

⁴ <https://www.nyserda.ny.gov/Researchers-and-Policymakers/Energy-Prices/Electricity/Monthly-Avg-Electricity-Commercial>

commercial customers in New York State was \$0.674/ccf⁵. The natural gas rate at the Town Hall was \$0.807/kWh, which is 20 percent greater than the state average.

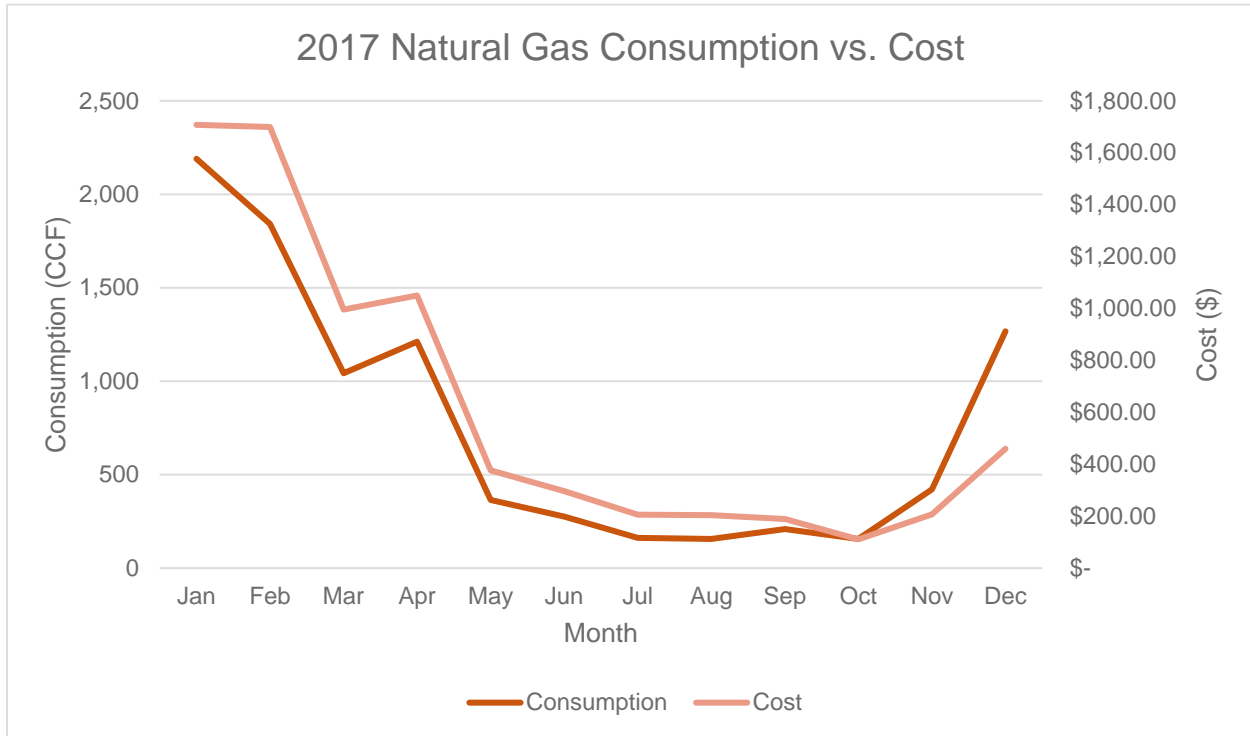


Figure 25: Town Hall 2017 Natural Gas Consumption vs. Cost

Energy Use Breakdown

Figure 26 displays the energy use by each system which was broken out through analysis. Utility bills, equipment sizes, use patterns, and benchmark breakdowns were used to develop the chart. The largest consumers are for heating, ventilation, and air conditioning processes (HVAC), which represent approximately 56 percent of the overall annual energy consumption. The other largest consumer is the lighting, which accounts for 25 percent of annual energy use.

⁵ <https://www.nyserda.ny.gov/Researchers-and-Policymakers/Energy-Prices/Natural-Gas/Monthly-Average-Price-of-Natural-Gas-Industrial>

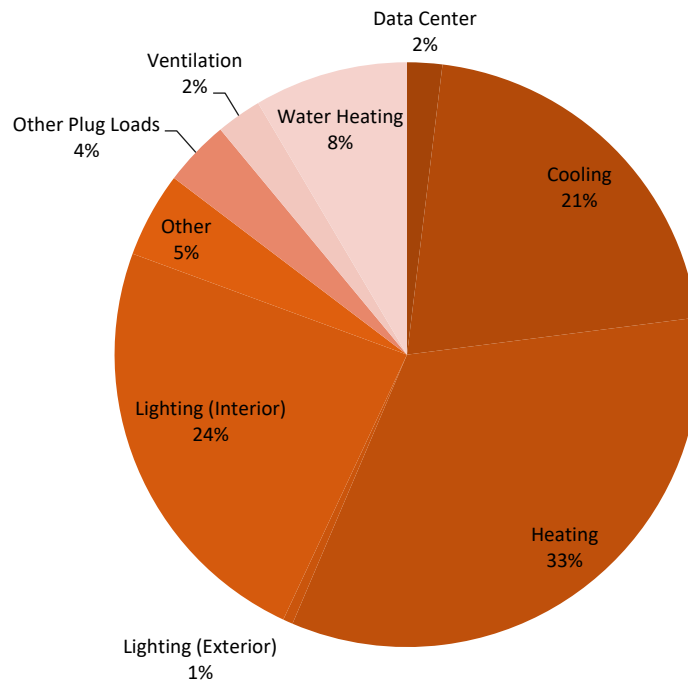


Figure 26: Town Hall Combined Fuel End-Use Breakdown

Frank D. Greco Senior Center

The Senior Center is a 5,428 square foot single-story multi-purpose recreational facility serving the broader Saugerties community that was constructed in 1978. The facility is slab on grade, wood frame construction with T-111 siding and an asphalt shingle roof. Windows are wood-framed, double pane and were estimated to be original to the building. Despite the age, the majority of the windows are in good shape without any observable thermal breaks, however there was one window in the big room with observable thermal breaks as evidenced by moisture buildup. Roof insulation was observed to be laid on the drop ceiling throughout the Senior Center.

The typical hours of operation are from Monday to Friday, 8 AM to 4 PM; however, the Senior Center also serves as a rental space on some weekends for short periods of time for various community and personal events. The building has four main areas: the big room, the small room, the lobby, and the kitchen. The big room and the small room are available as rental spaces during the weekends. The kitchen is typically used by the senior community to prepare breakfast and lunch during the week and for other events on the weekends.



Figure 27: Senior Center exterior

Equipment Description

Heating and Cooling

Heating

Heating throughout the Senior Center is provided by three natural gas-fired AirEase G1D91BU100D16C-2A condensing furnaces installed in 2008 and located in the mechanical room adjacent to the kitchen. Each unit is rated at 100 MBH input and 91 MBH output, for an efficiency of 91 percent. Two of the furnaces serve the big room, while the third furnace serves the lobby, small room, and kitchen. During the walkthrough, it was observed that a thermostat located in the big room was set to 71 degrees Fahrenheit. A second thermostat in the small room was set to 70 degrees Fahrenheit.



Figure 28: Heating units in the mechanical room

Cooling

Cooling for the Senior Center is provided by three DX AirEase condensers. Evaporator coils are located above each furnace to provide air conditioning to the Senior Center. The building cooling setpoint could not be observed during the walkthrough.



Figure 29: Cooling condensing units

Air Distribution

The primary sources of ventilation for the Senior Center are the three furnaces. Dedicated supply and return ducts serve each room that is heated and cooled by the furnaces. Additionally, the kitchen has two oven recirculation hoods. Since the two ovens are sparingly utilized, the recirculation hoods are rarely used.

Controls

The Senior Center does not utilize a central control system, such as a BMS. The systems and equipment on site are manually operated with the exception of the digitally-controlled thermostats.

Lighting

Interior

All lighting within the Senior Center is manually operated by manual wall switches. No occupancy sensors were observed to control lighting. The majority of the rooms utilize four-foot, two-lamp T8 recessed troffer fixtures. The lobby also utilizes two-foot, three-lamp T8 recessed parabolic fixtures. The light fixtures are typically operated during the normal operation of the Senior Center.



Figure 30: Big room light fixtures

Exterior

All outdoor light fixtures at the Senior Center are light-emitting diode (LED) wallpacks and are controlled by photocell sensors for dusk-dawn operation.

Domestic Water Systems

Domestic Water

Domestic water is used in the lavatories and kitchen.

Domestic Hot Water

One A.O. Smith GCV-50-300 50-gallon, 40 MBH input natural gas-fired atmospheric DWH was manufactured in 2013 and provides all of the hot water needs for the Senior Center. The hot water temperature setpoint could not be determined during the site visit.



Figure 31: A.O. Smith DWH in mechanical room

Additional Systems

Solar Photovoltaic

Twenty solar photovoltaic (PV) panels were installed on the Senior Center roof in the spring of 2017 and cover approximately 10% of the roof's area. The panels are mounted flat on the roof's surface at approximately a 30-degree pitch and face west southwest. The exact system size could not be confirmed during the walkthrough.

Standby Generator

The Senior Center has a natural gas-fired life-safety standby generator which provides electricity during utility power outages. The generator's nameplate could not be observed during the site visit due to weathering of the essential information, but the generator is tested monthly to confirm operation.

Utilities

Electricity and natural gas supply and distribution for the Senior Center are provided by Central Hudson. Arcadis requested three years of historical electric and natural gas usage broken out on a monthly basis from the Town of Saugerties. The Town of Saugerties provided monthly data for 2017 that included the electricity consumption, electricity cost, natural gas consumption, and natural gas cost. A summary of the utility accounts are included in Table 10.

FLEXIBLE TECHNICAL ANALYSIS - TOWN OF SAUGERTIES

Table 10: 2017 Senior Center Annual Usage Summary

Description	Usage	Rate	Total Cost
Electricity Consumption	17,973 kWh	\$0.168/kWh	\$3,026
Natural Gas Consumption	2,362 ccf	\$0.927/ccf	\$2,190
TOTAL			\$5,216

Electricity Use

Monthly electricity consumption for the Senior Center for an entire year was only provided for 2017. Based on average state-wide electricity price estimates provided by NYSDERDA for 2017, the average annual electricity rate for commercial customers in New York State was \$0.147/kWh⁴. The electricity rate at the Senior Center was \$0.168/kWh, which is 14 percent less than the state average.

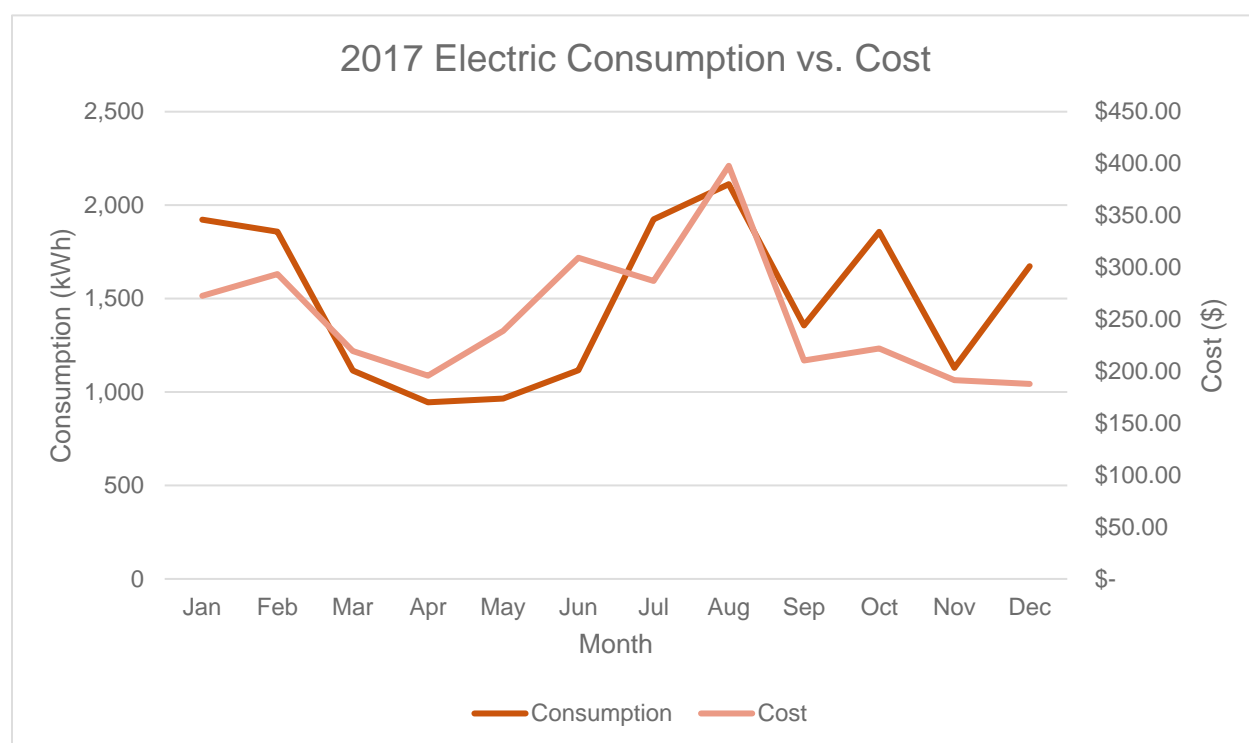


Figure 32: Senior Center 2017 Electricity Consumption vs. Cost

Natural Gas Use

Monthly natural gas consumption for the Senior Center for an entire year was only provided for 2017. Based on average state-wide natural gas price estimates provided by NYSDERDA for 2017, the average annual natural gas rate for commercial customers in New York State was \$0.674/ccf⁵. The natural gas rate at the Senior Center was \$0.927/ccf, which is 37 percent greater than the state average.

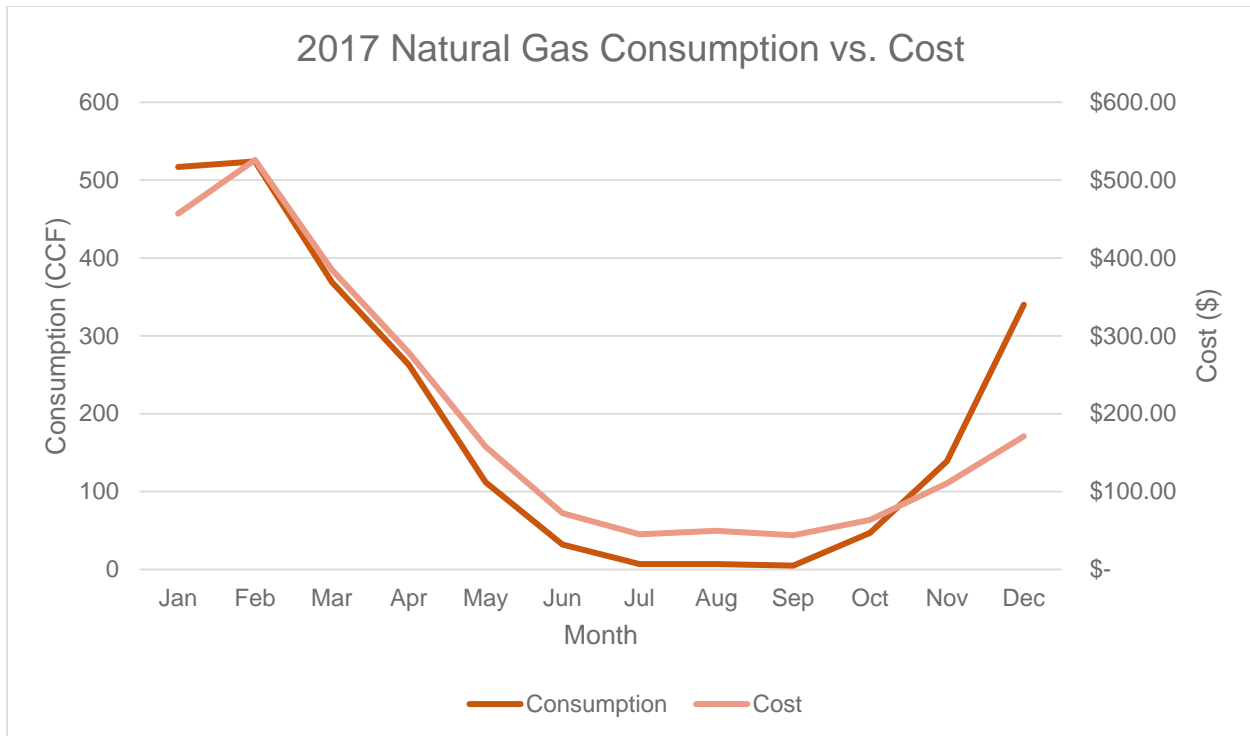


Figure 33: Senior Center 2017 Natural Gas Consumption vs. Cost

Energy Use Breakdown

Figure 34 displays the energy use consumed by each system which was broken out through analysis. Utility bills, equipment sizes, use patterns, and benchmark breakdowns were used to develop the chart. The largest consumers are for HVAC, representing 84 percent of the overall annual energy consumption. The other largest consumer is the lighting, which accounts for 8 percent of annual energy use.

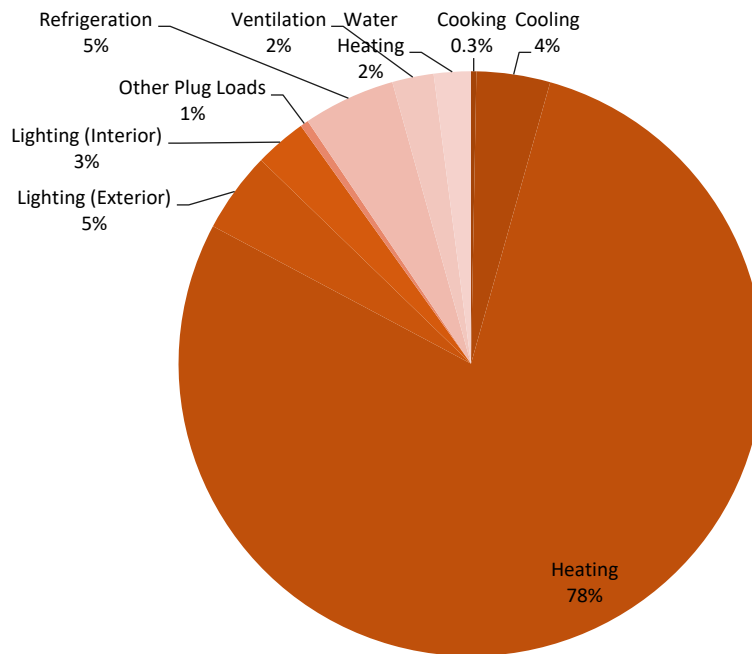


Figure 34: Senior Center Combined Fuel End-Use Breakdown

ENERGY ANALYSIS SUMMARY

Analysis of all building systems were performed at the WWTP, Town Hall, and Senior Center. It was determined that most systems did not offer compelling opportunities for energy savings; however, for the systems that did offer compelling opportunities, Energy Conservation Measures (ECMs) and Operational Measures (OMs) have been identified to reduce building energy use. They have been separated into two categories based on their cost and payback potential: low/no cost and capital improvement measures. In addition, capital improvement measures that were deemed not cost effective were categorized separately. None of the analyzed ECMs were deemed to be cost prohibitive. Table 11 displays ECM information while additional details on each ECM are provided in Appendix A.

FLEXIBLE TECHNICAL ANALYSIS - TOWN OF SAUGERTIES

Table 11: ECM Summary Table

Location	ECM/ OM	Measure Type	Description	Cost Savings (\$)	Project Cost (\$)	Payback Period (Years)	lbs CO ₂ Removed
WWTP	ECM 1	CI	Replace inefficient lighting with LED equivalent lighting	\$922	\$1,905	2.1	2,318
	ECM 2	CI	Install a condensing instantaneous natural gas water heater and reduce the temperature setpoint	\$295	\$1,000	3.4	1,170
	OM 1	LC/NC	Reduce the Control Room thermostat setpoint	\$127	\$0	0.0	1,614
Town Hall	ECM 1	CI	Replace inefficient lighting with LED equivalent lighting	\$3,070	\$19,950	6.5	10,643
	ECM 2	CI	Implement occupancy sensors in breakrooms, conference rooms, and lavatories	\$116	\$1,969	17.0	402
	ECM 3	CI	Implement outdoor air boiler temperature reset controls on both Weil-McLain models and the Utica model boilers	\$27	\$150	5.5	351
	ECM 4	LC/NC	Install a vending machine miser on the refrigerated vending machine	\$174	\$200	1.1	604
	OM 1	LC/NC	Turn off the lobby lighting in the Helmsmortel Wing	\$144	\$0	0.0	501
Senior Center	ECM 1	CI	Replace inefficient lighting with LED equivalent lighting	\$770	\$6,300	8.2	1,351
	ECM 2	LC/NC	Install a vending machine miser on the refrigerated vending machine	\$344	\$200	0.6	604
	OM 1	LC/NC	Reduce the DWH temperature setpoint	\$4	\$0	0.0	43

*Note: Pounds of CO₂ removed are calculated based on estimates of CO₂ emissions by the Environmental Protection Agency's (EPA) Emission Factors for Greenhouse Gas Inventories, March 9, 2018.

Glasco Wastewater Treatment Plant

ECM 1: LED lighting

Due to the WWTP staff's careful attention to turning off lights in areas that are not occupied, lighting energy savings are not widespread. However, for emergency lights that operate 24/7 and operation of inefficient lighting technologies such as incandescent and metal halide, upgrading to LED equivalent lighting is recommended. All labor for implementation was assumed to be completed by WWTP staff.

Project Cost	Estimated Annual Operating Savings	Simple Payback Period (Years)
\$1,905	\$922	2.1

ECM 2: Natural gas instantaneous water heater and temperature setpoint reduction

During the site visit, WWTP personnel expressed interest in converting the existing fuel oil-fired DWH to a natural gas unit. Due to the proximity of the boiler and existing DWH, costs for extension of the natural gas line to a new DWH are minimal. The DWH only provides hot water for the kitchen, lavatories, and showers. However, the onsite showers are not typically used by WWTP personnel. Since the overall hot water demand is minimal, it is recommended to replace the fuel oil-fired DWH with a condensing, high-efficiency natural gas-fired instantaneous water heater to increase energy efficiency and reduce standby losses that occur in storage tank DWHs. Since the WWTP fuel oil bills were not provided, it was conservatively estimated that the DWH operates a half hour per day, five days a week. Additionally, it was assumed that the replacement instantaneous water heater has an energy factor of 0.94. For additional savings, the majority of the hot water usage will be used for washing hands, which does not require temperature setpoints above 110 degrees Fahrenheit. The temperature setpoint could not be observed during the site visit but was estimated as 120 degrees Fahrenheit as the basis for determining energy savings. The New York State food service industry recommends water temperatures of at least 100 degrees Fahrenheit for washing hands to reduce the spread of illnesses. Additionally, the United States Department of Energy estimates annual fuel savings of 3 percent for every 10-degree Fahrenheit reduction in hot water temperature setpoint.

Project Cost	Estimated Annual Operating Savings	Simple Payback Period (Years)
\$1,000	\$295	3.4

ECM 3: VFD on recirculation pumps

Since the amount of recirculated effluent is dependent on changing diurnal flow patterns, the pumps were evaluated for integration with a variable frequency drive (VFD) to reduce the pump speed during high influent flows into the plant. Based on the minimum hydraulic loading required for the trickling filters and the current recirculated pump flow rates, reducing the recirculation pump speeds could adversely affect the trickling filter environment. The recirculation pump VFDs were not evaluated further for energy savings.

Project Cost	Estimated Annual Operating Savings	Simple Payback Period (Years)
N/A	N/A	N/A

OM 1: Reduce the Control Room thermostat setpoint

The control room in the Main Building is heated by a single hydronic fan coil unit controlled by a wall-mounted thermostat on the room's east-facing interior wall. The thermostat's setpoint was somewhere between the "LO" and "50" settings on the unit, but the room was noticeably warmer than the thermostat indicated (approximately 60 degrees Fahrenheit or so). The "LO" setting's associated temperature setpoint could not be determined, however based on similar units and the temperature increments of the thermostat, the "LO" setting was assumed to be 40 degrees Fahrenheit. It was observed that the thermostat was directly mounted on the masonry block wall, which is colder than the surrounding air temperature of the room. Despite the thermostat's setpoint, it was believed that the cold wall was causing false temperature readings and causing the hydronic fan coil unit to operate longer than necessary. To prevent unnecessary overheating of the Control Room, this measure recommends adjusting the thermostat as needed to reduce the room temperature to 50 degrees Fahrenheit.

Project Cost	Estimated Annual Operating Savings	Simple Payback Period (Years)
\$0	\$127	0.0

Saugerties Town Hall

ECM 1: LED lighting

During the walkthrough of the Town Hall, the hours of operation of the Town Hall and lighting were recorded. This measure analyzed a combination of replacing the existing light fixtures with LED retrofit kits, which are less expensive than purchasing solid-state LED fixtures, and replacing the exterior fixtures with solid-state LED fixtures.

Project Cost	Estimated Annual Operating Savings	Simple Payback Period (Years)
\$19,950	\$3,070	6.5

ECM 2: Occupancy sensors

The majority of the Town Hall does not utilize occupancy sensors. Based on conversations with Town Hall staff, the town assessor's area had occupancy sensors, but due to inadequate coverage or placement, lights would turn out while staff were working at their desks and not walking around. Since office areas are typically consistently occupied during the Town Hall's operating hours of 8 AM to 4 PM, alternative rooms were analyzed for occupancy sensor implementation. The breakrooms, conference rooms, and lavatories were identified as potential sources of occupancy sensor savings due to limited usage of these spaces throughout a typical day. Based on typical design of these space types, a lighting power density (LPD) of 1.5 watts per square foot was assumed for estimating total installed wattage in each space type. Based on a study of lighting energy savings associated with wireless sensors from the United States Department of Energy, breakrooms, conference rooms, and lavatories can expect to reduce lighting energy consumption by 29 percent, 45 percent, and 30 to 90 percent, respectively. These savings were conservatively downgraded by 5% to account for Town Hall occupation and operation.

Project Cost	Estimated Annual Operating Savings	Simple Payback Period (Years)
\$1,969	\$116	17.0

ECM 3: Outdoor Air Reset on boiler water supply temperature

Outdoor air reset on boiler water supply temperature is a control method which uses an automated algorithm to control the temperature limit of a hot water boiler based on the outside air temperature. This method of control allows the boiler to produce lower temperature water during warmer months due to a building's reduced heating load. Unnecessary overheating of the boiler water supply temperature reduces the boilers' overall efficiencies and increases thermal loss through the piping infrastructure. Most of the boilers that were observed onsite were producing 180-degree Fahrenheit water supply temperature despite the approximate outdoor air temperature during the audits of 32 degrees Fahrenheit. Based on the operation of the Town Hall, it is recommended to decrease the water supply temperature for the Weil-McLain Ultra S4 (299 MBH input) boilers. Based on product literature, the Ultra S4 units already have pre-programmed outdoor air reset logic. However, due to actual operation, the Ultra S4 units' outdoor air reset programming logic is not integrated with an outdoor air temperature sensor. Therefore, it is recommended to install an air temperature sensor to leverage the outdoor air temperature reset capabilities of the boilers. For the purposes of this calculation, it was estimated that the supply water temperature at maximum load (coldest outdoor air temperatures) 190-degree Fahrenheit supply water temperature was linearly reduced

to 160-degree Fahrenheit supply water temperature at the minimum load (warmest outdoor air temperatures). Additional savings could be realized if the boiler water supply temperatures can be dropped further, but confirmation of the Ultra S4 outdoor air reset schedule from the manufacturer is necessary to ensure optimal and safe boiler operation.

Project Cost	Estimated Annual Operating Savings	Simple Payback Period (Years)
\$150	\$27	5.5

ECM 4: Vending machine misers

Vending machine misers can be installed on refrigerated vending machines to reduce energy use. This equipment includes an occupancy sensor and associated electronics to power down vending machines when occupancy hasn't been sensed for 15 minutes. The refrigerated vending machines still maintain a cold temperature by turning on every 1-3 hours even if occupancy is not sensed. An example is VendingMiser <http://www.energymisers.com/>. The building currently has one vending drink machine that would benefit from this upgrade.

Project Cost	Estimated Annual Operating Savings	Simple Payback Period (Years)
\$200	\$174	1.1

OM 1: Turn off Helsmortel Wing lighting

During the walkthrough of the Helsmortel Wing, it was noted that the lobby receives a large amount of natural lighting due to the high bay windows. As a result, the area was sufficiently illuminated despite the overcast weather. Since additional lobby lighting was unnecessary, it was recommended to manually turn off the wall wash light fixtures and recessed light fixtures to reduce energy consumption. The calculation assumed a nominal operation of these lights for two hours a week for special occasions or ambiance for visitors.

Project Cost	Estimated Annual Operating Savings	Simple Payback Period (Years)
\$0	\$144	0.0

Frank D. Greco Senior Center

ECM 1: LED lighting

During the walkthrough of the Senior Center, the quantity of light fixtures were counted, and the hours of operation of the Senior Center were recorded. This measure analyzed replacing the existing light fixtures with LED retrofit kits, which is less expensive than purchasing LED fixtures. This measure was not recommended due to the high payback associated with overall low hours of operation of the fixtures.

Project Cost	Estimated Annual Operating Savings	Simple Payback Period (Years)
\$6,300	\$770	8.2

ECM 2: Vending machine misers

Vending machine misers can be installed on refrigerated vending machines to reduce energy use. This equipment includes an occupancy sensor and associated electronics to power down vending machines when occupancy hasn't been sensed for 15 minutes. The refrigerated vending machines still maintain a cold temperature by turning on every 1-3 hours even if occupancy is not sensed. An example is VendingMiser <http://www.energymisers.com/>. The building currently has one vending drink machine that would benefit from this upgrade.

Project Cost	Estimated Annual Operating Savings	Simple Payback Period (Years)
\$200	\$344	0.6

OM 1: DWH temperature setpoint reduction

The DWH only provides hot water for the kitchen and lavatories. The majority of the hot water usage will be used for washing hands, which does not require temperature setpoints above 110 degrees Fahrenheit. The temperature setpoint of the DWH at the Senior Center could not be observed during the site visit but was estimated as 120 degrees Fahrenheit as the basis for determining energy savings. The New York State food service industry recommends water temperatures of at least 100 degrees Fahrenheit for washing hands to reduce the spread of illnesses. Additionally, the United States Department of Energy estimates annual fuel savings of 3 percent for every 10-degree Fahrenheit reduction in hot water temperature setpoint.

Project Cost	Estimated Annual Operating Savings	Simple Payback Period (Years)
\$0	\$4	0.0

ENERGY SUSTAINABILITY METRICS

Metrics

Since 2009, the Town of Saugerties is a registered New York State CSC. Pursuant to the goals of Climate Smart Community program, the Town of Saugerties is committed to ongoing implementation of actions to reduce greenhouse gas emissions and adapt to the effects of climate change. The original focus of the program was to encourage local governments to commit to act on climate change by passing the CSC Pledge. However, starting back in 2014, the CSC program requires all registered CSCs to go beyond the CSC Pledge by completing and documenting a suite of actions that mitigate and adapt to climate change at the local level. The CSC program offers over 100 climate mitigation and adaptation actions. CSCs earn points toward certification for each action they complete. In addition to accumulating points, each community must complete a number of mandatory and priority actions at each level of certification.

The completion of government building energy audits and the recent installation of solar PV on the Senior Center roof are two of the methods to earn points as a CSC. The CSC website provides all possible actions for each community to take and the assigned point values. Additionally, the website specifies which actions are mandatory and priority along with new actions that are currently under review for approval. Arcadis recommends that the Town of Saugerties Climate Smart Task Force continues to pursue implementation of these actions and develop a plan to incorporate these actions into future planning. The full list of CSC actions can be found at the following website:

<https://climatesmart.ny.gov/fileadmin/csc/documents/CSCC-ActionChecklist-6-6-2018.pdf>

Greenhouse Gas Emissions

Arcadis calculated the recommended greenhouse gas emission reductions utilizing data provided by the U.S. EPA. The data includes emission factors for CO₂, methane (CH₄), and nitrous oxide (N₂O). The emission factors are provided for a variety of fuel types and methods of combustion (stationary combustion, mobile combustion, road vehicles, steam and heat, and business travel and employee commuting). Emissions for electricity consumption are estimated based on regions within the United States and typical methods of electricity generation (coal, natural gas, nuclear, renewables) as shown in Figure 35. The full version provided by the U.S. EPA can be found at the following website:

https://www.epa.gov/sites/production/files/2018-03/documents/emission-factors_mar_2018_0.pdf

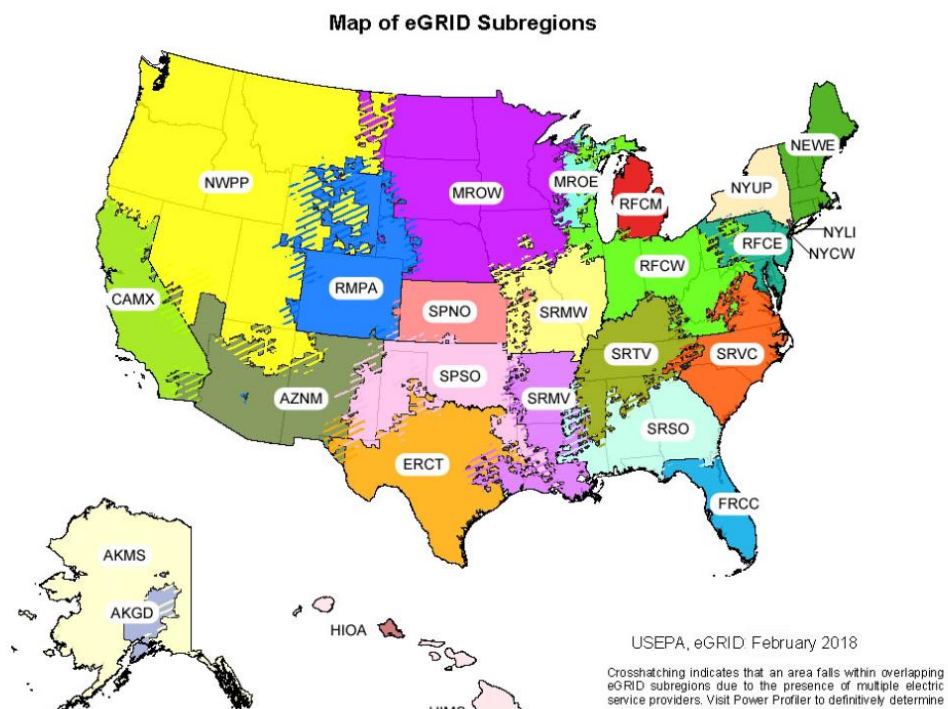


Figure 35: Electricity eGRID Subregions

APPENDIX A

ECM Calculations





Project #: 02255219.0000

Project Name: Flexible Technical Analysis - Town of Saugerties

Engineer: Scott Burger

ECM: ECM Summary

				Energy Savings								
Location	ECM	Description	Measure Status	Demand (kW)	Electric (kWh)	Natural Gas (CCF)	Fuel Oil (gal)	Total Energy (MMBtu)	Cost Savings (\$)	Implementation Costs (\$)	Payback Period (Years)	lbs CO ₂ Removed
Glasco WWTP	ECM 1	Replace inefficient lighting with LED equivalent lighting	R	1.08	7,866	0	0	26.84	\$ 922	\$ 1,905	2.1	2,318
	ECM 2	Install a condensing instantaneous natural gas water heater and reduce the temperature setpoint	R	0.00	0	-86	98	4.64	\$ 295	\$ 1,000	3.4	1,170
	OM 1	Reduce the Control Room thermostat setpoint	R	0.00	0	135	0	13.95	\$ 127	\$ -	0.0	1,614
Town Hall	ECM 1	Replace inefficient lighting with LED equivalent lighting	R	8.27	36,115	0	0	123.22	\$ 3,070	\$ 19,950	6.5	10,643
	ECM 2	Implement occupancy sensors in breakrooms, conference rooms, and lavatories	NR	0.00	1,365	0	0	4.66	\$ 116	\$ 1,969	17.0	402
	ECM 3	Implement outdoor air boiler temperature reset controls on the Weil-McLain Ultra S4 boilers	R	0.00	0	29	0	3.04	\$ 27	\$ 150	5.5	351
	ECM 4	Install a vending machine miser on the refrigerated vending machine	R	0.00	2,050	0	0	6.99	\$ 174	\$ 200	1.1	604
	OM 1	Turn off the lobby lighting in the Helsmortel Wing	R	0.00	1,699	0	0	5.80	\$ 144	\$ -	0.0	501
Senior Center	ECM 1	Replace inefficient lighting with LED equivalent lighting	NR	2.10	4,585	0	0	15.64	\$ 770	\$ 6,300	8.2	1,351
	ECM 2	Install a vending machine miser on the refrigerated vending machine	R	0.00	2,050	0	0	6.99	\$ 344	\$ 200	0.6	604
	OM 1	Reduce the DWH temperature setpoint	R	0.00	0	4	0	0.37	\$ 4	\$ -	0.0	43
Recommended				9.35	49,780	82	98	191.85	\$ 5,107	\$ 23,405	4.6	17,849
Not Recommended				2.10	5,950	0	0	20.30	\$ 886	\$ 8,269	9.3	1,753

Assumptions:
Emission Factors: Electric - 294.70 lb CO₂/MWh (0.29470 lb CO₂/kWh), Natural Gas - 5.444 kg CO₂/CCF (12.00 lb CO₂/CCF), No. 2 Fuel Oil - 10.21 kg CO₂/gal (22.51 lb CO₂/gal)

Project #:	02255219.0000
Project Name:	Flexible Technical Analysis - Town of Saugerties
Engineer:	Scott Burger
ECM:	ECM 2 - DWH Replacement and Temperature Setpoint Reduction

Natural Gas Rate	\$	0.942 /CCF	2015 Home Heating Oil Prices (NYS Statewide)	\$	15.04 /MMBtu
			2015 Home Heating Oil Prices (NYS Statewide)	\$	2.08 /gal
			RSMean Construction Cost Index Escalator		1.04
			Escalated 2017 Home Heating Oil Prices (NYS Statewide)	\$	2.16 /gal

Existing										Proposed							Savings			Costs				Payback
DWH Type	Fuel Type	Input	Operating Hours¹	Total Energy Consumed	Energy Factor²	Total Fuel Needed	Heat Content³	Total Fuel Needed	Total Fuel Consumed	DWH Type	Fuel Type	Energy Factor⁴	Total Fuel Consumed	Heat Content⁵	Total Fuel Consumed	Total Fuel Consumed	Fuel Oil	Natural Gas	Cost Savings⁶	Material	Labor	O&P	Total	Payback Period
		Btu/h	(Hours/yr)	Btu		(Btu)	(Btu/gal)	(Gals)	(Gals)				Btu	(Btu/CF)	CF	CCF	(Gal)	(CCF)	(\$)	(\$)	(\$)	(\$)	(\$)	(Years)
Storage Tank	Fuel Oil	104,000	130	13,520,000	0.63	8,517,600	138,500	61	98	Instantaneous	Natural Gas	0.94	9,061,277	1,037	8,738	87	98	-87	\$ 292.95	\$ 520	\$ 286	\$ 194	\$ 1,000	3.4

Temp Reduction								Savings		Costs	Payback
Unit	Estimated Annual Consumption	Estimated Existing Temperature Setpoint⁷	Proposed Temperature Setpoint⁸	Temperature Reduction	Energy Savings of Temperature Setpoint Reduction⁹	Proposed Energy Savings	Proposed Energy Consumption	Energy Savings	Cost Savings	Total	Payback Period
	(CCF)	(°F)	(°F)	(°F)	(%/10 °F reduction)	(%)	(CCF)	(CCF)	(\$)	(\$)	(Years)
Natural Gas	87	120	100	20	1%	2%	86	2	\$ 1.65	\$ -	0.0

Notes:

1. Operating hours of the DWH were estimated as 0.5 hour per day, 5 days per week

2. Energy Factor of existing DWH determined from manufacturer cutsheets

3. Heat content of No. 2 fuel oil estimated by the United States Energy Information Administration (U.S. EIA)

4. Energy Factor of the proposed DWH estimated using a typical high-efficiency condensing instantaneous water heater

5. Heat content of natural gas estimated by the U.S. EIA

6. Cost savings for fuel oil estimated based on 2015 data provided by the New York State Energy Research and Development Authority (NYSERDA) for home heating oil (No. 2 fuel oil) and escalated to 2017 dollars using the RSMeans Construction Cost Index

7. The Estimated Existing Temperature Setpoint was assumed to be the typical recommended temperature setpoint for domestic water heaters by the United States Department of Energy (U.S. DOE)

8. The Proposed Temperature Setpoint (100°F) is the minimum temperature recommended for hand washing by the New York State food service industry, which was used as the basis for determining energy savings

9. The U.S. DOE estimates 3% annual fuel savings for every 10°F reduction in supply water temperature for storage tanks. Since this is an instantaneous unit, the savings were conservatively estimated as 1% for every 10°F reduction in supply water temperature

Project #: 02255219.0000

Project Name: Flexible Technical Analysis - Town of Saugerties

Engineer: Scott Burger

ECM: OM 1 - Reduce Control Room Temperature

Nat Gas Rate \$ 0.942 /CCF

Construction	U-Value
Wall Assembly	0.1
Roof Assembly	0.1

	Exposed Area Dimensions		
	Roof	West Wall	South Wall
Dimension #1	41	41	30
Dimension #2	30	16	16
Area	1,230	656	480

			Existing								Proposed								Savings		Costs	Payback				
Mid-pts	Dry Bulb Temp	Hours at Bin	Existing Space Temp	Heat Loss West Wall	Heat Loss South Wall	Heat Loss Roof	Total Heat Loss	Natural Gas Required	Efficiency	Natural Gas Consumed	Existing Space Temp	Heat Loss West Wall	Heat Loss South Wall	Heat Loss Roof	Total Heat Loss	Natural Gas Required	Efficiency	Natural Gas Consumed	Natural Gas Savings	Cost Savings	Total Cost	Payback Period				
(°F)	(°F)	(Hours)	(°F)	(MBtu)	(MBtu)	(MBtu)	(MBtu)	(CCF)	(%)	(CCF)	(°F)	(Btu)	(Btu)	(Btu)	(Btu)	(CCF)	(%)	(CCF)	(CCF)	(\$)	(\$)	(Years)				
57.5	55 to 60	885	60	145	106	272	523	5	81.6%	6	50								6	\$ 6	\$ -	0.0				
52.5	50 to 55	837	60	412	301	772	1,485	14	81.6%	18	50								18	\$ 17						
47.5	45 to 50	604	60	495	362	929	1,786	17	81.6%	21	50	99	72	186	357	3	81.6%	4	17	\$ 16						
42.5	40 to 45	756	60	868	635	1,627	3,130	30	81.6%	37	50	372	272	697	1,342	13	81.6%	16	21	\$ 20						
37.5	35 to 40	747	60	1,103	807	2,067	3,977	38	81.6%	47	50	613	448	1,149	2,209	21	81.6%	26	21	\$ 20						
32.5	30 to 35	553	60	998	730	1,871	3,598	35	81.6%	43	50	635	465	1,190	2,290	22	81.6%	27	15	\$ 15						
27.5	25 to 30	374	60	797	583	1,495	2,876	28	81.6%	34	50	552	404	1,035	1,991	19	81.6%	24	10	\$ 10						
22.5	20 to 25	337	60	829	607	1,554	2,990	29	81.6%	35	50	608	445	1,140	2,193	21	81.6%	26	9	\$ 9						
17.5	15 to 20	214	60	597	437	1,119	2,152	21	81.6%	25	50	456	334	855	1,646	16	81.6%	19	6	\$ 6						
12.5	10 to 15	127	60	396	290	742	1,427	14	81.6%	17	50	312	229	586	1,127	11	81.6%	13	4	\$ 3						
7.5	5 to 10	110	60	379	277	710	1,366	13	81.6%	16	50	307	224	575	1,106	11	81.6%	13	3	\$ 3						
2.5	0 to 5	77	60	290	213	545	1,048	10	81.6%	12	50	240	176	450	865	8	81.6%	10	2	\$ 2						
-2.5	-5 to 0	33	60	135	99	254	488	5	81.6%	6	50	114	83	213	410	4	81.6%	5	1	\$ 1						
-7.5	-10 to -5	20	60	89	65	166	319	3	81.6%	4	50	75	55	141	272	3	81.6%	3	1	\$ 1						
-12.5	-15 to -10	10	60	48	35	89	172	2	81.6%	2	50	41	30	77	148	1	81.6%	2	0	\$ 0						
			264								323								154		189		135	\$ 127	\$ -	0.0

Project #: 02255219.0000

Project Name: Flexible Technical Analysis - Town of Saugerties

Engineer: Scott Burger

ECM: ECM 1 - LED Lighting Upgrade

Electric Rate \$ 0.085 /kWh

		Existing									Proposed								Savings			Costs				Payback		
Fixture Type	Location	Technology	Lamp Quantity	Fixture Quantity	Lamp Wattage (W)	Ballast Factor	Fixture Wattage (W)	Hours of Operation (Hours)	Demand (kW)	Energy Consumption (kWh)	Technology	Lamp Quantity	Fixture Quantity	Lamp Wattage (W)	Fixture Wattage	Hours of Operation (Hours)	Demand (kW)	Energy Consumption (kWh)	Demand Savings (kW)	Energy Savings (kWh)	Cost Savings (\$)	Fixture Cost (\$)	Labor (\$)	O&P (\$)	Total (\$)	Payback Period (Years)		
2x4 Troffer	Town Hall	Fluorescent	2	93	32	0.88	5237.8	2,600	5.24	13,618	LED - Retrofit	1	93	23	2139.0	2,600	2.14	5,561	3.10	8057	\$ 684.83	\$ 100			\$ 9,300	13.6		
2x2 Troffer	Town Hall	Fluorescent	2	6	32	0.88	337.9	2,600	0.34	879	LED - Retrofit	1	6	23	138.0	2,600	0.14	359	0.20	520	\$ 44.18	\$ 100			\$ 100	2.3		
Sconce	Court Room	CFL	2	13	26	1	676.0	2,600	0.68	1,758	LED Bulb	2	13	14	364.0	2,600	0.36	946	0.31	811	\$ 68.95	\$ 5			\$ 130	1.9		
Pendant	Court Room	CFL	3	12	26	1	936.0	2,600	0.94	2,434	LED Bulb	3	12	14	504.0	2,600	0.50	1,310	0.43	1123	\$ 95.47	\$ 5			\$ 180	1.9		
Flood Light	Court Room	Incandescent	1	18	75	1	1350.0	2,600	1.35	3,510	LED Bulb	1	18	11	198.0	2,600	0.20	515	1.15	2995	\$ 254.59	\$ 5			\$ 90	0.4		
Exit Sign	Town Hall	Incandescent	1	30	5.4	1	162.0	8,760	0.16	1,419	LED	1	30	0.7	21.0	8,760	0.02	184	0.14	1235	\$ 104.99	\$ 45			\$ 1,350	12.9		
2x4 Troffer	Police Station	Fluorescent	2	35	32	0.88	1971.2	8,760	1.97	17,268	LED - Retrofit	1	35	23	805.0	8,760	0.81	7,052	1.17	10216	\$ 868.35	\$ 100			\$ 3,500	4.0		
2x2 Troffer	Police Station	Fluorescent	2	35	32	0.88	1971.2	8,760	1.97	17,268	LED - Retrofit	1	35	30	1050.0	8,760	1.05	9,198	0.92	8070	\$ 685.93	\$ 100			\$ 3,500	5.1		
Wallpack	Town Hall	HID	1	6	150	1.2	1080.0	3,650	1.08	3,942	LED	1	6	39	234.0	3,650	0.23	854	0.85	3088	\$ 262.47	\$ 300			\$ 1,800	6.9		
																				8.27	36,115	\$ 3,070					\$ 19,950	6.5

Notes:

1. The fixture quantities for the 2x4 and 2x2 troffer fixtures in the Donlon Wing were provided by the Town. The other 2x4 and 2x2 troffer fixtures in the Helmsmortel Wing and Police Station were estimated based on approximate square footage of both areas.

2. A ballast factor for all linear fluoreseents was estimated as 0.88

3. It was assumed that all lighting is installed in-house to save on labor charges



Project #: 02255219.0000

Project Name: Flexible Technical Analysis - Town of Saugerties

Engineer: Scott Burger

ECM: ECM 2 - Install Occupancy Sensors

Electric Rate \$ 0.085 /kWh

				Existing			Proposed			Savings			Costs				Payback	
Area	Expected Savings	Approximate Square Footage	LPD ¹	Total Wattage	Hours of Operation	Energy Consumption	Total Wattage	Hours of Operation	Energy Consumption	Demand Savings	Energy Savings	Cost Savings	Sensor Cost	Labor	O&P	Total	Payback Period	
	(%)	(sqft)	(W/sqft)	(W)	(Hours)	(kWh)	(W)	(Hours)	(kWh)	(kW)	(kWh)	(\$)	(\$)	(\$)	(\$)	(\$)	(Years)	
Breakrooms	24%	650	1.5	975	2,600	2,535	975	1,976	1,927	0.00	608	\$ 51.71	\$ 537			\$ 537	10.4	
Conference Rooms	40%	250	1.5	375	2,600	975	375	1,560	585	0.00	390	\$ 33.15	\$ 358			\$ 358	10.8	
Lavatories	25%	1,000	1.5	1,500	2,600	3,900	1,500	1,950	2,925	0.00	975	\$ 82.88	\$ 1,611			\$ 1,611	19.4	
										0.00	1,365	\$ 116					\$ 1,969	17.0

Project #: 02255219.0000

Project Name: Flexible Technical Analysis - Town of Saugerties

Engineer: Scott Burger

ECM: ECM 3 - Outdoor Air Temperature Reset

Nat Gas Rate \$ 0.927 /CCF

Well-McLain 299MBH Boiler Information

In	299	MBH
Out (rated)	276.575	MBH
Efficiency	0.925	MBH

CONDENSING, SUPPLY WATER TEMP @ 180F

																						Savings		Costs				Payback																							
Mid-pts	Dry Bulb Temp	Hours at Bin	Crawlspace Temperature	Hours at Crawlspace Temperatures	Beneficial Heat Factor	Base HW Temp	Reset HW Temp	Fraction of Insulated Pipe and Valve System	Length of Pipe Outside Thermal Envelope	Heat Loss of Insulated Pipe	Heat Loss Rate	Heat Loss	Natural Gas Loss	Efficiency	Natural Gas Input	Heat Loss of Insulated Pipe	Heat Loss Rate	Heat Loss	Natural Gas Loss	Efficiency	Natural Gas Input	Natural Gas	Cost Savings	Material	Labor	O&P	Total	Payback Period																							
(°F)	(°F)	(Hours)	(°F)	(Hours)		(°F)	(°F)		(ft)	(Btuh/ft)	(MBH)	(MBtu)	(CCF)	(%)	(CCF)	(Btuh/ft)	(MBH)	(MBtu)	(CCF)	(%)	(CCF)	(CCF)	(\$)	(\$)	(\$)	(\$)	(\$)	(Years)																							
67.5	65 to 70	774	72	1,685	1.00	190	160	1.00	100	18	1.8	3,104	30	92.5%	32	13	1.3	2,244	22	93.5%	23	9	\$ 8.54	\$ 150.00	\$ -	\$ -	\$ 150	5.5																							
62.5	60 to 65	911																																																	
57.5	55 to 60	885	62	1,722	1.00	190	165	1.00	100	20	2.0	3,411	33	92.5%	36	16	1.6	2,674	26	93.2%	28	8	\$ 7.32																												
52.5	50 to 55	837																																																	
47.5	45 to 50	604	52	1,360	1.00	190	170	1.00	100	21	2.1	2,879	28	92.5%	30	18	1.8	2,411	23	92.9%	25	5	\$ 4.62																												
42.5	40 to 45	756																																																	
37.5	35 to 40	747	42	1,300	1.00	190	180	1.00	100	23	2.3	2,926	28	92.5%	31	21	2.1	2,700	26	92.5%	28	2	\$ 2.19																												
32.5	30 to 35	553																																																	
27.5	25 to 30	374	32	1,302	1.00	190	190	1.00	100	24	2.4	3,101	30	92.5%	32	24	2.4	3101	30	92.5%	32	0	\$ -																												
22.5	20 to 25	337																																																	
17.5	15 to 20	214																																																	
12.5	10 to 15	127																																																	
7.5	5 to 10	110																																																	
2.5	0 to 5	77																																																	
-2.5	-5 to 0	33																																																	
-7.5	-10 to -5	20																																																	
-12.5	-15 to -10	10																																																	
161										136						29		\$ 27		\$ 150				5.5																											

Notes:

Heat Loss of Insulated Pipe calculated using: <https://checalc.com/calc/inshoriz.html>

Assumed existing supply water temperature of 190F

Assumed that the crawlspace temperatures where the boilers and piping are located fluctuate between 32F and 72F

Assumed that the reset supply water temperature of the boiler operates in 5F increments between 160F and 190F

Lowering the supply water temperature and return water temperature can increase boiler efficiency. We estimated that at lower supply water temperatures, the boiler could see an increase of efficiency to 93.5%

Assumed 100 feet of piping located in the crawlspace outside the thermal envelope

Assumed that purchase of a tempeprature sensor to measure outdoor air is defined as the only measure cost (\$150), with all labor for wiring and integrating the sensor into the boiler operation completed with in-house labor

Project #: 02255219.0000
 Project Name: Flexible Technical Analysis - Town of Saugerties
 Engineer: Scott Burger
 ECM: ECM 4 - Vending Machine Misers

Electric Rate \$ 0.085 /kWh

Vending Machine Type	Refrigerated?	Existing	Proposed	Savings		Costs	Payback
		Energy Consumption (kWh)	Energy Consumption (kWh)	Energy Savings (kWh)	Cost Savings (\$)	Total (\$)	Payback Period (Years)
Drink	Y	3,500	1,450	2,050	\$ 174.25	\$ 200	1.1
				2,050	\$ 174.25	\$ 200	1.1

Savings Calculator

Please replace the default values in the table below with your location's unique information and then click on the "calculate savings" button.

Energy Costs (\$0.000 per kWh)	<input type="text" value="\$0.085"/>
Facility Occupied Hours per Week	<input type="text" value="50"/>
Number of Cold Drink Vending Machines	<input type="text" value="1"/>
Power Requirements of Cold Drink Machine (Watts; 400 typical)	<input type="text" value="400"/>
VendingMiser Price	<input type="text" value="\$189.00"/>

Calculate Savings!

Results of your location's projected savings with VendingMiser® installed:

COLD DRINK MACHINES	Current	Projected	Total Savings	% Savings
kWh	3494	1449	2045	59%
Cost of Operation	\$297.02	\$123.17	\$173.85	59%

Total Project Cost	Break Even (Months)
\$189	13.05

Estimated Five Year Savings on ALL Machines = **\$869.27**

Estimated Five Year Return on Investment = **360%**

Project #: 02255219.0000

Project Name: Flexible Technical Analysis - Town of Saugerties

Engineer: Scott Burger

ECM: OM 1 - Turn Off Unncessary Light Fixtures

Electric Rate

\$

0.085 /kWh

		Existing									Proposed				Savings			Cost	Payback
Fixture Type	Location	Technology	Lamp Quantity	Fixture Quantity	Lamp Wattage	Ballast Factor	Fixture Wattage	Hours of Operation	Demand	Energy Consumption	Fixture Wattage	Hours of Operation¹	Demand	Energy Consumption	Demand Savings	Energy Savings	Cost Savings	Total	Payback Period
					(W)		(W)	(Hours)	(kW)	(kWh)		(Hours)	(kW)	(kWh)	(kW)	(kWh)	(\$)	(\$)	(Years)
Wall Wash	Helsmortel Wing Lobby	Fluorescent	25	1	32	0.88	704.0	2,080	0.70	1,464	704.0	104	0.70	73	0.00	1391	\$ 118.24	\$ -	0.0
Recessed	Helsmortel Wing Lobby	CFL	2	6	13	1	156.0	2,080	0.16	324	156.0	104	0.16	16	0.00	308	\$ 26.20	\$ -	0.0
															0.00	1,699	\$ 144	\$ -	0.0

Note:

1. Estimated that in the Proposed Case, the lights will be turned on for special occasions, or two hours per week

Project #: 02255219.0000

Project Name: Flexible Technical Analysis - Town of Saugerties

Engineer: Scott Burger

ECM: ECM 1 - LED Lighting Upgrade

Electric Rate \$ 0.168 /kWh

		Existing									Proposed								Savings			Costs				Payback	
Fixture Type	Location	Technology	Lamp Quantity	Fixture Quantity	Lamp Wattage	Ballast Factor	Fixture Wattage	Hours of Operation	Demand	Energy Consumption	Technology	Lamp Quantity	Fixture Quantity	Lamp Wattage	Fixture Wattage	Hours of Operation	Demand	Energy Consumption	Demand Savings	Energy Savings	Cost Savings	Fixture Cost	Labor	O&P	Total	Payback Period	
					(W)		(W)	(Hours)	(kW)	(kWh)				(W)		(Hours)	(kW)	(kWh)	(kW)	(kWh)	(\$)	(\$)	(\$)	(\$)	(\$)	(Years)	
2x4 Troffer	Senior Center	Fluorescent	2	63	32	0.88	3,548	2,184	3.55	7,749	LED - Retrofit	1	63	23	1,449	2,184	1.45	3,165	2.10	4,585	\$ 770.21	\$ 100			\$ 6,300	8.2	
																			2.10	4,585	\$ 770.21					\$ 6,300	8.2

Project #: 02255219.0000
 Project Name: Flexible Technical Analysis - Town of Saugerties
 Engineer: Scott Burger
 ECM: ECM 2 - Vending Machine Misers

Electric Rate \$ 0.168 /kWh

Vending Machine Type	Refrigerated?	Existing	Proposed	Savings		Costs	Payback
		Energy Consumption (kWh)	Energy Consumption (kWh)	Energy Savings (kWh)	Cost Savings (\$)	Total (\$)	Payback Period (Years)
Drink	Y	3,500	1,450	2,050	\$ 344.40	\$ 200	0.6
				2,050	\$ 344.40	\$ 200	0.6

Savings Calculator

Please replace the default values in the table below with your location's unique information and then click on the "calculate savings" button.

Energy Costs (\$0.000 per kWh)	\$0.085
Facility Occupied Hours per Week	50
Number of Cold Drink Vending Machines	1
Power Requirements of Cold Drink Machine (Watts; 400 typical)	400
VendingMiser Price	\$189.00

Calculate Savings!

Results of your location's projected savings with VendingMiser® installed:

COLD DRINK MACHINES	Current	Projected	Total Savings	% Savings
kWh	3494	1449	2045	59%
Cost of Operation	\$297.02	\$123.17	\$173.85	59%

Total Project Cost	Break Even (Months)
\$189	13.05

Estimated Five Year Savings on ALL Machines = **\$869.27**

Estimated Five Year Return on Investment = **360%**

Project #:

02255219.0000

Project Name:

Flexible Technical Analysis - Town of Saugerties

Engineer:

Scott Burger

ECM:

OM 1 - DWH Temperature Setpoint Reduction

Natural Gas Rate

\$

0.999 /CCF

								Savings		Costs	Payback
Unit	Estimated Annual Consumption	Estimated Existing Temperature Setpoint ¹	Proposed Temperature Setpoint ²	Temperature Reduction	Energy Savings of Temperature Setpoint Reduction ³	Proposed Energy Savings	Proposed Energy Consumption	Energy Savings	Cost Savings	Total	Payback Period
	(CCF)	(°F)	(°F)	(°F)	(%/10°F reduction)	(%)	(CCF)	(CCF)	(\$)	(\$)	(Years)
A.O. Smith GCV-50	60	120	100	20	3%	6%	56	4	\$ 3.60	\$ -	0.0

Notes:

1. The Estimated Existing Temperature Setpoint was assumed to be the typical recommended temperature setpoint for domestic water heaters by the United States Department of Energy (U.S. DOE)

2. The Proposed Temperature Setpoint (100°F) is the minimum temperature recommended for hand washing by the New York State food service industry, which was used as the basis for determining energy savings

3. The U.S. DOE estimates 3% annual fuel savings for every 10°F reduction in supply water temperature

Arcadis of New York, Inc.

855 Route 146

Suite 210

Clifton Park, New York 12065

Tel 518 250 7300

Fax 518 371 2757

www.arcadis.com

A decorative graphic consisting of three thin orange lines. One line is horizontal, extending from the left edge of the page towards the right. Two other lines are diagonal, starting from the bottom left and extending towards the top right, intersecting the horizontal line.