

BROOME COUNTY DETAILED ENERGY AUDIT

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PART I

Executive Summary

A. Study Results

Facility Improvement Measures Identified:

	Facility Improvement Measure																
	Upgrade Heating System in Maintenance Office	Install Tight Fitting OA Damper on Air Handling Unit #	Upgrade Pneumatic Actuators	Convert Pneumatic Controls to DDC	Building Envelope Weatherization Upgrades	Water Conservation	Install Walk in Freezer and Cooler Controllers	Lighting Upgrades	Install Demand Controlled Ventilation (DCV)	Upgrade Transformers	Plug Load Management	Ice Pit Improvements	Replace Absorption Chiller with an Efficient Chiller	Add Morning Warm-up to Heating Schedule	Replace Boiler in Hangar 2 with Condensing Boiler	Install High Efficiency Water Heaters	Convert Propane Equipment to Natural Gas
Broome County Office Building	X	X	X	X	X	X											
Public Safety Facility						X	X	X	X								
Veterans Memorial Arena						X				X	X						
Courthouse energy annex												X	X				
Transportation Garage						X											
Greater Binghamton Airport										X					X	X	X
Forum						X				X							
Library						X				X							
Harpursville Senior Center						X											
DPW Garage						X	X			X							

B. Background

The purpose of this Report is to provide recommendations to improve energy efficiency for Broome County New York. The summary and Facility Improvement Measures recommended are as a result of a detailed energy audit and interviews with the staff.

C. Summary of Building Baseline Energy Usage

The table below represents twelve months of utility information that was furnished by the facility staff.

Broome County Building ID	SF	Electric			Gas		Water		#2 Fuel Oil		Propane		kBTu/sf
		kWhr	kW	Cost	Therms	Cost	1000 gal	Cost	Gallons	Cost	Gallons	Cost	
Broome County Office Building	113,706	2,345,618	2,675	\$208,760	31,649	\$24,813	1,151.7	\$12,047	0	\$0	0	\$0	98.2
Public Safety Facility	247,962	2,800,146	6,815		193,580		12,334.8		0		0		116.6
Veterans Memorial Arena	120,899	2,633,108	7,612	\$244,879	83,810	\$59,254	2,490.2	\$26,047	0	\$0	0	\$0	143.6
Greater Binghamton Airport	139,250	1,940,530	2,500	\$168,826	0	\$0	224.1	\$2,245	50,000	\$145,700	30,358	\$57,134	117.3
Hangar 1	37,241	All usage and cost shown in Greater Binghamton Airport											
SRV	23,490												
Courthouse energy annex	161,149	2,044,745	3,089	\$167,669	153,079	\$113,891	1,213.1	\$7,736	0	\$0	0	\$0	138.3
George Harvey Justice Building	65,980	All usage and cost shown in Courthouse Energy Annex											
County Court House	43,169												
Court Annex	52,000												
Forum	23,845	146,700	399	\$11,883	27,507	\$19,447	542.6	\$5,675	0	\$0	0	\$0	136.3
Library	70,653	455,138	1,649	\$36,411	21,775	\$5,144	201.0	\$2,102	0	\$0	0	\$0	52.8
Johnson City Senior Center	9,026	100,000	370	\$8,000	11,000	\$7,777	70.3	\$352	0	\$0	0	\$0	159.7
Whitney Point Senior Center	6,604	73,704	348	\$6,095	0	\$0	35.5	\$300	0	\$0	6,531	\$9,209	128.8
Harpursville Senior Center	5,922	68,000	310	\$5,440	0	\$0	41.1	\$430	0	\$0	5,900	\$8,319	130.5
Intermodal Transportation Hub	14,810	212,560	0	\$17,005	17,567	\$12,420	187.5	\$1,961	0	\$0	0	\$0	167.6
Transportation Garage	45,268	338,791	880	\$23,715	41,684	\$29,471	98.3	\$807	0	\$0	0	\$0	117.6
DPW Garage	47,988	298,342	655	\$20,884	4,514	\$3,191	83.5	\$1,290	0	\$0	0	\$0	30.6

Notes:

1. Energy and water data was supplied by Broome County for the year of 2014.
2. kBTu/sf is based on total building square footage served by each electric, gas, fuel oil and propane account as applicable.

D. Study Objective

The objective of this study was to identify and analyze specific Facility Improvement Measures (FIMs) for the locations listed above. These FIMs would then be implemented in a Performance Contract.

PART II*Existing Conditions*

Broome County is located in the southern tier of New York State, has a population of approximately 200,000 people, an area of 706 square miles with 16 towns, 7 villages and 4 hamlets. The County buildings surveyed cover approximately 1.55 million square feet. A description of each building existing condition follows:

EDWIN L. CRAWFORD BROOME COUNTY OFFICE BUILDING**GENERAL**

The Broome County Edwin L. Crawford Office Building is a seven story structure that was constructed in the early 1970's located at 60 Hawley Street, Binghamton. The office is operated Monday through Friday, except.

UTILITIES

Electricity to the Edwin L. Crawford County Office Building (County Office Building) is supplied by Integrys and delivered by NYSEG, through one meter (Account No 1001-0376-399). During 2014, the facility consumed a total of 2,345,618 kWh with a maximum demand of 557.8 kW, which occurred in August 2014. During 2013, the facility consumed a total of 2,284,278 kWh with a maximum demand of 566.5 kW, which occurred in September 2013. The average blended electric rate for the facility during these periods was \$0.089 per kWh and \$0.088 per kWh respectively.

Natural Gas to the County Office Building is supplied by Direct Energy and delivered by NYSEG, through one meter (Account No 1001-0376-407). During 2014 and 2013, the facility consumed a total of 31,649 therms and 31,862 therms respectively. The average natural gas rate for the facility during these periods was \$0.78 per therm and 0.77 per therm respectively.

MECHANICAL SYSTEMS

Heating hot water (HHW) is supplied by three (3) natural gas fired PK Thermific hot water boilers (model # N1200) with nameplate data showing 1200 MBH maximum input capacity and 1020 MBH output capacity, a 240 MBH minimum input and an efficiency of 85%. Two large AHU's are located in the 7th floor penthouse. AHU # 1 supplies heated, cooled and ventilation air to the core of the building. AHU # 2 supplies heated or cooled air to the perimeter zones. The outside air damper on AHU # 1 is leaking by and allowing unregulated flow of outside air into the building when the air handler is operating and the damper is closed. Cooling is supplied by a chilled water system installed in 2015.

TEMPERATURE CONTROL

The building is controlled by a Johnson Controls Metasys DDC system with a Tridium interface. The County's Tridium system has remote capability for control, alarms, trending, etc. There are pneumatic operators for valves and dampers that are various ages in generally poor condition.

LIGHTING

Lighting is a mix of technologies, incandescent, HID, CFL's T8 fluorescents and HID fixtures for outside lighting. The 2x2 ceiling fixtures in the offices are also the return air diffusers. Lighting is scheduled on and off via programmable timers.

BROOME COUNTY PUBLIC SAFETY FACILITY

GENERAL

This building was opened in 1996. It houses the sheriffs' departments, the emergency 911 center and the correctional facility. It operates as a 536 bed facility. Overall, the facility is approximately 247,962 ft². The majority of this building is occupied continuously.

UTILITIES

Electricity to the Public Safety Facility is supplied by Integrys and delivered by NYSEG through one meter (Account number 1001-0659-166). During 2014, the facility consumed a total of 2,800,146 kWh with a maximum demand of 725.2 kW, which occurred in June 2014. During 2013, the facility consumed a total of 2,902,195 kWh with a maximum demand of 727.2 kW, which occurred in June 2013. The average blended electric rate for the facility during these periods was \$0.088 per kWh and \$0.086 per kWh respectively.

Natural Gas to the Public Safety Facility is supplied by Direct Energy and delivered by NYSEG through one account (Account number 1001-0015-765). During 2014 and 2013, the facility consumed a total of 193,580 therms and 215,724 therms respectively. The average natural gas rate for the facilities during these periods was \$0.69 per therm and 0.70 per therm respectively.

MECHANICAL SYSTEMS

Heating hot water (HHW) is supplied by five (5) natural gas fired PK Thermific hot water boilers (model # N1200) with nameplate data showing 1200 MBH maximum input capacity and 1020 MBH output capacity, a 240 MBH minimum input and an efficiency of 85%. These boilers are in good condition. Air handling units (AHU's) are located in each pod plus a unit for Admin. Cooling is supplied by a chilled water system with two (2) Trane chillers.

TEMPERATURE CONTROL

The building is controlled by Siemens Apogee/Insight DDC system. There is a temperature setback and scheduling system that is maintained in the DDC System.

LIGHTING

The existing interior lighting is a combination of T8, T12, CFL and incandescent with HID for outside lighting

BROOME COUNTY VETERAN'S MEMORIAL ARENA

GENERAL

The Floyd L. Maines Veterans Memorial Arena was constructed in 1973, and had skyboxes added in 2003. The Arena is the home of the Binghamton Senators an AHL hockey team that plays from October through April for 37 (home) games (2014/2015 season).

OCCUPANCY

The building is occupied 8 am to 4:30 pm M-F throughout the year with night and weekend hours depending on show/event schedules. During hockey season the Senators will practice during the day and occasionally ice time will be scheduled for local kids hockey or figure skating practice.

UTILITIES

Electricity to the Arena is supplied by Integrys and delivered by NYSEG, through one meter. During 2014, the facility consumed a total of 2,633,108 kWh with a maximum demand of 792.7 kW, which occurred in August 2014. During 2013, the facility consumed a total of 2,281,810 kWh with a maximum demand of 887.8 kW, which occurred in October of 2013. The average blended electric rate for the facility during these periods was \$0.093 per kWh and \$0.088 per kWh respectively.

Natural Gas to the County Office Building is supplied by Direct Energy and delivered by NYSEG, through one meter (Account No 1001-0376-407). During 2014 and 2013, the facility consumed a total of 80,901 therms and 70,6501 therms respectively. The average natural gas rate for the facility during these periods was \$0.784 per therm and 0.77 per therm respectively.

HEATING SYSTEM

Heating hot water (HHW) is supplied by three (3) natural gas fired PK Thermific hot water boilers (model # N2000-MFD) with nameplate data showing 2000 MBH maximum input capacity and 1700 MBH output capacity, a 400 MBH minimum input and an efficiency of 85%. The HHW is circulated by two (2) 15 HP pumps with VFD's and is supplied to AHU reheats, finned tube radiation, and cabinet unit heaters. Four (4) Ventrol 28,000 cfm RTU's (AC-14 through 17) supply the main Arena space with (gas fired) heating, (chilled water) cooling and ventilation. The concourse, lobbies, galleries (Arena Club, Arena Dining Rm, and Senators Office) are served by seven (7) Carrier model 508A AHU's also original to the building.

COOLING SYSTEM

Cooling is supplied by brined chilled water from two (2) Carrier 30HX chillers (model number 30HXC246RZU671TA, 248.8 tons capacity) for AC-14 thru 17 (arena RTU's). AC-14 through 17 chilled water is mixed via a 3 way valve to 40-50degF. AC-1, 2, 3, 4, 5, 12, 13 have DX systems cooled by condenser water. This requires the condenser water system to operate even if there is no call for chilled water by other systems.

TEMPERATURE CONTROL

The building is controlled by two Johnson Controls Metasys DDC systems. The first is an older system that controls operational status and shows alarms for the seven AHUs that serve the concourse, offices, and Arena Club, along with finned tube radiation and cabinet unit heaters. These systems do not have remote access and are not accessible through the Tridium system. The second Johnson system is newer and controls the four arena RTU's, the boiler plant, the chiller plant, and the skybox RTU. The County's Tridium system sits over the newer Johnson system which has remote capability for control, alarms, trending, etc.

LIGHTING

Lighting is a mix of technologies, there are LEDs in the Arena installed by the County, incandescent, HID, CFL's and fluorescents on the concourse, linear fluorescents in offices, bathrooms and stairwells and HID fixtures for outside lighting. Exit lighting has been cited by Codes as being inadequate.

Outside lighting for the marquis is LED installed in 2003.

MISCELLANEOUS

A snow melt system is in use for the ice pit. The Zamboni dumps ice shavings onto a concrete slab and pit heated with boiler water to facilitate melting. Nyla-braid tubing is wrapped around the perimeter of the pit and under the slab and is supplied from a brass manifold and a 1/25 HP Taco circulator pump mounted on the wall above the pit.

Fogging occasionally occurs on the ice rink in the fall and spring due to the current inability of the RTU's to dehumidify.

The Arena has the capability to cover the ice rink with insulated material for alternative events during hockey season such as concerts.

BROOME COUNTY COURT COMPLEX

GENERAL

The Broome County Court complex is made up of three separate buildings. The buildings range in age with the old court building dating back to 1898. However, most of the mechanical systems have been upgraded over the last twenty years. The square footage of the three buildings is approximately 161,149 ft².

OCCUPANCY

The building is occupied 8 am to 5:00 pm M-F throughout the year.

UTILITIES

Electricity to the Court Complex is supplied by Integrys and delivered by NYSEG, through one meter (Account number 1001-0376-480). During 2014, the facility consumed a total of 2,044,745 kWh with a maximum demand of 429.3 kW, which occurred in June 2014. During 2013, the facility consumed a total of 2,044,245 kWh with a maximum demand of 502.0 kW, which occurred in July 2013. The average blended electric rate for the facilities during these periods was \$0.082 per kWh and \$0.084 per kWh respectively.

Natural Gas to the Court Complex is supplied by Direct Energy and delivered by NYSEG, through three different meters. (Account numbers 1001-0376-498, 1001-0376-464, 1001-0376-472). Account 1001-0376-464 is the primary heating usage, account 1001-0376-472 is the primary cooling usage (Absorption Chiller) and account 1001-0376-498 is miscellaneous usage. During 2014 and 2013, the facility consumed a total of 138,486 therms and 153,079 therms respectively. The average natural gas rate for the facilities during these periods was \$0.76 per therm and 0.74 per therm respectively.

HEATING SYSTEM

One boiler plant serves the entire Court Complex. The plant has four non-condensing 1,900 MBH input P-K Thermific gas fired vertical water tube hot water boilers (Model # N-1900) that provide heating hot water to the building. Trending from the building management system indicated the boiler outside air lockout temperature to be set at 95°F. This is because one boiler is used in the summer for reheats. The design thermal efficiency for this type of boiler was 85% when new. For our calculations we have assumed that the boiler plant efficiency has reduced by approximately 10% over the years. This is due to corrosion and scaling which lowers the rate of heat transfer. The boilers operate through the heating season. Additionally, they operate during the cooling season to provide reheat to the spaces.

COOLING SYSTEM

The Court Complex has two 230 Ton Carrier direct-fired, double effect, hermetic absorption liquid chillers (Model # 16DF-028-90498) which provide chilled water to the buildings in the complex. The chillers, original to 1999, are nearing the end of their useful lives and parts are not readily available. Reportedly, one of the chillers is sufficient to meet the cooling loads for most of the time and the second chiller is operated when the ambient temperature exceeds 90°F.

LIGHTING

Lighting is a mix of technologies, incandescent, HID, CFL's and fluorescents are in use throughout; linear fluorescents in offices (some T5 in the Harvey Justice Bldg, T8 in the Family Court Bldg.), bathrooms and stairwells and HID fixtures for outside lighting. The old Courthouse has some T12 fluorescent lighting.

BROOME COUNTY TRANSIT GARAGE

GENERAL

The building was constructed in 1983 and is comprised of one floors plus a mezzanine. There are three main areas, the bus storage bay, the bus repair bay and the administration area. The boilers are located in the mezzanine mechanical room along with two (2) air handling units (AHU's) which supply the admin area and the offices, break room, and locker room adjoining the bus repair bay.

OCCUPANCY

The building is generally occupied year round from 4:30 am until 11:00 pm by both administration personnel and drivers.

UTILITIES

The facility purchases commodity natural gas from Direct Energy, which is delivered by NYSEG. The majority of the natural gas is used in the boilers and direct fired Cambridge Air Units used to ventilate and heat the storage and repair areas. Electric commodity is supplied by Integrys with delivery by NYSEG. All utilities are purchased through Broome County.

HEATING SYSTEM

Heating hot water (HHW) is supplied by two (2) boilers; one (1) Patterson Kelly Modufire with 1000 MBH capacity (model # SNM-1000) installed in 2005 and one (1) Weil Mclain Ultra (condensing model # Ultra 750) with 750 MBH capacity installed in 2012. The HHW is supplied to finned tube radiation and the hot water coils of two AHU's (located on the mezzanine). There are two new gas fired (2013) Cambridge M series make up air units which supply heating to the bus storage and maintenance areas. The units are 100% outside air. There one set of two pumps that circulate HHW throughout the heating system, each is a 3 HP B&G close coupled pump.

HEATING DISTRIBUTION SYSTEMS

Two (2) original Carrier AHU's supply ventilation heating to the admin area and to the offices adjoining the bus maintenance bay. The larger unit (6000 CFM) for the admin area AHU supplies constant volume air boxes in the ceilings, there is a VFD on this unit controlled by temperature, DDC dampers and a reheat located in the ductwork just downstream of the unit. The smaller maintenance area AHU (approximately 3000 CFM) also supplies constant volume air boxes in the ceilings of the maintenance offices.

COOLING SYSTEM

The admin area is cooled via a DX coil in the admin AHU, the condenser is located on the roof outside the mezzanine mechanical room, it is a Rheem model # RAW-092DAZ with 7.5 tons of cooling at 11.2 EER. There is also a small Trane RTU supplying the manager's office in the maintenance area that has DX cooling estimated to be 1.5 tons (nameplate not visible due to age).

TEMPERATURE CONTROL

The building is controlled mostly by a Trane Tracer DDC system connected to the County Tridium interface.

LIGHTING

There are T8's in the admin area, the bus maintenance area, and bus maintenance offices. The bus storage area has ceiling hung HID's except for one row of LED's that building personnel have installed using their own upgrade program. There are no occupancy sensors used inside the building.

Outside lighting is HID with the exception of a few LED's that building personnel have installed to replace older failed fixtures. Outside lighting is on timers.

GREATER BINGHAMTON AIRPORT

GENERAL

The airport has been in service since the early fifties and had a major upgrade in 1999. Currently it is made up of a number of structures which includes the Main Terminal, Hangars 1, 2 and 3, Crash and Fire Rescue (CFR) building, and the truck maintenance building (SRV). Utilities are separated by end user. The buildings that make up the airport are approximately 139,250 ft².

UTILITIES

Electricity to the Airport is supplied by Integrys and delivered by NYSEG, through multiple meters. During 2014, the facility consumed a total of 1,940,530 kWh with a maximum demand of 459.9.8 kW, which occurred in May 2014. During 2013, the facility consumed a total of 1,946,364 kWh with a maximum demand of 450.5 kW, which occurred in June 2013. Due to the absence of electric supply data, a total blended electric rate of \$0.087/kWh has been assumed. # 2 Fuel Oil is supplied and delivered by a local supplier and is used for heating and domestic hot water at the terminal building of the airport. During the period from 01/28/2014 to 01/26/2015, a total of 50,000 gallons were delivered to the facility. The average # 2 fuel oil rate for the facility during this period was \$2.74 per gallon. Propane is supplied and delivered by a local supplier and is used for heating and domestic hot water at the hangars, CFR and SRV buildings of the airport. During the period from 01/02/2014 to 01/03/2015, a total of 30,358 gallons were delivered to the facility. The average propane rate for the facilities during this period was \$1.88 per gallon.

HEATING SYSTEM

Heating and cooling are supplied by various systems located in their respective buildings. The terminal building uses heating hot water supplied by two (2) oil fired boilers and is cooled with a water cooled Train chiller.

LIGHTING

There are T8, T5, T12 incandescent and CFL technologies throughout the Airport buildings. Some LED has been retrofitted in one of the hangars.

Outside lighting is HID with the exception of a few LED's that building personnel have installed to replace older failed fixtures. Outside lighting is on timers.

BROOME COUNTY FORUM

GENERAL

The building was constructed in 1919, with renovations in 1946, 1960 and 2011 and additions in 1975 (dressing rooms) and 1981 (lobby and recital hall), the 2011 renovation included seat replacement. The Forum is used as a theater and is comprised of one floor for the stage and main seating area, a balcony seating area, entrance and common areas, a loading dock/backstage and a basement. The boilers are located in the basement mechanical room along with the domestic water heater. There are four (4) new roof top units (RTU's) that supply heating, cooling and ventilation to the building.

OCCUPANCY

The building is lightly occupied 8 am to 4:30 pm M-F throughout the year with night and weekend hours depending on show/event schedules.

UTILITIES

The facility purchases commodity natural gas from Direct Energy, which is delivered by NYSEG. The majority of the natural gas is used in the boiler with the rest being used by the domestic water heater. Electric commodity is supplied by Integrys with delivery by NYSEG. All utilities are purchased through Broome County.

HEATING SYSTEM

Heating hot water (HHW) is supplied by two (2) natural gas fired Weil McLain sectional hot water boilers (model # PMGB-9) with nameplate data showing 1360 MBH maximum input capacity and 1088 MBH output capacity, a 350 MBH minimum input and an efficiency of 80%. These boilers appear to be 35+ years old and are in poor condition. The HHW is circulated by two (2) Goulds close coupled, 2 HP pumps and is supplied to finned tube radiation, cabinet unit heaters and the hot water coils of four RTU's.

HEATING DISTRIBUTION SYSTEMS

Four (4) RTU's supply the following main areas with heating and ventilation; the stage, seating, dressing rooms and the ticket/entrance/café/concession areas. Three of these RTU's were installed in 2005-6, one was installed 30-45 years ago and has a wood structure. All are on the Tridium EMS.

COOLING SYSTEM

The four RTU's used for heating also have DX cooling for all the same areas.

TEMPERATURE CONTROL

The building is controlled by a Johnson DDC system with the Tridium system atop for the County interface. The four RTU's are scheduled for operation during normal occupancy with additional schedules for event and shows. There is a temperature setback and scheduling system that is maintained in the DDC System.

DOMESTIC HOT WATER

The building is served by an AO Smith MasterFit hot water heater with 70 gallons of storage. This hot water heaters is natural gas fired and is rated at 300 MBH input.

LIGHTING

Lighting is a mix of technologies, there are incandescent in the dressing rooms, seating/stage areas, chandeliers (and pendants) and exit lights, T8 fixtures in the dressing room common areas, T12's in the basement. There are also HID high bay fixtures in the loading dock area. There are no occupancy sensors used inside the building. Outside lighting for the marquis is incandescent. There is also a battery back-up system for exit lights, some house lights and emergency fixtures

BROOME COUNTY LIBRARY

GENERAL

The Broome County Library was constructed in 2000. The Library is approximately 70,600 square feet with two floors and a brick and block construction. There are 2 floors of books with table, study carrolls, meeting rooms and storage.

OCCUPANCY

The building is occupied 9 am to 8 pm M-Th, and 9 am to 5 pm Fri-Sat throughout the year. Occupancy level varies with library patrons and events.

UTILITIES

Electricity to the Library is supplied by Integrys and delivered by NYSEG, through one meter (acct. # 1001-0437-472). During 2014, the facility consumed a total of 455,138 kWhr with a maximum demand of 208.1 kW, which occurred in July. During 2013, the facility consumed a total of 501,498 kWhr with a maximum demand of 209.7 kW, which occurred in July. The average blended electric rate for the facility during these periods was \$0.087per kWh and \$0.088 per kWh respectively.

Natural Gas to the Library is supplied by Direct Energy and delivered by NYSEG, through one meter (Account No 1001-0437-480). During 2014 and 2013, the facility consumed a total of 16,143herms and 16,822 therms respectively. The average natural gas rate for the facility during these periods was \$0.84 per therm and 0.86 per therm respectively.

HEATING SYSTEM

Heating hot water (HHW) is supplied by one Weil-McLain natural gas fired hot water boilers (model # LGB-6) original to the building. It has nameplate data showing 650 MBH maximum input capacity and 526.5 MBH output capacity, and an efficiency of 84%. This boiler is in good condition. The HHW is circulated by two (2) 3 HP pumps and is supplied to AHU reheats, finned tube radiation, and cabinet unit heaters.

HEATING AND COOLING VENTILATION SYSTEMS

Fourteen roof top units (RTUs) supply ventilation air to all spaces in the library. These RTUs are operated by the EMS on a temperature control basis only, that is when temperature in a given space is satisfied the associated RTU shuts off and does not come back on until temperature goes out of setpoint +/- 2degF. Cooling is supplied by DX coils in the RTUs shown above. All RTUs have dual scroll compressors.

TEMPERATURE CONTROL

The building is controlled by an Transformativewave Catalyst EMS with wireless networking back to the central Tridium control system in the Court Annex/maintenance shop. Temperatures in all areas are controlled by cycling the associated RTU on and off by temperature setpoint. There is an economizer control in use and a temperature setback and scheduling system that is maintained in the DDC System.

LIGHTING

Lighting is a mix of technologies, there are incandescent, HID, CFL's and fluorescents in the building. Direct/indirect linear fluorescent pendant fixtures make up most of the lighting in the common areas but there are linear fluorescents in both troffers and sconces too (in lesser numbers). Linear fluorescent troffers make up most of the fixtures in offices, bathrooms and stairwells. There are HID fixtures for outside lighting, exit lighting is LED. Outdoor lighting is controlled by timers, indoor lighting has some occupancy sensors but most is controlled by switches.

BROOME COUNTY SENIOR CENTER-HARPERSVILLE

GENERAL

The community center is a one floor, 6,161 square foot, building consisting of various common areas for seniors. This includes a dining area, game room, exercise room, and library. There are two boiler rooms, one is located in a furnace room only accessible from an exterior door located on the south wall and the second is located in a storage room on the north corner of the main dining area.

OCCUPANCY

The building is generally occupied throughout the year 9am – 2:30pm, Monday through Friday. It is occasionally occupied on week nights until 7pm and on some weekends.

UTILITIES

Electricity to the Easter Broome Senior Center is supplied by Integrys and delivered by NYSEG, through two meters. During 2014, the facility consumed a total of 40,506 kWhr with a maximum demand of 19.22 kW, which occurred in December 2014. The average blended electric rate for the facility during this period was \$0.116 per kWh. The building also uses propane in the heating furnaces, kitchen, and domestic water heater. Propane is purchased from Mirabito and billing data was incomplete but building personnel report using 5,900 gallons of propane for 2014.

HEATING SYSTEM

The building is heated by two natural gas fired Ducane Condensing Furnaces installed in 1997. Both are rated for 125 MBH. Each is connected to its own duct work that supplies heat to various spaces in the Community Center. The boiler room is maintained at 55 degrees with a ceiling mounted Dayton electric radiator.

HEATING DISTRIBUTION SYSTEMS

The furnaces supply heated air to all spaces in the Community center with separate duct work connected to each furnace. The furnace in the outside room serves the kitchen and community room, and the other serves the front rooms including the offices and library space.

COOLING SYSTEM

Each furnace unit has remote condensing unit with evaporator coils in the furnace ductwork.

TEMPERATURE CONTROL

The Community Center is controlled by two White-Rodgers thermostats. Thermostat one is located in the dining area and the second thermostat is located in the library/computer room. Below is a matrix representing the temperature schedules of each thermostat.

DOMESTIC HOT WATER

Domestic hot water in the Community Center is generated by one Bradford-White Model D75T1603X heater installed in 1998. It is fitted with an old inefficient atmospheric burner. The unit is located in the Community Center outside boiler room. The domestic hot water is circulated between the tank and the heater to maintain 140°F water temperature.

KITCHEN

The kitchen staff prepares one meal a day, 5 days a week. Occasionally, a second meal is prepared during the evenings and on weekends.

BROOME COUNTY DEPARTMENT OF PUBLIC WORKS HIGHWAY GARAGE

GENERAL

The Department of Public Works-Highway Division consists of three main buildings that contain high-bay garage and work spaces, offices, and some common areas for workers. The square footage across all buildings is 44,500 sf.

OCCUPANCY

The buildings are generally occupied throughout the year during business hours starting at 5am, Monday through Friday. It also runs a 2nd shift until midnight occasionally open nights depending on significant weather in the Broome County area.

UTILITIES

Electricity to the DPW is supplied by Integrys and delivered by NYSEG, through two meters. During 2014, the facility consumed a total of 296,102 kWh with a maximum demand of 81.6 kW, which occurred in March 2014. The average blended electric rate for the facility during this period was \$0.0845 per kWh.

Natural gas is supplied by Direct Energy and delivered by NYSEG through 3 meters. The facility used 38,156 therms of natural gas at an average rate of \$0.73 per therm.

HEATING SYSTEM

The Main Building is supplies heat to the front offices with an RTU, and supplies heat to the break room and locker room with a carrier furnace. The Garage space is heated with infrared heating. The Mechanical Building supplies heat to the parts room with two Carrier furnaces. The front offices are supplied heat with a gas fired RTU unit. There are four AAHX units in the mechanical garage that are not turned on. There are also four total RTU units on the Mechanical Building; three were noted to not be running because they could not find parts for them. The mechanical garage and welding garage are both heated with infrared heating as well. The Post Plant building is heated with infrared heaters.

COOLING SYSTEM

Cooling is supplied from the DX coils in the AHUs and the split condensing units in the carrier furnaces.

AIR-HANDLING UNITS

There is one RTU that supplies the offices in the main building. In the Mechanical building there is one RTU that serves the office space, as well as three other RTU units that are not currently running.

TEMPERATURE CONTROL

The DPW is controlled entirely by a JCI DDC System, which is tied into a frontend system that operates all of the Broome County Municipal buildings. The table below shows the stat temperature set points.

DOMESTIC HOT WATER

Domestic hot water in the buildings is generated by 4 separate domestic hot water heaters. The table below displays information on each.

PART III*Facility Improvement Measures***HEATING AND BOILER IMPROVEMENTS****HEATING IMPROVEMENTS FOR THE COUNTY OFFICE BUILDING MAINTENANCE SHOP****Existing Condition**

The maintenance area in the basement level of this building was added to the building heating system by adding piping and coils in this area. The pumps were not originally sized for this additional load. These house pumps currently operate at higher speed than required, causing slight overheating in the remainder of the building, while not meeting the heating load of maintenance area. As a fix, the county has installed a large electric resistance heater (15 kW) to improve the comfort in this maintenance area. The hot water pumps in the office building are currently set to operate at no lower than 60% speed. Despite operating the hot water pumps at 60% speed, the comfort conditions in the maintenance area can only be maintained by adding additional heat to the space with a large electric resistance heater.

Recommendation

This space can be improved by adding booster pumps that are dedicated to this space. Other options include installing a small natural gas boiler or a variable refrigerant style heat pump system.

Electric Resistance Heat Savings-Despite operating the hot water pumps at minimum 60% speed, the comfort conditions in the maintenance office in the office building can only be maintained by heating the space with electric resistance heat. Upgrading the heating system in this space would help in avoiding the use of the electric resistance heat and thus save energy.

Pump Energy Savings-The hot water pumps in the office building are currently locked to operate at minimum 60% speed. Upgrading the heating system in the maintenance office would allow for the house hot water pumps to be operated at minimum 40% speed instead of the 60% speed. As per the affinity laws, the motor horsepower varies as the cube of speed. Operating the hot water pumps at a lower speed would thus result in energy savings.

PROPANE TO NATURAL GAS CONVERSION FOR AIRPORT BUILDINGS**Existing Condition**

The CFR building has a non-condensing 225 MBH input De Dietrich propane fired hot water boiler (Model # DTG 120 Eco NOx) that provides heating hot water to the building. Data from the building management system indicated that the boiler outside air lockout temperature was set at 60°F. The boiler operates throughout the heating season. The CFR building has a 40 gallon A.O. Smith propane fired water heater that provides domestic hot water. Hangar 1 has a 450 MBH input P-K Mach propane fired condensing boiler (Model # C450) that provides heating hot water to the building. The boiler was installed in 2005. Data from the building management system indicated that the boiler outside air lockout temperature was set at 80°F, since it is used to heat domestic hot water for the building. Hangar 1 has a 36 gallon Weil McLain indirect fired hot water heater (Model Gold Plus 40) that provides domestic hot water from the P-K Mach boiler.

Recommendation

It is recommended that the propane fired equipment be operated on natural gas to obtain cost savings.

DOMESTIC WATER HEATERS REPLACEMENT FOR AIRPORT TERMINAL BUILDING

Existing Condition

The terminal building has a 119 MBH input 70 gallon Bradford White Corporation # 2 fuel oil fired water heater (Model # CF-70-3) that provides domestic hot water.

Recommendation

It is recommended that the existing water heater be replaced with appropriately sized natural gas fired condensing storage water heaters. The scenarios of operating the proposed condensing storage water heaters on both propane and natural gas have been evaluated.

COOLING AND CHILLER IMPROVEMENTS

Existing Condition

The Court Complex uses 2 natural gas fired absorption chillers to provide cooling (chilled water) to all three buildings. The older absorption chillers have lower efficiencies when compared to modern high efficiency mechanical chillers. They are harder to operate and can require specialty parts that are more expensive to purchase.

Recommendation

To improve the economics, it is recommended that one of the existing absorption chillers be replaced with a new high efficiency Carrier 23XRV Screw Chiller. It is recommended that the project be carried out in the following phases.

Phase #1 (reclamation of the Carrier 16DF Absorber #1, parts for future use on Chiller #2)

- Remove all the solution and refrigerant from the chiller into qualified drums.
- Disconnect and remove both the refrigerant and solution complete pump assemblies from the chiller.
- Prepare the pump assemblies (per manufacture recommendations) for long storage.
- Disconnect, remove and store the complete disconnect and control panel.
- Disconnect, remove and store the complete burner and controller.
- Disconnect, remove and store the complete vacuum pump system.
- All above work should be performed by a factory trained 16DF mechanic for proper care and storage of the parts.

Phase #2 (the removal of Chiller #1)

- Disconnect all the piping from the chiller to the building system piping.
- Disconnect and remove the gas piping from the chiller (include cutting and capping the gas at the main.)
- Disassemble the chiller into two sections.
- Cut and remove the 6" gas main in front of the stairs for the removal of the chiller. (Include the reinstallation of the gas main with new flanges)
- Remove the entire door assembly for chiller removal and replacement. (include a temporary secured door during construction)
- Remove and discard the chiller.

Phase #3 (providing and installing a new Carrier 23XRV Chiller)

- Provide a new Carrier 23XRV Chiller.
- Rig into place the new chiller.
- Re-pipe the chilled water and condenser water connections.
- Provide and install all new fiberglass insulation on the new chilled water lines.
- Provide and install new Grundfos inline secondary chilled water pump with circuit setter.
- Provide and install a new 500 Amp, 480 Volt circuit breaker along with all the new conduit and wiring to the new chillers VFD.
- Provide and install the new wiring to the chilled water pump.
- Install and program the new chiller to the existing BMS system.
- Provide factory start up and inspect the chiller operation.

FIM-3 BUILDING AUTOMATION AND CONTROLS**INSTALL OUTSIDE AIR DAMPER ON AHU-1 IN COUNTY OFFICE BUILDING****Existing Condition**

Two air handling units supply air to the entire facility to maintain comfort conditions. AHU # 1 supplies heated, cooled and ventilation air to the core of the building. AHU # 2 supplies heated or cooled air to the perimeter zones. The outside air damper on AHU # 1 is leaking by and allowing unregulated flow of outside air into the building when the air handler is operating and the damper is closed.

Recommendation

Install a tight fitting outside air damper to limit the infiltration of outside air during heating season. The outside air damper is approximately 13' x 5'.

UPGRADE PNEUMATIC ACTUATORS IN SUPPLY AIR DISTRIBUTION SYSTEM IN COUNTY OFFICE BUILDING**Existing Condition**

The old pneumatic actuators that serve the supply air distribution system on each floor are failing. This causes overheating of areas in the winter. Upgrading these pneumatic actuators would allow for a more precise temperature control and avoid the energy loss through overheated spaces. Replacement parts are no longer available and these units should be replaced.

Recommendation

Upgrade the existing old pneumatic actuators with new electronic units and integrate into the existing Building Management System (BMS).

CONVERT PNEUMATIC CONTROLS TO DDC IN COUNTY OFFICE BUILDING**Concept**

During the seventies and through the nineties temperature control was accomplished with pneumatic systems or simple standalone thermostats in most commercial buildings including the County Office Building. Now Direct Digital Controls (DDC) is the system of choice for these types of buildings. Digital controls are more accurate at temperature measurements and control than existing pneumatic systems. Using DDC, it is possible to develop historical records on the operating characteristics of a building to identify trends which can lead to better performance. The DDC system also allows for alarm management in the event of a mechanical system malfunction. DDC systems save time by eliminating the need to change various time clocks for holidays and schedule changes. Pneumatic controllers tend to drift out of calibration and suffer from "offset", requiring more calibration and maintenance to control sensors. True Digital Controls are electrically operated so there is no compressed air system to maintain. DDC can be web based so troubleshooting can be done remotely before going on site.

Existing Condition

The office building is currently controlled using a combination of pneumatic controls and direct digital controls.

Recommendation

Convert the existing old pneumatic controls to direct digital to improve temperature control avoid overheating and wasted energy.

INSTALL DEMAND CONTROLLED VENTILATION ON PUBLIC SAFETY BUILDING AHU-1

Existing Condition

AHU-1 serves the administration wing of the Public Safety Building.

Recommendation

Siemens will implement demand controlled ventilation strategy on AHU-1 in the Public Safety Facility. The amount of ventilation air will be controlled by measuring carbon dioxide levels (CO₂). There will be CO₂ sensors installed in the return air ductwork in the AHU and several spaces. The monitored CO₂ level will control outside air dampers and supply/return fan speeds to only supply enough outside air to meet occupancy levels.

ARENA ICE PIT IMPROVEMENTS

Existing Condition

The Arena ice pit has a boiler water heating coil in the concrete pad and another in the ice pit itself. The boiler water heats the pad and pit to accelerate snow melting operations during hockey games and ice maintenance. The circulation pump is started in the spring and runs throughout the season.

Recommendation

Siemens will install controls to only operate the pump when the ice pit is between the temperatures of 40degF and 80degF. A pump and sprinkler system will be installed to use pit sump water to further accelerate snow melt and allow the boiler water circulating pump to shut off as soon as possible.

ADD MORNING WARM-UP TO HEATING SCHEDULE OF THE COURT COMPLEX

Existing Condition

The occupancy schedules of the air handling units at the court buildings indicate that the status of the air handling units is switched to "occupied" several hours before the actual occupancy of the space. This ensures the setpoint conditions have been achieved by the time actual occupancy occurs. However, it was observed that a constant flow of outside air was being supplied during morning warm up. In order to bring the spaces to desired occupancy setpoints, the outside air supplied during the unoccupied period has to be heated. The following occupancy schedules were obtained from the BMS.

New Court (Court Annex)

Recommendation

It is recommended to program the Building Management System (BMS) to avoid bringing in outside air during morning warm-up.

LIGHTING IMPROVEMENTS IN THE PUBLIC SAFETY BUILDING AND THE DPW HIGHWAY BUILDING

Existing Condition

Currently the PSF and DPW Highway Buildings are lit with T8, T12, incandescent and CFL technologies.

Recommendation

Siemens will upgrade lighting to LED lamps or fixtures depending on application. A summary is shown only for reference in Tables below:

Public Safety Building

Existing Fixture Summary	
Fixture Desc.	Count
F42LL	1629
F44LL	54
F43LL	476
F41LL	48
CFQ13/2	269
I50/1	15
I65/1	2
F22LL	3
MH70/1	40
F22SS	1
MH400/1	34
I75/1	35
MH175/1	7
F21LL	2
F48SHS	12
I100/1	8
F46SHS	6
F42ILL	10
MH150/1	32
MH250/1	20
MH400/2	12
Total	2715

Post Construction Fixture Summary	
Fixture Desc.	Count
ALED-12	3098
LED031	489
LED037	257
LED033	13
0	87
ALED-8.5	7
NO ACTION	205
LED025	40
LED020	1
LED160	16
ALED-9.5	35
LED038	2
LED013	2
LED134	49
LED036	6
LED240	12
LED0120	6
LED035	10
LED070	32
LED093	20
Total	4387

Department of Public Works Highway Garage

Existing Fixture Summary	
Fixture Desc.	Count
F43EE	17
F42EE	91
F44EE	40
FU2EE	3
CFQ42/1	93
MH50/1	23
F41LL	3
F42LL	42
CFQ26/1	9
F44LL	2
MH100/1	49
I100/1	2
F43LL	6
MH400/1	23
MH250/1	36
F46ILL/2	1
MH150/1	6
Total	446

Post Construction Fixture Summary	
Fixture Desc.	Count
LED037.5	8
LED036	15
LED025	76
LED038	24
LED020	3
LED050	18
ALED-13	93
LED031	35
ALED-12	87
ALED-9.5	11
LED042	11
LED0134	23
LED093	20
LED0120	1
LED046	6
LED043	43
Total	474

WATER CONSERVATION

Existing Condition

Currently the County buildings have water fixtures of various ages from projects completed in the past 20 years.

Recommendation

Siemens will install the following water conservation components:

- Toilet Flushometers
 - New Valve X-Body: Remove and replace flushometer valve assembly where specified
 - Spud Replacement: SIEMENS will remove and replace the fixture spud
 - Flushtube Replacement: SIEMENS will remove/replace the flushometer tube assembly where specified
 - Control stop adapters will be replaced where specified
 - Automatic flush controls will be replaced where specified
 - Flushometers will be re-commissioned to flow at the required rate for the toilet fixture

Tank toilets

- System tuning to optimize flush performance where specified
- Retrofit upgrade will be performed where specified
- Angle stop valves will be installed where specified
- Sinks; Vandal-Resistant Flow Control
 - Sink flow control device with appropriate flow rate and pattern. Include appropriate adapter (if necessary) to ensure uniformity across the affected buildings.
 - Hands free sink controls will be installed where specified
- Showers
 - Low flow shower heads installed where specified
- Kitchen sprayers
 - Low flow sprayer heads will be installed
- Counts and locations specified are shown in Table 1.2.1.5

Building or Meter	Flushometers Recommissioning						Tank Toilets			Sinks		Showers		
	Valve Recommissioning	New Valve X-Body	Spud Replacement	Flushtube Replacement	Control Stop Adapt/Replace	Handle-Mount Hands-Free	System Tuning	Retrofit Upgrade	Angle Stop "Adder Valve"	Vandal-Resistant Flow Ctrl	Hands-Free Sink Faucet	Wall Showerhead	Handheld Showerhead	
Broome County Office Building		42	23	23						39				
Broome County Veterans Memorial Arena		117	61	61						82		27		
Broome County Forum Performing Arts Theater (Forum)		24	13	13				11	1	26				
Broome County Public Library		12	9	9						13				
Public Safety Facility	433	57	42	42						95	8	12	2	2
Highway Department		10	10	10			1	1		6				
Eastern Broome Senior Center (Harpursville)		1	1	1				3		4				
Bus Garage/ Transportation Center		9	5	5						7				

Siemens will install the following additional equipment at the Public Safety Facility:

- Electronic flush controls on inmate toilets
 - Flush controls will allow two (2) flushes within a five (5) minute period
 - There is a random 2-58 second delay between pushing the flush button and the actuation of the flush
 - A third flush attempt within the five (5) minute time frame disables the ability to flush for one (1) hour
 - A switch will be installed in the power supply to the flush control allowing safety officers to shut off power to the toilet controls which disables the ability to flush the toilet
 - This allows inspections without flushing of contraband
 - Shutting off power also resets the 5 minutes flush window and the 1 hour delay
- Electronic flow controls on inmate showers
 - A touch sensitive button will be installed on the shower side of the wall
 - Existing flow controls will be removed and new electronic controls installed in the chase
 - Touching the shower control button will activate the shower for two (2) minutes
 - Multiple two (2) minute shower periods are allowed
 - A switch will be installed in the power supply to the shower control allowing safety officers to shut off power which will shut off the shower
- Laundry ozone controls
 - SIEMENS will install an ozone supply system for the PSF laundry
 - This system will pipe ozone to the laundry washer tubs
 - Washer controls will be modified to use lower amounts of domestic hot water
 - An ozone sensor will be installed in the laundry space
 - The sensor will shut off flow of ozone if detected

TRANSFORMER UPGRADES AT THE PUBLIC SAFETY BUILDING**Existing Condition**

The Public Safety Building has standard efficiency transformers.

Recommendation

Siemens will replace select transformers at the Public Safety Facility. The new transformers will be high efficiency and meet NEMA premium efficiency requirement for their respective sizes. Table 1.2.1.6 below shows transformer kVA, locations and tag numbers for identification.

Table 1.2.1.6

Tag Number	Building Name	Location ID or Room #	Transformer Designation	Existing kVA	Replacement kVA	Replace
33216	Public Safety Bldg	101	T1	150	150	1
33217	Public Safety Bldg	JU103	T3	45	45	1
33218	Public Safety Bldg	JU102	T2	75	75	1
33219	Public Safety Bldg	JU104	T4	30	30	1
33220	Public Safety Bldg	JU105	T5	30	30	1
33221	Public Safety Bldg	JU106	T6	45	45	1
33222	Public Safety Bldg	JU107	T7	45	45	1
33223	Public Safety Bldg	JU108	T8	30	30	1
33224	Public Safety Bldg	JU109	T13	225	225	1
33225	Public Safety Bldg	JU109	T9	150	150	1
33226	Public Safety Bldg	Main Electric Room	T10	150	150	1

FIM-9 BUILDING ENVELOPE WEATHERIZATION UPGRADES

Existing Condition

The County Office Building has envelope issues that cause occupant comfort issues.

Recommendation

Siemens will install new door weather stripping on man-doors and overhead doors, clean and seal exhaust fan penetrations, seal roof wall interface, add insulation to walls and ceilings, seal and insulate soffits above entries, and install rigid foam board in County Office Building wall air returns. Table 1.2.1.7 shows specific work at each building below.

Table 1.2.1.7

Building	Measure description			
	Single entry doors to be weather stripped	Double entry doors to be weather stripped	Overhead/roll up doors to be weather stripped	Exhaust fans to be sealed/cleaned
Broome County Office Building	3	2	1	4

Notes:

Additionally, at the County Office Building, the diffuser panels on the perimeter will be removed and rigid foam board insulation installed along the angled outside panel. Spray foam insulation will be used to seal and hold the foam board in place and diffuser panels reinstalled. This will be done on all areas where the perimeter air supply/return is below the windows.

PLUG LOAD MANAGEMENT

Existing Condition

County buildings have many plug loads and no way of controlling or scheduling them.

Recommendation

Siemens will install plug load control devices (BERTs) at the County Buildings to reduce unoccupied and parasitic electric loads. The BERT system will connect to the buildings wireless network and be controlled by a user accessible scheduler. Schedules will be setup by Siemens with County personnel input.

Building	Projector\Smartboard		Large Copier		Printer\Monitor Combo		PC Lab Monitors (3 per Bert)		Medium Printer		Soda Machine		Snack Machine		LCD\CRT TV		Water Cooler		Hot Cold Dispensor		Comercial Coffee Maker		Sm Refridg in Suites		Totals	
	# Berts	# Devices	# Berts	# Devices	# Berts	# Devices	# Berts	# Devices	# Berts	# Devices	# Berts	# Devices	# Berts	# Devices	# Berts	# Devices	# Berts	# Devices	# Berts	# Devices	# Berts	# Devices	# Berts	# Devices	# Berts	# Devices
Arena			4	4	2	4			6	6	2	2			6	6			4	4			8	8	32	34
Forum			1	1	1	2			1	1	1	1							1	1					5	6
Library	2	2	5	5	3	6			4	4	1	1	1	1	1	1									17	20
Airport			3	3					4	4	2	2	1	1	3	3									13	13
Highway Department			2	2			5	15																7	17	

FIM-10 WALK IN FREEZER AND COOLER IMPROVEMENTS**Existing Condition**

There are three large walk-in cooler/freezer units located at Public Safety Facility.

Recommendation

Walk-in cooler/freezer control systems will be installed to more efficiently control the operation of these units. Fans with electronically commutated motors (ECM) will replace the standard shaded pole motors. The control system can more efficiently control the evaporator fan to help to reduce evaporator fan runtime, saving electricity. Door and frame heaters are controlled based on kitchen dew point, which reduces the runtime of these units.

The following equipment shall be installed:

Quantity	Description of Equipment
1	Controls for Temp, Evap Fan, Defrost
7	Controls per Additional Cooler/Freezer
1	Cooler Door Heater Control Option
1	Freezer Door Heater Control Option
2	Additional Cooler Door Heater Circuits
16	ECM Evaporator Fan Motor Replacement

A temperature sensor will be installed in each freezer or cooler and tied to the EMS. The control point shall be monitored and an alarm condition will notify building personnel.

Part IV

OPTIONAL FACILITY IMPROVEMENT MEASURES FOR BROOME COUNTY MAIN PROJECT:

Facility	Facility Improvement Measure
Broome County Office Building	Add Condensing Boilers
Broome County Office Building	Install Economizer for Free Cooling
Broome County Office Building	Upgrade Transformers
Broome County Office Building	Lighting Upgrades
Broome County Office Building	Plug Load Management
Public Safety Facility	Add Condensing Boilers for a Hybrid Heating Plant
Public Safety Facility	Replace Existing Chiller and Cooling Tower
Public Safety Facility	Install a Heat Pump Pre-heater on Emergency Backup Generators
Public Safety Facility	Install VFDs on Condenser Water Pumps
Public Safety Facility	Install Vending Machine Controls
Public Safety Facility	Building Envelope Weatherization Upgrades
Public Safety Facility	Install High Efficiency Water Heaters
Public Safety Facility	Add coil freeze protection pumps on AHU 3+4
Public Safety Facility	Install VFDs on Chillers (Alt)
Public Safety Facility	Plug Load Management
Veterans Memorial Arena	Lighting Upgrades
Veterans Memorial Arena	Replace AHU 12+13
Veterans Memorial Arena	Upgrade Boilers
Veterans Memorial Arena	Upgrade Pneumatic Actuators to DDC
Veterans Memorial Arena	RTU Dehumidification Improvement
Veterans Memorial Arena	Install Demand Controlled Ventilation on AC 4+5
Veterans Memorial Arena	Install VFDs on Chilled Water Pumps (RTU Loop)
Veterans Memorial Arena	Parallel Chilled Water Pumps
Veterans Memorial Arena	Add Domestic Hot Water Boiler
Veterans Memorial Arena	Upgrade Motors
Veterans Memorial Arena	Building Envelope Weatherization Upgrades
Courthouse energy annex	Add Condensing Boilers
Courthouse energy annex	Upgrade Transformers
Courthouse energy annex	Building Envelope Weatherization Upgrades
Courthouse energy annex	Water Conservation
Courthouse energy annex	Lighting Upgrades
Courthouse energy annex	Plug Load Management
Transportation Garage	Lighting Upgrades
Transportation Garage	Building Envelope Weatherization Upgrades
Transportation Garage	HW coil for Maint Managers Office
Transportation Garage	Transformer Upgrades
Transportation Garage	Plug Load Management
Greater Binghamton Airport	Replace Boilers in the Terminal building with Condensing Boilers

Facility	Facility Improvement Measure
Greater Binghamton Airport	Replace Existing Chiller and Cooling Tower with an Efficient Air Cooled Chiller
Greater Binghamton Airport	Replace Existing Chiller with an Efficient Water Cooled Chiller (Alternative)
Greater Binghamton Airport	Install Ductless Split Cooling System for Airport Control Tower
Greater Binghamton Airport	Install a Heat Pump Pre-heater on Emergency Backup Generator
Greater Binghamton Airport	Building Envelope Weatherization Upgrades
Greater Binghamton Airport	Water Conservation
Greater Binghamton Airport	Lighting Upgrades
Greater Binghamton Airport	Install Vending Machine Controls
Greater Binghamton Airport	Install VFD on existing chillers
Forum	Lighting Upgrades
Forum	Boiler replacements
Forum	Battery Backup Upgrade
Forum	Building Envelope Weatherization Upgrades
Library	Lighting Upgrades
Library	Boiler replacement
Library	Building Envelope Weatherization Upgrades
Johnson City Senior Center	Lighting Upgrades
Johnson City Senior Center	transfer duct from NE multi function room to center section
Johnson City Senior Center	strip heaters under windows in NE multi function room
Johnson City Senior Center	Building Envelope Weatherization Upgrades
Johnson City Senior Center	Repair roof leaks at RTU
Johnson City Senior Center	Rebalance north rooms
Johnson City Senior Center	Water Conservation
Johnson City Senior Center	Plug Load Management
Whitney Point Senior Center	Lighting Upgrades
Whitney Point Senior Center	Building Envelope Weatherization Upgrades
Whitney Point Senior Center	Water Conservation
Whitney Point Senior Center	Boiler replacements
Whitney Point Senior Center	Plug Load Management
Harpurville Senior Center	Lighting Upgrades
Harpurville Senior Center	Building Envelope Weatherization Upgrades
Harpurville Senior Center	Plug Load Management
Intermodal Transportation Hub	Lighting Upgrades
Intermodal Transportation Hub	Building Envelope Weatherization Upgrades
Intermodal Transportation Hub	Water Conservation
DPW Garage	Building Envelope Weatherization Upgrades

Part V

[PROFORMA CASHFLOW](#)

The proforma showing Broome County Energy Performance Contract (excluding Willow Point Nursing Home) cashflow is on the following page.

Total Implementation Cost:	(\$3,540,705)	Other Costs(Construction Interest):	(\$107,694)
Implementation Cost + Other Credits:	(\$3,540,705)	Other Credits (Rebates/Incentives):	\$295,542
Interest Rate (5):	3.00%	Net Financed Investment:	(\$3,648,399)
Financial Term in Years:	20	Construction Period Escrow Interest:	\$0
Guarantee Period(yrs):	20	Service Inflation Rate:	3%
Annual Payment:	(\$242,807)	Energy Inflation Rate:	3%
		Operational Savings Inflation Rate:	3%

Yr	Energy Costs		Assets		Total Assets	Payment (2)	Liabilities		Net Annual Benefit	Cumulative Cash Flow
	Base Year Energy Costs	Energy Savings	Associated Savings	Arena Service Agreement Cancellation			Potential Rebates & Incentives (1)	On-Going Services (3,4)		
0	Construction	\$77,233	\$0	\$0	\$0	\$0	\$0	\$0	\$77,233	\$77,233
1	\$2,537,522	\$257,444	\$21,249	\$0	\$377,207	(\$242,807)	(\$59,394)	(\$302,201)	\$75,006	\$152,239
2	\$2,613,648	\$285,167	\$21,886	\$0	\$385,568	(\$242,807)	(\$61,176)	(\$303,983)	\$81,585	\$233,824
3	\$2,692,057	\$273,122	\$22,543	\$0	\$394,179	(\$242,807)	(\$63,011)	(\$305,818)	\$88,361	\$322,185
4	\$2,772,819	\$281,316	\$23,219	\$0	\$304,535	(\$242,807)	\$0	(\$242,807)	\$61,728	\$383,913
5	\$2,856,003	\$289,755	\$23,916	\$0	\$313,671	(\$242,807)	\$0	(\$242,807)	\$70,864	\$454,777
6	\$2,941,683	\$298,448	\$24,633	\$0	\$323,082	(\$242,807)	\$0	(\$242,807)	\$80,274	\$535,051
7	\$3,029,934	\$307,402	\$25,372	\$0	\$332,774	(\$242,807)	\$0	(\$242,807)	\$89,967	\$625,018
8	\$3,120,832	\$316,624	\$26,134	\$0	\$342,757	(\$242,807)	\$0	(\$242,807)	\$99,950	\$724,968
9	\$3,214,457	\$326,122	\$26,918	\$0	\$353,040	(\$242,807)	\$0	(\$242,807)	\$110,233	\$835,201
10	\$3,310,891	\$335,906	\$27,725	\$0	\$363,631	(\$242,807)	\$0	(\$242,807)	\$120,824	\$956,025
11	\$3,410,217	\$345,983	\$28,557	\$0	\$374,540	(\$242,807)	\$0	(\$242,807)	\$131,733	\$1,087,757
12	\$3,512,524	\$356,363	\$29,414	\$0	\$385,776	(\$242,807)	\$0	(\$242,807)	\$142,969	\$1,230,726
13	\$3,617,900	\$367,054	\$30,296	\$0	\$397,350	(\$242,807)	\$0	(\$242,807)	\$154,542	\$1,385,269
14	\$3,726,437	\$378,065	\$31,205	\$0	\$409,270	(\$242,807)	\$0	(\$242,807)	\$166,463	\$1,551,732
15	\$3,838,230	\$389,407	\$32,141	\$0	\$421,548	(\$242,807)	\$0	(\$242,807)	\$178,741	\$1,730,472
16	\$3,953,377	\$401,089	\$33,105	\$0	\$434,195	(\$242,807)	\$0	(\$242,807)	\$191,387	\$1,921,860
17	\$4,071,978	\$413,122	\$34,098	\$0	\$447,220	(\$242,807)	\$0	(\$242,807)	\$204,413	\$2,126,273
18	\$4,194,137	\$425,516	\$35,121	\$0	\$460,637	(\$242,807)	\$0	(\$242,807)	\$217,830	\$2,344,103
19	\$4,319,961	\$438,281	\$36,175	\$0	\$474,456	(\$242,807)	\$0	(\$242,807)	\$231,649	\$2,575,752
20	\$4,449,560	\$451,430	\$37,260	\$0	\$488,690	(\$242,807)	\$0	(\$242,807)	\$245,883	\$2,821,634
Total		\$6,994,849	\$570,969		\$295,542	(\$4,856,144)	(\$183,581)	(\$5,039,726)	\$2,821,634	

- Notes:**
- Associated Savings include operational cost savings.
 - Payment represents an annual sum of periodic payments.
 - Technical Support Program is escalated at Service Inflation Rate.
 - Performance Assurance required during guarantee period only.
 - Interest Rate Subject to Change.
 - Simple Payback=(Total Project Cost - NYSERDA) / (First Year Energy Savings plus Associated Savings plus Maintenance Savings plus First Year On-Going services).
 - Annual guarantee may not exceed Total Project Cost.
 - Construction Interest based on 12-month funding to payment schedule
 - Annual guarantee amount is based on revenue neutral program.
 - Cash Flow is for discussion purpose only.
 - Total NYSEERDA grant incentives applied over years 1, 2.