SIEMENS

Oswego City School District

Preliminary Energy Assessment

Completed During Fall of 2021

Creating perfect places.

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Preliminary Analysis

General

Oswego City School District (Oswego CSD) has a total of 7 school buildings and a bus garage. The Table below provides an overview of each of the facilities.

Facility Name	Area sq.ft.	Students	Year Built
High School	207,893	1,142	1970
Middle School	123,510	557	1980
Fitzhugh Elementary	71,800	423	1927
Kingsford Park Elementary	71,800	457	1927
Leighton Elementary	85,900	295	1956
Minetto Elementary	85,400	430	1958
Riley Elementary	70,139	407	1955
Bus Garage	27,864	-	1984

Utilities Service

Historical billing data has been reviewed for the period from March 2019 to February 2020, and a summary of annual electricity and natural gas usage is provided in the Table below. Oswego CSD spent an estimated **$799,824** annual for electricity and natural gas.

Building	*Electricity kWh*	*Electricity Spend*	*Natural Gas Therms*	*Natural Gas Spend*	*Total Energy Spend*
High School & Leighton Elementary	2,540,299	$242,569	199,170	$118,506	$361,075
Middle School	943,256	$ 92,013	67,457	$40,811	$132,825
Fitzhugh Elementary	480,979	$ 58,997	32,892	$20,229	$79,226
Kingsford Park Elementary	559,986	$ 57,543	35,643	$21,921	$79,464
Minetto Elementary	585,685	$ 49,783	31,682	$19,485	$69,268
Riley Elementary	695,992	$ 52,686	41,108	$25,281	$77,967
TOTALS	**5,806,196**	**$553,591**	**407,952**	**$246,233**	**$799,824**

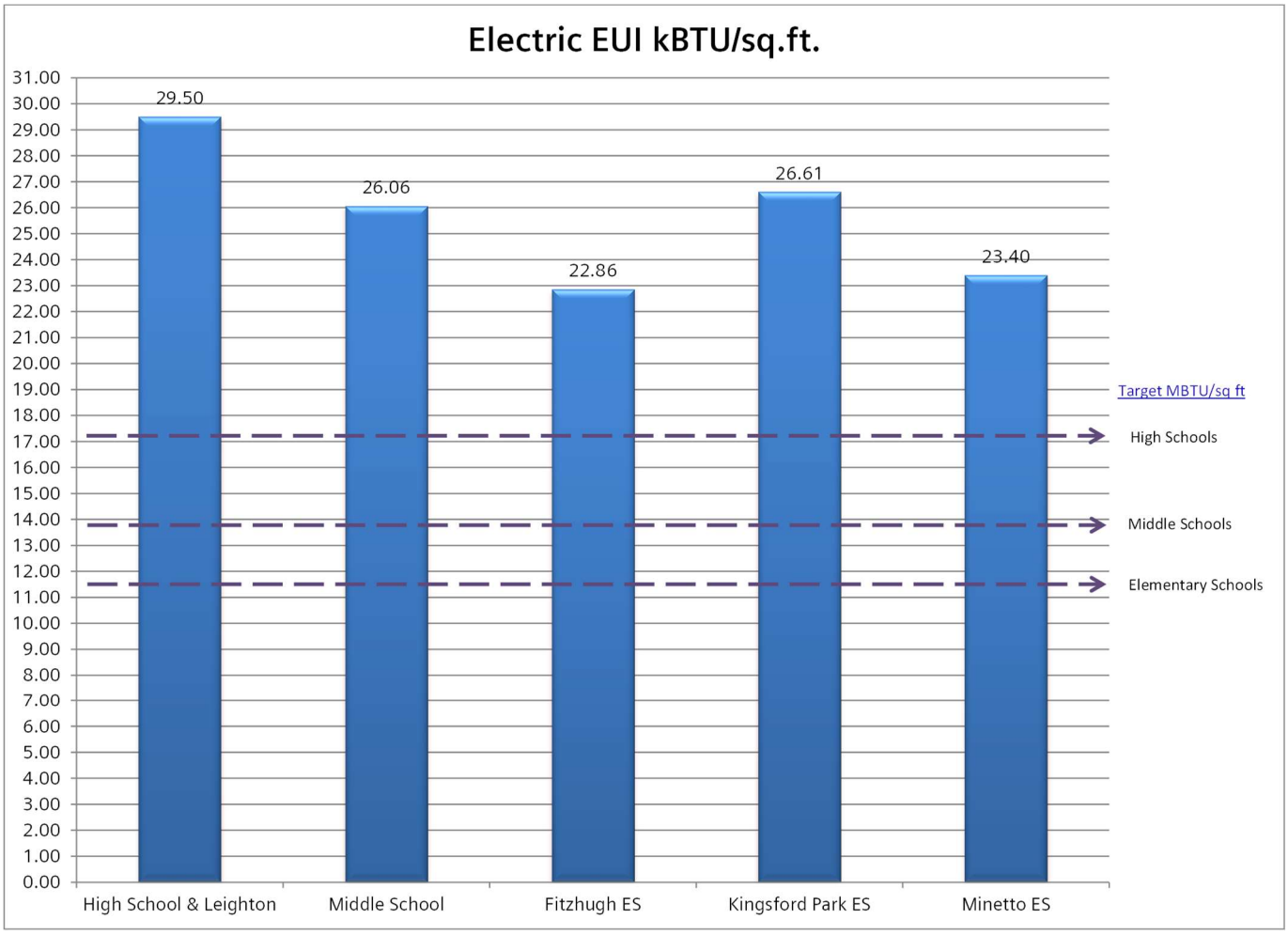
Utility Consumption Analysis

An analysis was done on the existing utility consumption at each of the campuses in the Oswego CSD. An energy intensity value, or kBTU per square foot, was calculated for both electric and natural gas consumption. There is a wide range of values throughout the CSD, as some buildings are more efficient than others in terms of consumption and have different educational uses. The variance in energy intensity can be attributed to building construction, functionality, building age and occupant practices. The utility information, especially on the natural gas, needs to be validated to ensure that all consumption is being captured accurately.

The electric and natural gas at the High School and Leighton Elementary School are billed together and the graphs reflect the same.

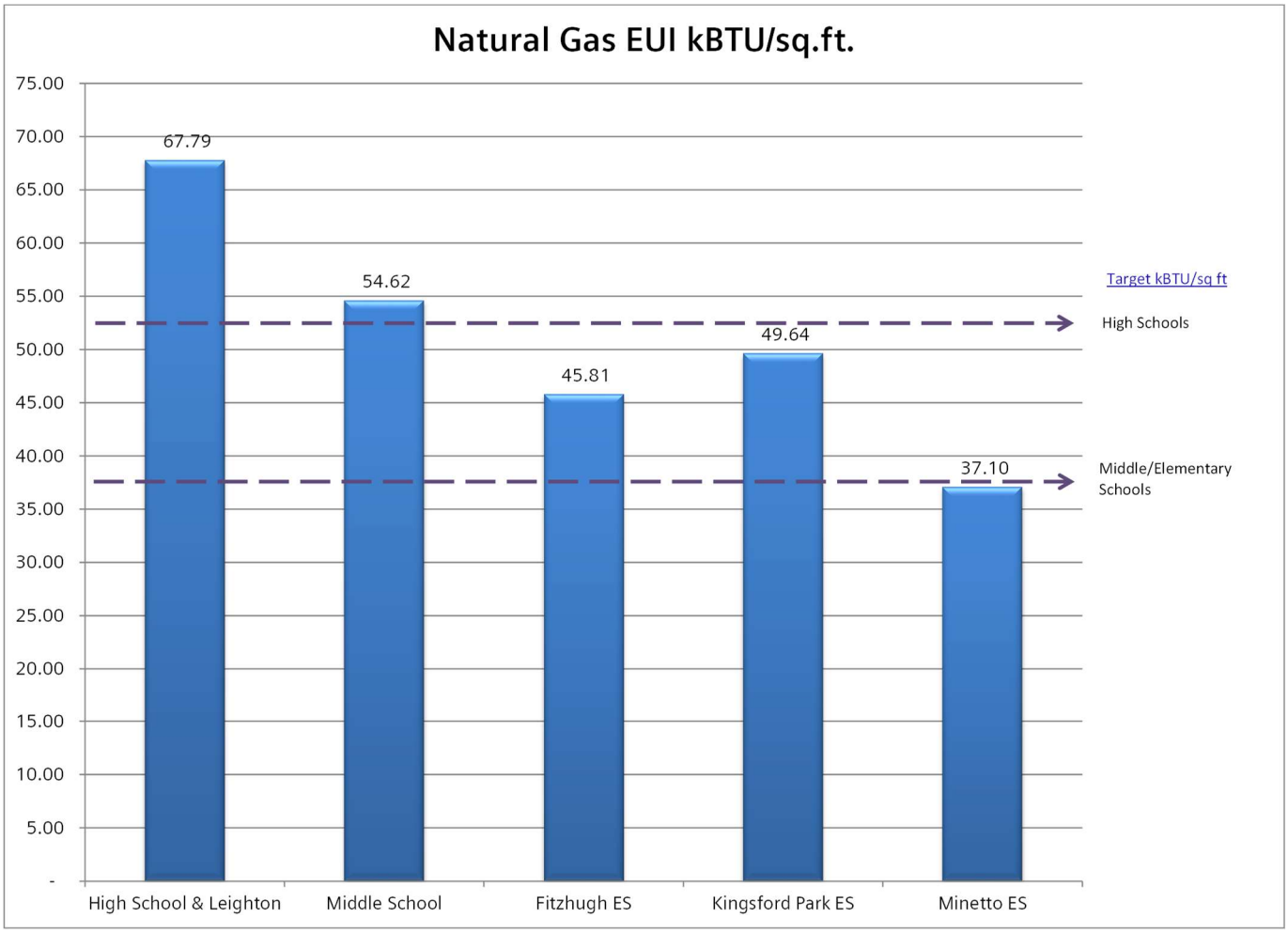
Electric Energy Use Intensity (EUI)

The graph below highlights the current EUI (kBTU/sq.ft.) for the electric consumption in various buildings compared against typical EUI for an energy-efficient school in this geographic region.



Natural Gas Energy Use Intensity (EUI)

The graph below highlights the current EUI (kBTU/sq.ft.) for the natural gas consumption in various school buildings compared against target EUI for an energy-efficient school.



Infrastructure Targets – 2015 BCS

The table below shows the list of infrastructure needs from the 2015 Building Conditions Survey (BCS) reports that have been identified as potential opportunities during the preliminary energy audit. The shaded rows are opportunities that are included in the priority measures in the proposal.

School	Pg.	Category	Condition	Year of Last Replacement	Cost to Replace	Comments
High School	29	Interior Lighting	Satisfactory	2011	$500,000	First generation T8 lights throughout
High School	36	AHU & Vent Equip	Satisfactory	1980	$150,000	Gymnasium Air Handling Equipment
High School	36	Piped Htg & Clg Sys	Satisfactory	2015	$185,000	Add VFDs and replace motors on select equipment
High School	39	Emerg Exit Lght Sys	Satisfactory	2004	$50,000	Replace / add battery packs in kind
Middle School	29	Interior Elec Dist	Satisfactory	1980	$200,000	Upgrade miscellaneous panels
Middle School	30	Interior Lighting	Satisfactory	2010	$500,000	First generation T8 lights throughout
Middle School	37	Piped Htg & Clg Sys	Satisfactory	2004	$4,000,000	Planned project is for complete HVAC replacement. Cost is for piping replacement. Controls Replacement, Ducted Htg/Clg Distribution Systems.
Middle School	40	Emerg Exit Lght Sys	Satisfactory	2004	$50,000	Replace / add battery packs in kind
Fitzhugh Elementary	29	Interior Elec Dist	Satisfactory	2010	$185,000	Interior panelboards are new. Existing Main Distribution Switchboard is nearing end of useful life and should be replaced
Fitzhugh Elementary	30	Interior Lighting	Satisfactory	2011	$500,000	First generation T8 lights throughout
Fitzhugh Elementary	37	Piped Htg & Clg Sys	Satisfactory	2010	$74,000	Add VFDs and replace motors on select equipment
Fitzhugh Elementary	40	Emerg Exit Lght Sys	Satisfactory	2004	$18,500	Replace / add battery packs in kind
Kingsford Park Elementary	29	Interior Elec Dist	Satisfactory	2010	$185,000	Interior panelboards are new. Existing Main Distribution Switchboard is nearing end of useful life and should be replaced
Kingsford Park Elementary	30	Interior Lighting	Satisfactory	2011	$500,000	First generation T8 lights throughout
Kingsford Park Elementary	37	Piped Htg & Clg Sys	Satisfactory	2010	$74,000	Add VFDs and replace motors on select equipment
Kingsford Park Elementary	40	Emerg Exit Lght Sys	Satisfactory	2004	$18,500	Replace / add battery packs in kind
Kingsford Park Elementary	41	Emerg Power Sys	Satisfactory	1977	$92,500	Replace in kind.
Leighton Elementary	30	Interior Lighting	Satisfactory	2004	$250,000	First generation T8 lights throughout
Leighton Elementary	31	Plumbing	Satisfactory	1988	$350,000	Replace all domestic hot, cold and hot water return in kindergarten wing and locker rm wing
Leighton Elementary	34	Heat Generation Sys	Satisfactory	1992	$350,000	Consider providing condensing boiler
Leighton Elementary	41	Emerg Power Sys	Satisfactory	1986	$150,000	Replace in kind.
Minetto Elementary	29	Interior Lighting	Satisfactory	2004	$250,000	First generation T8 lights throughout
Minetto Elementary	31	Plumbing	Unsatisfactory	1988	$750,000	Replace domestic piping distribution system in primary wing of building

School	Pg.	Category	Condition	Year of Last Replacement	Cost to Replace	Comments
Minetto Elementary	36	AHU & Vent Equip	Satisfactory	2010	$200,000	Replace 3 RTU's in kindergarten and 1 RTU in Music areas. Existing terminal equipment not replaced and will require replacement in 10 years
Minetto Elementary	36	Piped Htg & Clg Sys	Satisfactory	2010	$100,000	Add VFDs and replace motors on select equipment
Minetto Elementary	39	Emerg Exit Lght Sys	Satisfactory	1988	$100,000	Need to upgrade coverage in certain areas.
Minetto Elementary	40	Emerg Power Sys	Satisfactory	1988	$150,000	Replace in kind.
Riley Elementary	29	Interior Lighting	Satisfactory	2004	$500,000	First generation T8 lights throughout
Riley Elementary	32	Hot Water Heaters	Satisfactory	2010	$50,000	Replace gas fired heaters in boiler room
Riley Elementary	34	Heat Generation Sys	Satisfactory	1992	$350,000	Weil-McLain cast iron sectional boilers, model no. 1694. Consider providing condensing Boilers
Riley Elementary	36	Piped Htg & Clg Sys	Satisfactory	2015	$100,000	Add VFDs and replace motors on select equipment
Riley Elementary	39	Emerg Exit Lght Sys	Satisfactory	1988	$50,000	Replace / add battery packs in kind
Bus Garage	24	Interior Elec Dist	Satisfactory	1984	$50,000	Replace existing rusted panelboard with new.
Bus Garage	24	Interior Lighting	Satisfactory	1984	$75,000	First generation T8 lights throughout
Bus Garage	29	AHU & Vent Equip	Satisfactory	1984	$25,000	Gravity intake and relief are operational. Minor repairs to damper operators
Bus Garage	32	Emerg Exit Lght Sys	Satisfactory	1984	$25,000	Recommend Upgrading
Transportation Bldg	25	Interior Lighting	Satisfactory	1984	$75,000	First generation T8 lights throughout
Transportation Bldg	28	Hot Water Heaters	Satisfactory	2000	$25,000	Replace water heater, it is approaching end of useful life.
Transportation Bldg	32	AHU & Vent Equip	Satisfactory	1984	$370,000	Upgrade exhaust system. Replace RTU for paint bay with class of unit applicable for paint booth operations
Transportation Bldg	32	Hot Water Heaters	Satisfactory	1984	$50,000	Upgrade office and maintenance heating system
Targeted Energy Items TOTAL					**$20,502,500**	

Sub-Totals	Category
$ 3,150,000	Interior Lighting
$312,000	Emergency Lighting
$392,500	Emergency Power (Generators)
$1,925,000	Mechanical
$5,278,000	Air-Handling / Ventilation
$620,000	Electrical Distribution

Facility Improvement Measures

The initial data gathered during the preliminary facility assessment at Oswego CSD allows for potential Facility Improvement Measures (FIMs) to be identified at each facility. Further investigation is required to determine the feasibility of these measures, but they begin to illustrate the opportunity for energy savings in each building.

Facility Improvement Measure	High School	Middle School	Fitzhugh ES	Kingsford Park ES	Leighton ES	Minetto ES	Riley ES	Bus Garage & Trans
Electrical Improvements								
Lighting Retrofits & Controls	X	X	X	X	X	X	X	X
Install De-stratification Fans	X	X	X	X	X	X	X	
Vending Machine Controls	X	X	X	X	X	X	X	X
High Efficiency Transformers	X	X	X	X	X	X	X	X
Mechanical Upgrades								
Boiler Replacement					X		X	
Building Automation Upgrades								
HVAC Control Optimization	X	X	X	X	X	X	X	X
Siemens Digital Services (NYSERDA RTEM)	X	X	X	X	X	X	X	
Walk-in Cooler / Freezer Controls	X	X	X	X	X	X	X	
Building Envelope Improvements	X	X	X	X	X	X	X	X
Miscellaneous Measures								
Replace Pool Cover	X	X						
Plug Load Controllers	X	X	X	X	X	X	X	X
Pipe Insulation / Replacement	X	X	X	X	X	X	X	X

Future Measures to be Considered								
Boiler Replacement								o
Convert Pneumatic Controls to DDC		o						
Retro-Commissioning	o	o	o	o	o	o	o	o
Convert Field Lights to LED		o						
Water Conservation Measures	o	o	o	o	o	o	o	o

Key: X = Included in Project o = Pending Inclusion as Allotment FIM ☐ =BCS Target

Electrical Improvements

Lighting Retrofit and Controls

Buildings: All Buildings

The Oswego CSD buildings are comprised of areas that include typical classroom settings, cafeteria/kitchen, auditorium, gymasiums, libraries, offices and shop areas.

Many of the buildings have a combination of LED's, 32-watt T8 lamp in mostly 2 and 3 bulb configurations. Fixture types include fluorescent lay-in and wrap fixtures with instant start ballasts along with high-bay T5 or T8 fixtures in each of the gymnasiums. There are also a large number of recessed cans, which vary in size and have compact fluorescents and/or LED's.

Some of the hallways around the District have been converted to LED troffer fixtures as the areas have been renovated. Otherwise, most hallway areas are lit with standard T8 fluroescent troffer or surface-mount fixtures.

Most of the classroom spaces have occupancy sensors.

A minimal number of exterior fixtures, most notably some wall packs, have been converted to LED. All other exterior fixtures including other wall packs, flood lights, parking/roadway and common space area lights remain HID fixtures.

Some of the lighting highlights around the District include:

High School

- The light levels in the gymnasium measured between 38-56 footcandles (fc). Gymnasiums used for state competitions should be a minimum of 50 fc.
- The pool space has HID downlights and an over-water optic tube system. Light level readings around the perimter of the pool indicated 9-16 fc. NYSED requires 50 footcandles in a natatorium space.
- Staff indicated that the lamps in the optic tube fixtures need replacing 1-2 times annually.

Middle School

- Many hallways have a continuous, narrow recessed troffer fixtures down the center. These fixtures are approximately 6 inches wide with a single lamp. Many of the lenses are very yellowed, broken, or completely missing.
- The switches in a number of classrooms are very old and oddly positioned.
- The pool has the same over-water optic tube system as the High School. Assume lamps are replaced just as frequently in these fixtures.

- The 4-lamp T5 fixtures in the gymnasium had various colored lamps, giving the space a very inconsistent appearance.
- Athletic field has HID fixtures.

Fitzhugh & Kingsford Park Elementaries

- The gymnasiums have dropped ceilings with lay-in 2x4 6-lamp T5 fixtures. The lamps in the gyms were very yellow with many failed lamps. The spaces have a very dim, yellowed appearance.

Leighton Elementary

- The main entrance lobby and some other renovated areas (1 wing) have newer 2x2 LED troffer fixtures

Riley Elementary

- Many of the hallways have 4 foot 2-lamp surface-mount wrap fixtures. The lenses on these fixtures are quite old and have an aged appearance. These halls appear dim and have a very yellowed appearance.
- The main gymnasium has surface-mounted 4-lamp T5 fixtures. Again, there are many different lamp colors here, giving the space a very inconsistent appearance.

Description of Opportunity

LED Volumetric Kit

Lighting Retrofits

Fluorescent lighting throughout the building will be replaced with LED lighting. There are multiple solutions available for each existing fixture type.

New LED fixtures will be installed in most areas of each building. This will include classrooms, offices, common spaces, gymnasiums, and other areas. Areas to be retrofit with new lamps will include storage and mechanical spaces. The new fixtures will be selected to match the fixtures being used in on-going and future capital projects, as well as fixtures that have already been installedin previous projects around the District.

In the past, the combination of fluorescent lamps and instant start ballasts along with occupancy sensors significantly reduced the life of the fluorescent lamps. The more frequently a fluorescent lamp is turned on and off with an instant start ballast the more the life of the lamp is reduced, which can be up to 50% of rated life. With an occupancy sensor, it is inevitable that a lamp will be switched on and off more frequently than if it were being controlled by a manual switch.

With linear LED lamps, this is not the case. The frequency at which the lamps are turned on and off with an instant start ballast has no affect on the overall life of the LED. The lamps should last, on average, for the full rated life, regardless of the frequency of being switched on and off.

Recessed Can Retrofit

In hallways, LED volumetric kits will be installed, as the cost of a retrofit kit is higher than that of LED lamp and ballasts retrofits. The LED retrofit kits would provide the appearance of a new fixture without replacing the actual fixture housing that already exists, while significantly reducing the wattage of the fixture.

Recessed cans will be retrofitted with LED recessed can retrofit kits that fit into the existing recessed can footprint. There are also LED solutions for each type of compact fluorescent size and base. Each type of compact fluorescent lamp, including 2-pin, 4-pin, and biax (2G11) base can be re-lamped with self-ballasted LED lamps. This would maintain the integrity and appearance of the recessed cans that are in place throughout the District.

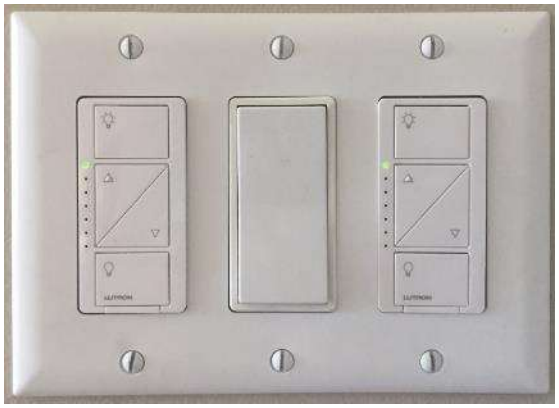
LED High-Bay Fixture

The T8 & T5 fluorescent fixtures in the gymnasiums throughout the District will be replaced new LED high-bay fixtures. LED high-bay solutions come in many shapes and sizes, but are all significantly less in wattage than existing technologies. A solution that meets the desire of the District in terms of fixture appearance and light appearance will be selected.

Lighting Controls Upgrades

There are a number of hallways that would benefit from the addition of occupancy sensors. While these sensors would enable standard on/off control, there are additional sensors and technology that can bring additional benefit.

Local Dimming Control



There are areas that would benefit from the occupants' ability to adjust the light levels based on the activity in the space or the natural light available from the windows. Fixtures will be installed that have 0-10 volt dimming ability. These fixtures will be wired back to a local dimmer switch panel that would allow for the occupant to manually control the light level in the space. This would yield additional energy savings while increasing the comfort level in the space by allowing the light level in the space to be tuned specifically to the task.

Dimming control will be provided in all spaces that require it, specifically classrooms and office areas.

Demonstration Lighting

At the start of the detailed energy audit (DEA) Siemens will work with Oswego CSD to select several spaces of various types as demonstration sites for LED lighting. This will allow staff to evaluate the LED technology before submission of the project to NYSED.

Siemens recommends a retrofit or replacement of these fluorescent fixtures with LEDs. In most cases a color temperaure of 4000K will be a very close match for the existing T8s, in specific cases bulbs of different temperatures will be used:

- In other cases such as shop or tech classes a 5000K temperature will provide the contrast needed for the detailed work taking place.
- All fixtures and lamps will be selected accordingly to provide the appropriate light level and color temperature for the setting.

LED Area Light

Capital Project Coordination

It is understood that the District has ongoing as well as future planned capital improvement projects that include areas where lighting needs to be addressed.

Siemens will work closely with the District and their design partners to ensure that the fixtures and lamps selected are coordinated with any capital improvement project efforts.

De-stratification Fans for Gyms

Buildings: All School Buildings

The gymnasiums in the building are high-bay spaces served by air-handling units. The temperature set point in each of these spaces is approximately 68-70°F. The temperature at the ceiling is much higher than at floor level, as the warm air used to heat the space stratifies in the upper part of the gym.

It is proposed to install AIR PEAR de-stratification systems throughout each of the gymnasiums. These fans are designed to mix the air in the space, which reduces air temperature near the ceiling and in turn reduces energy losses throughout the space.

De-stratification Fan

Vending Machine Occupancy Controls

Buildings: All Buildings

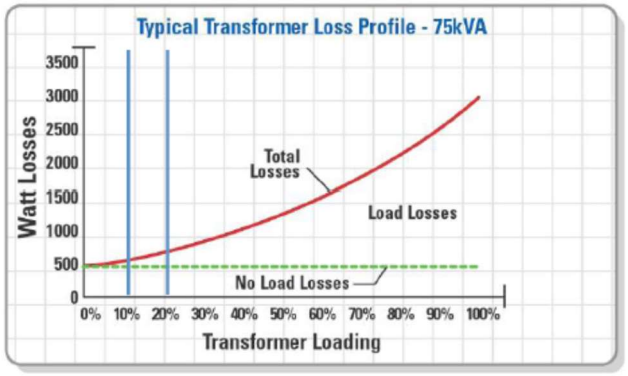
There are a number of beverage and snack vending machines located throughout the District. The beverage machines have display lights and cooling compressors that operate at all times, regardless of building occupancy. The snack machines have display lights that are also on at all times.

Specialized controls could be installed to operate the vending machine by monitoring both occupancy levels in the area around the vending machine and ambient temperature changes. The controls allow only enough power to keep the cooled product inside at the right temperature and have it ready to dispense when someone is in the vicinity, powering down costly heat generating lighting and preventing compressor cycles to run when they are not required. These controls will not be installed on any machine that has a credit card payment option.

High Efficiency Transformers

Buildings: All Buildings

There are step-down transformers throughout the district. Electrical transformers are comprised of two major components: a steel core and windings made of aluminum or copper. Transformers are in operation 24 hours a day, year-round, so they are producing energy losses constantly. Core losses, also known as no-load losses, are consistent. The core remains energized at all times, regardless of any load. Coil losses, also known as load losses, vary with the load placed on them. Therefore, core losses are a constant and the only variable is the losses associated with the load.



Data shows that transformers are typically loaded in the 10-20% range, with an average of 17% loaded. Many transformers exhibit a very predictable duty-cycle, so it is well understood.

The losses produced by the load of the building fall within a very small triangle above the no-load loss line. Therefore, the total losses are dominated by the no-load losses.

Traditional transformers were built to serve the smooth sine-wave loads of the past. These do not perform well under today's loads. Computers and other electronic devices draw electricity in pulses (non-linear). These types of loads result in higher electrical system loss, generate extra heat and can distort system voltage, reducing reliability.

Description of Opportunity

Siemens will replace the remaining low efficiency electric transformers with new high efficiency harmonic mitigating transformers to improve system power quality by reducing harmonic distortion, reducing harmonic related losses and improving system efficiency, performance and reliability. These transformers are able to reduce the voltage entering the building, and flowing throughout the building, while wasting less electricity than traditional transformers.

Also, the new transformers will generate significantly less heat than the traditional transformers. This puts less load on cooling equipment throughout the building and makes spaces more comfortable that are not cooled in the warmer months.

Mechanical Upgrades

Boiler Replacements

Buildings: Leighton Elementary, Riley Elementary

The existing boilers at both Leighton and Riley Elementary schools are original to the building and past the end of their useful life. These boilers are all Weil-McLain cast iron sectional hot water boilers with original mechanically actuated burners.

The boilers at Leighton Elementary are sized at 6,856 MBH input capacity each, while the boilers at Riley Elementary are sized at 5,412 MBH input capacity each.

Description of Opportunity

Siemens proposes to replace the existing boilers at Leighton and Riley Elementary schools. The new boiler plants would adhere to the same approach implemented in the Middle School. In this configuration, a bank of standard efficiency boilers heats the building in the colder months when the condensing affect does not regularly happen, while a bank of high-efficiency condensing boilers heats the building in the milder months where condensing occurs and the highest rates of boiler efficiency can occur.

The new boilers will be more efficient than the existing boilers overall due to better jacket insulation and more finely tuned air-fuel ratios from the boiler burner regardless of if the standard efficiency or the high efficiency boilers are being fired. The new boilers will update the infrastructure of the building.

Building Automation Upgrades

The existing building control is done through the Siemens automation system. Though the system is functioning properly in most cases, there are opportunities to optimize the Energy Management System (EMS) to add a higher level of automation.

All of the air-handling units, rooftop units, and fin-tube are DDC controlled. The exhaust hoods in the kitchens are on manual switches.

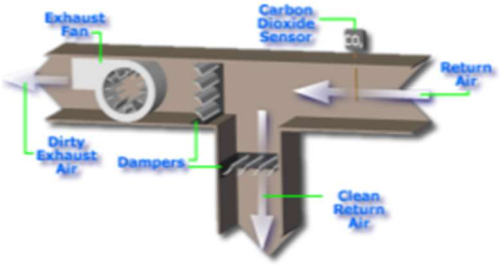
There are opportunities to enhance the existing controls system to allow for more dynamic heating and ventilation control in specific settings.

Description of Opportunity

HVAC Control Optimization: Demand-Controlled Ventilation

Buildings: All Buildings

There are a number of areas throughout the facilities where demand-controlled ventilation would provide a savings opportunity such as the libraries, cafeteria, media centers, auditoriums, weight room, LGI rooms and gymnasiums. Typically, when air-handlers are specified for large areas, they are designed to provide enough outdoor air to satisfy the space as if it were fully occupied at all times. Obviously, these spaces are not always fully occupied and spend much more time at minimal occupancy, or even empty.



A demand-controlled ventilation strategy uses carbon dioxide sensors in the space served by the units to determine if a reduced amount of outdoor air can be used to properly ventilate the space. This reduces the amount of air to be conditioned during the heating season which will result in natural gas savings and cooling for units that have AC which will result in electricity savings.

HVAC Control Optimization: Optimal Start Time on AHUs and Unit Ventilators

Buildings: All Buildings

Currently, each of the air-handling units, rooftop units and unit ventilators in the District operate on a set schedule. Each piece of equipment is programmed to come on at a scheduled time to warm the building up during the heating season. The control system allows for adequate time to warm the building up to set point on the coldest days. On milder days, the building does not need as much time to come up to occupied temperature set point.

There is also an opportunity to shorten unit run time at the end of a school day. Some of the schedules seem to run longer than normal occupancy, causing un-needed heating energy consumption.

Siemens will investigate the implementation of a start time optimization algorithm to start the air-handling units, rooftop units and unit ventilators at variable times based on calculations that determine the optimal use of the system. Any of the units that are already utilizing an optimal start algorithm will be excluded from this measure. Start times of equipment will depend upon the outside and inside temperatures of the building, occupancy state, expected occupancy times, and temperature and ventilation set points. Optimal start will enable the unit prior to occupancy, but no earlier than necessary to have the space conditions satisfied at occupancy.

Siemens Digital Services (NYSERDA RTEM)

Buildings: All Buildings

The District has the ability to have a dedicated energy management platform to better track building and equipment performance as well as energy consumption.

It is difficult to monitor where electricity is being wasted or how each building is performing.

With the addition of an integrated digital platform into the existing building controls system, Siemens can provide remote services for controls installed including services to analyze data and find facility improvement measures; remote services to proactively maintain the systems; and monitoring to immediately diagnose critical alarms and if possible, resolve them remotely.

- **CloudFIM:** Siemens Fault Detection & Diagnostics (FDD) with Remote Resolution offerings make buildings smarter by proactively collecting and analyzing data to identify, diagnose and take action on building issues before they negatively impact performance. Our FDD Analytics run on Navigator. Navigator is a comprehensive, cloud-based energy management and building performance platform that enables real and measurable savings for our customers.

- **Remote Services:** Our teams of remote service specialists transform the customer's business by leveraging digital tool sets for new and existing service offerings. This enables us to be more predictive and prescriptive in servicing our customers. Studies show that when a customer shifts their operations and maintenance strategy from reactive (wait until it fails) to predictive (prevent failure), their buildings are ranked as top performers compared to their peers. This results in cost savings on energy and operations and maintenance budgets while extending the overall life of building systems and equipment.

- **Automation Proactive Services:** Proactive services allow us to use system health reports to develop targeted maintenance task lists. By combining a service delivery model that uses data and reporting to prioritize maintenance tasking, combined with traditional planned scheduled maintenance tasking, Siemens helps the customer make important and intelligent decisions regarding the maintenance of their facility.

- **Online Data Backup and Protection Services:** According to a pre-determined schedule, Siemens will back-up your graphics, reports, configurations, user information and databases, and store this information as agreed either on-site or off-site. If, for any reason, any of the data and information that has been backed up is lost, we will re-load the data and information with the backup copy within a specified time period.

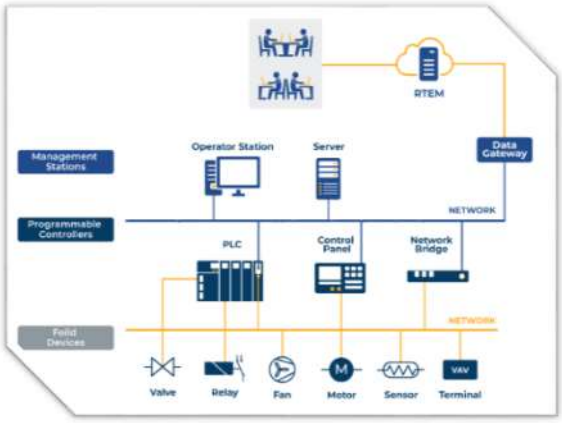
Real-Time Energy Management (RTEM) is a cutting-edge technology that continuously sends a building's live and historical performance data to an advanced cloud-based system where it is transformed into actionable insights for property owners, building managers and tenants.

RTEM is a program that NYSERDA offers through qualified vendors only. Siemens is a NYSERDA-qualified vendor that can help the District incorporate this innovative technology into the buildings throughout the District. NYSERDA will cost share up to 30% of the overall RTEM expenses and provide Elmira City School District with the tools and support

needed to reap the benefits of building performance optimization. NYSERDA estimates a 15% to 30% savings per year on energy utilizing this technology.

Ongoing Commissioning
A cloud-based RTEM system continually monitors a building's systems by using advanced capabilities such as fault detection and diagnostics, predictive analytics and performance optimization to ensure that energy is used more intelligently throughout a building.

High Performance Buildings
The District will have a smarter group of buildings with greater appeal and marketability. Plus, the confidence and peace of mind knowing that everything is running smoothly.



Description of Opportunity

Siemens proposes to build upon the Navigator platform that works with the existing building automation system. Portions of the offerings outlined in the above sections could be selected to enhance the overall functionality of select buildings around the District. The Navigator platform will allow for RTEM features that will transform the way the District manages, consumes and purchases energy.

RTEM systems come equipped with powerful features and capabilities to create high-performing building environments.

- **Fault Detection** — an advanced feature that detects abnormal energy consumption in a building and helps avoid energy spikes and expensive equipment failures.
- **Fault Diagnostics** — powerful software that continuously analyzes energy usage and equipment data to identify issues and opportunities to optimize performance.
- **Predictive Analytics** — combines data mining, statistics, modeling and forecasting intelligence to analyze current energy data and make predictions about the future.
- **Performance Optimization** — energy usage is continuously analyzed throughout an entire building to ensure each space is optimized to its fullest potential.

Walk-In Cooler / Freezer Controls

Buildings: All School Buildings

There is a food preparation kitchen in each school in the District. Each of the kitchens has both a walk-in cooler and freezer.

Siemens will install specialized controls for the walk-in freezers. In most coolers and freezers, air is cooled by forced-circulation evaporators containing propeller fans powered by fractional horsepower motors. Typically, these fans run continuously even though full airflow is only required about half of the time.

A controller can be used to slow the evaporator fans when full-speed operation is not required. The controller does this simply and inexpensively by applying a lower voltage to the fan motor, producing less rotational force.

Cooler Control Panel

Building Envelope Improvements

Buildings: All Buildings

There is an opportunity to tighten the overall building envelope at each building in the District. These areas include entry doors, roof-wall interface, roof-mounted exhaust fans, entry soffits, and window-mounted air-conditioner penetrations.

Description of Opportunity

Window and Door Weather-stripping

Many of the entry and overhead doors in the schools are in need of full weather-stripping replacement. Both side seals and bottom sweeps are worn and/or damaged. New weather-stripping and door sweeps will be installed to reduce the infiltration and heat loss through the doors.

Worn Weather-Strips Allow Unconditioned Air to Infiltrate

Seal Roof-Wall Intersection

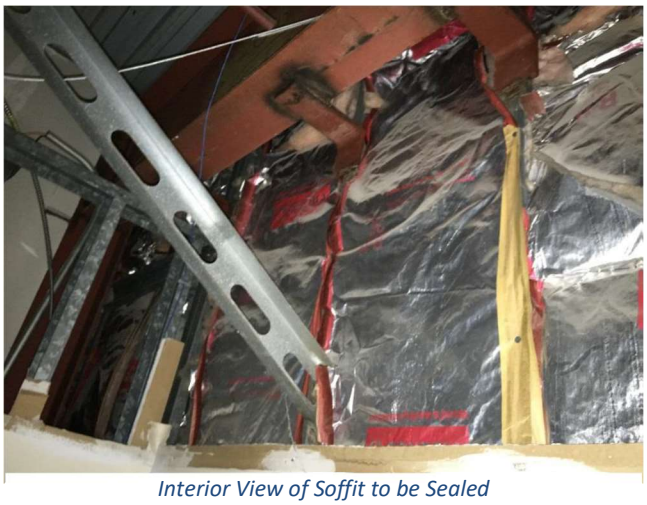
There are several areas in the schools where sealing the roof wall interface is a good opportunity for savings. This includes areas where sealant will be applied above and below the beam, as well as areas where gaps in the masonry will be sealed. The majority of the gaps will be sealed with closed cell spray foam insulation. Depending on the identified roof wall gap, it could be sealed from both the top and the bottom of the spandrel and/or support joist or site of infiltration. This will create an air boundary from the inside of the building and allow the curtain wall gap to breath and relieve moisture that may develop in the air gap.

Gaps at Roof-Wall Interface to be Sealed

Soffit Overhead Sealing

Various entryway soffits have openings approximately eighteen inches in width from the interior wall plane. This allows outside air to infiltrate through fixtures and the seam on the exterior deck of the soffit. Because these soffits are not air sealed and/or insulated, outside air also conducts from the soffit deck.

The soffits could be treated with a combination of foil face foam board and one-part foam to construct an insulated wall. This would create an airtight thermal barrier between the outside air of the soffit and the conditioned interior space. The seams and additional gaps will be sealed with spray foam to complete the air barrier.



Interior View of Soffit to be Sealed

Exhaust Fan Sealing

For a rooftop exhaust fan, typical gaps exist between the internal ductwork and the fan curb level with the roof deck. This allows unintentional air to be drawn out through the exhaust fan, and outside air to infiltrate the plenum through these gaps.

Various Styles of Exhaust Fans to be Sealed

The exhaust fan hoods would be removed and the gap between the duct and the curb will be air sealed at the roof deck. The hood will be re-installed and all screws will be tarred to prevent infiltration at the mounting holes.

Miscellaneous Measures

Replace / Upgrade Pool Cover

Buildings: High School and Middle School

Siemens will investigate the feasibility of replacing the pool cover at the High and Middle Schools along with any obsolete or damaged components. Renewing these components would renew the lifespan of the overall system and allow for maximum functionality going forward.

The reduction in the pool water evaporation rate will reduce water and chemical treatment costs and will produce significant thermal energy savings. In addition to reducing heat transfer from the water into the air, pool covers also provide additional control to minimize the loss of chlorine due to evaporation, and also reduce the amount of moisture that escapes from the pool surface into the atmosphere of the pool, which can accelerate the deterioration of building elements if not controlled.

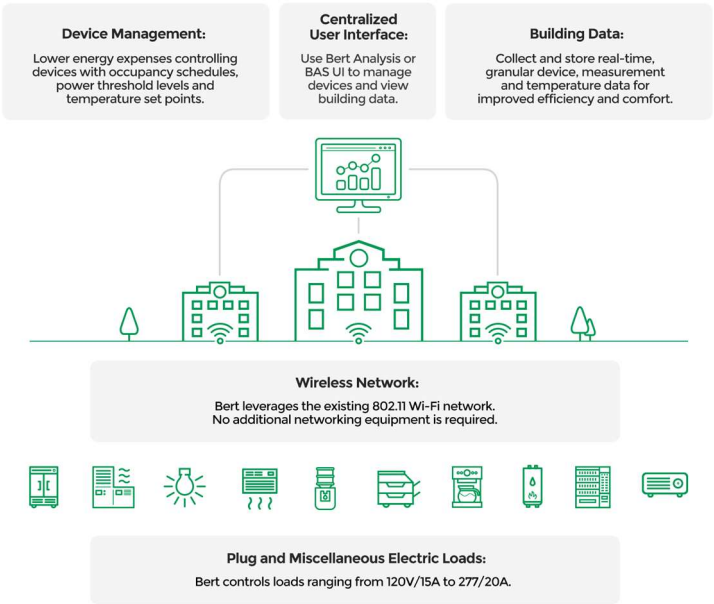
Plug Load Controllers

Buildings: All Buildings

Each facility has a significant number of plug-in devices such as smart boards, coffee makers, printers, copiers, computers, computer charging carts, vending machines, drinking fountains, etc.

Siemens proposes to install hardware for plug load devices, to measure actual energy use, analyze potential savings, create schedules and control energy use. Approximately 10% of building electric load is plug load and controlling these loads when they are not needed is an excellent means to save energy.

The devices are controlled and configured via wifi, so setup and management is a centralized function that allows the user to change settings with ease.



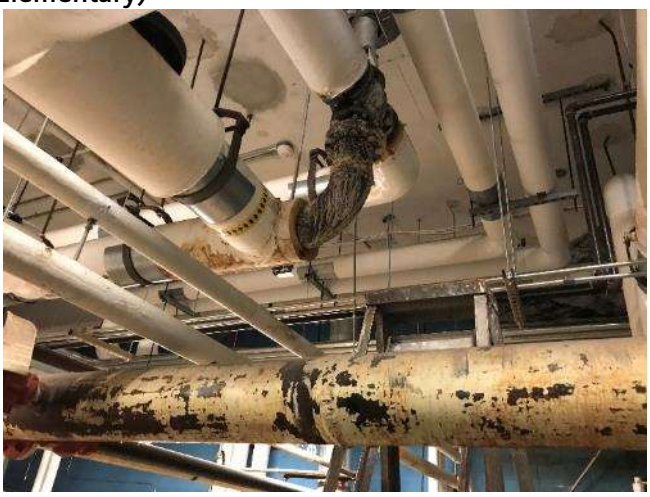
Pipe Insulation / Replacement

Buildings: All Buildings (Replacement specifically at Riley Elementary)

There are multiple lengths of hot water heating pipe that were observed to be uninsulated during the preliminary site visit.

Siemens will insulate the pipe and jacket the valves per NYS standards. This will reduce heat loss in the heating system.

There was also a section of pipe located in the boiler room at Riley Elementary that was rotted and leaking water. Based on the accumulation of water, it seems this has been the case for quite some time. This, and presumably other sections of pipe around the District in similar condition, are in need of replacement.



Future Measures to be Considered

Boiler Replacements

Buildings: Bus Garage

The boiler at the Bus Garage is past its useful life and was identified in the 2015 Building Condition Survey to be replaced.

Description of Opportunity

Siemens will explore the feasibility of replacing these boilers.

The new boilers will be more efficient than the existing boilers overall due to better jacket insulation and more finely tuned air-fuel ratios from the boiler burner regardless of if the standard efficiency or the high efficiency boilers are being fired. The new boilers will update the infrastructure of the building.

Convert Pneumatic Controls to DDC

Buildings: Middle School

There may be other opportunities around the District to convert remaining pneumatic controls to direct digital controls (DDC), but it was communicated to Siemens that the Middle School is the primary candidate for conversion.

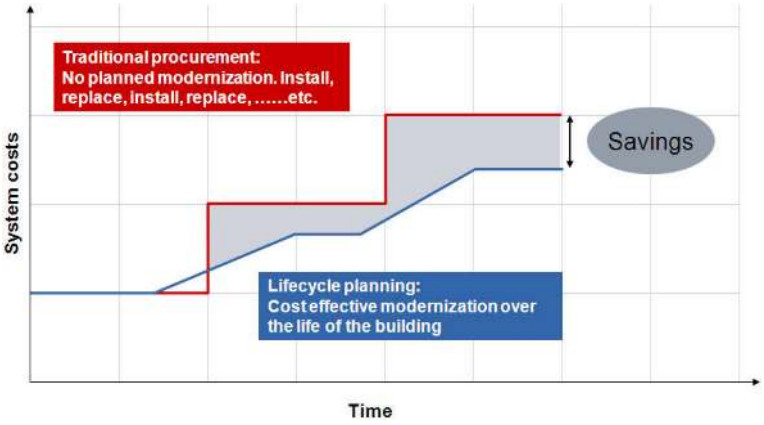
There remains a significant amount pneumatic controls and controllers in the Middle School with no immediate or future plans for conversion to DDC. There is a sizable air compressor and older pneumatic control panels around the building. Where applicable, these controls should be converted to the latest version of DDC (Siemens Desigo) and added onto the existing EMS to add a higher level of automation.

Retro-Commissioning

Buildings: All Buildings

The Retro-Commissioning measure will be a strategy that is followed once Siemens has reached the detailed energy audit phase of the project. At this stage, the extent to which this approach is applied, and in what buildings and areas, is still unknown. Siemens will develop a plan with the District to determine the most suitable areas for retro-commissioning versus areas that will be targeted for more complete replacement (whether it be automation, HVAC, etc.).

Introduction



What makes Siemens' retro-commissioning (RCx) approach unique is our ability to fully diagnose and execute work. Many other firms such as engineering and commissioning firms simply identify and recommend measures, but they are not capable of making corrective actions. Although this may result in identifying the deficiencies and potential cost savings, it does not correct the issues unless a third-party contractor and/or the facilities personnel implement the corrections of the identified deficiencies/cost savings. This results in an effort with some value, but with no tangible impact in system performance at the end of the project. Siemens has decades of experience identifying, understanding and implementing the corrective actions/measures that are required to solve the deficiencies.

This approach will be used to re-commission the building systems at Oswego CSD. These objectives are met by employing a mix of people, processes and technology through the development of an integrated commissioning team comprised of Siemens' building commissioning team (e.g. senior commissioning engineers, senior energy engineers, senior controls technicians, project managers and account engineers); key stakeholders from Oswego CSD including, but not limited to engineers, commissioning engineers, project managers, building engineers, operations and management staff, technicians, mechanics; and any requisite third-party participants. This commissioning scope of work provides an overview of the commissioning process and tasks that will be utilized for this project.

Program Objectives

The goal of the retro-commissioning (RCx) program is to make the building systems perform interactively to meet the Current Facility Requirements (CFR) and provide the tools to support the continuous improvement of system performance over time. The RCx process focuses on the dynamic energy-using systems with the goal of reducing energy waste, obtaining energy cost savings for the owner, and identifying and fixing existing issues.

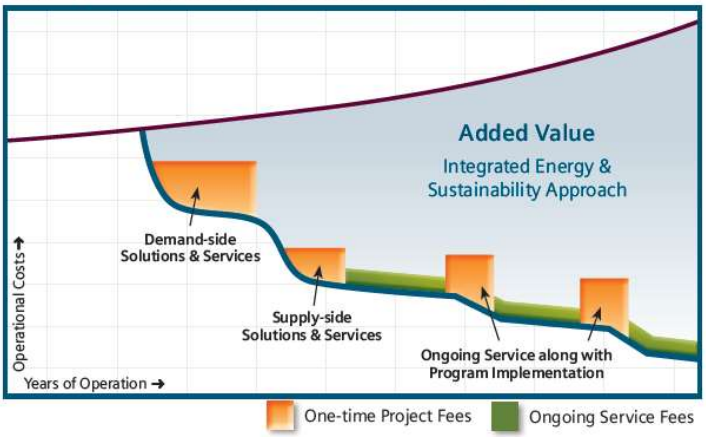
The primary objectives of the RCx program are:

- Document baseline operating conditions through trending of performance measurements.
- Optimize control systems through calibration/replacement of critical sensors, review data and trend logs, and functional performance testing of the equipment in the scope of work.
- Identify energy related operational and maintenance enhancements that result in improvements in energy efficiency and occupant comfort. These will be identified as Commissioning Conservation Measures (CCMs).
- Identify non-energy related preventive maintenance issues. These will be identified as Commissioning Corrective Actions (CCAs).
- Identify operation and maintenance staff training needs (if necessary).
- Identify Facility Improvement Measures (FIMs)

The Siemens Program Team

Siemens, as the RCx authority, will lead, plan, schedule and coordinate the RCx process. The Siemens RCx team consists of the Commissioning Engineer, Energy Engineers, Automation Technician, Project Manager and technicians and in some cases mechanics. This team will also be involved in the implementation.

Existing Buildings: Energy & Sustainability Value Proposition



Description of Opportunity

Siemens shall perform a documented series of verifications and adjustments to the equipment shown below, in support of your commitment to excellence, compliance with ASHRAE regulations and other regulatory standards. These devices, by nature, drift out of calibration with changes in building use, time and climatic conditions. Normal decrease in systems efficiency can be as much as 6% per year. Through our RCx services, we ensure that your HVAC devices and controls are operating in accordance with the Current Facility Requirements (CFR), sequence of operations as written and the readings are within the tolerances your processes require. You will benefit from decreased downtime resulting from out-of-tolerance environmental conditions, compliance with regulatory agencies, and realize a more productive environment. Siemens will assess, investigate, identify and prioritize Commissioning Conservation Measures (CCMs), Commissioning Corrective Actions (CCAs) and Facility Improvement Measures (FIMs) and provide a written report on the tasks performed, findings and future recommendations.

Also Included:

- Quick fixes of minor repairs needed to keep testing and balancing progressing.
- Coordination with all sub-contractors and Oswego CSD throughout the project.
- Utility incentive application and coordination with National Grid.

Commissioning also includes calibration (if required) or replacement (if necessary) of the above listed sensors/detectors up to the estimated implementation cost.

Final Commissioning Report

Siemens provides Oswego CSD with a final commissioning report as a record of the RCx activities and recommended measures, which will become an important document for the building and an invaluable resource to current and future building operators.

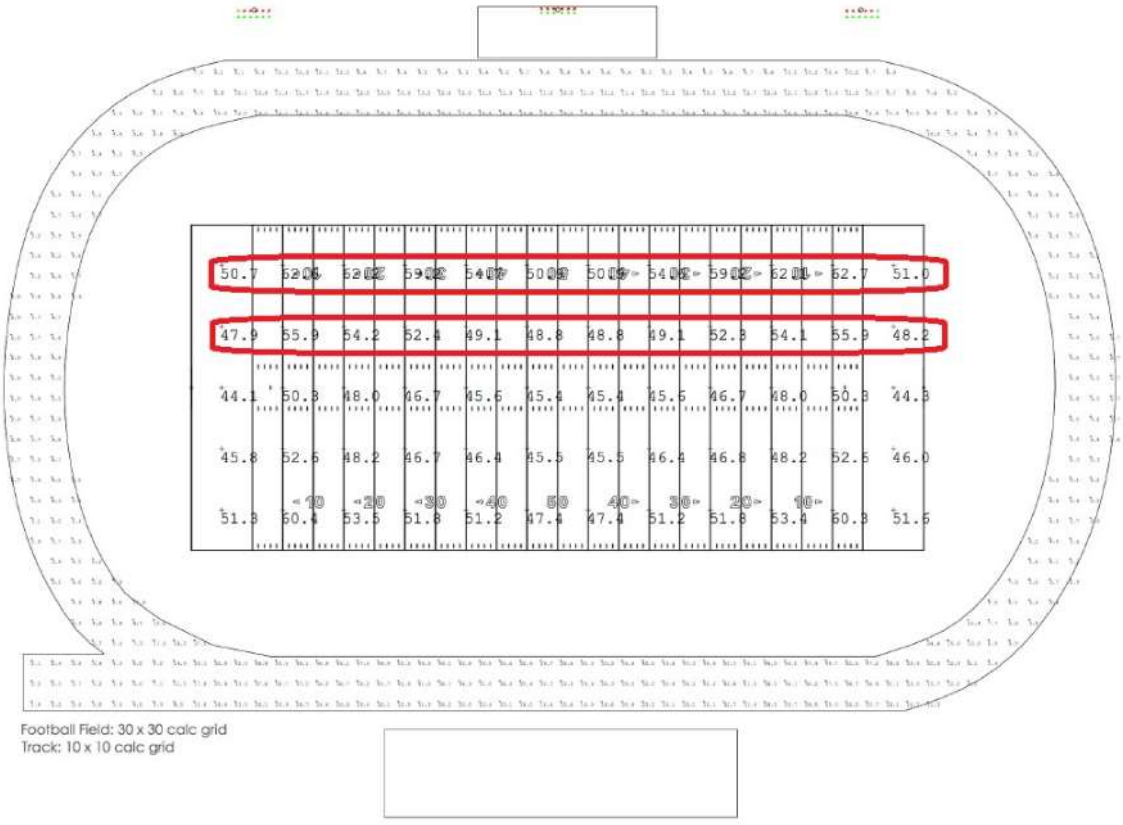
Convert Field Lights to LED

Buildings: Middle School

There is an athletic field located behind the Middle School that is lit with high-wattage HID metal halide fixtures. These fixtures are known to cause significant maintenance issues, as most districts do not possess the equipment necessary to regularly replace lamps and other components when they fail. This causes the lighting system to operate with less than full light output for a period of time before the district has a subcontractor out to the site to perform the replacement work. This work typically comes at a very high cost, as a heavy-duty lift is necessary to reach the high pole-tops.

A new LED field lighting system would drastically reduce the required maintenance and replacement required to maintain the lighting system. The long life of the new LED fixtures (typically upwards of 100,000 hours and beyond) eliminates the need for regular maintenance for outages. The new system would also significantly improve the overall light output and quality for the field.

An example photometric study is shown below for a football field to illustrate the light levels that a new lighting system would achieve:



Example Photometric Analysis of an Athletic Field with New LED Lighting

Water Conservation Measures

Buildings: All Buildings

Many of the faucets, toilets, urinals and showerheads in the District are standard flow units.

During the preliminary walk-through, a variety of different pre-rinse sprayers were identified in food preparation areas. Pre-rinse sprayers are often used at dishwashing stations to remove food waste. Typically, hot water is used through these sprayers, so a reduction of water flow also provides an energy savings due to the reduction of hot water. They are also used in dishwashing applications because of the force of water the nozzle exerts.

Description of Opportunity

Faucets, showerheads, toilets and urinals offer good water saving opportunities because many of these fixtures can be retrofitted to reduce the amount of water consumed per flush (toilets and urinals) or per minute of use (sinks and showers). Reducing domestic water usage will result in a reduction in water use along with fossil fuel energy savings due to more efficient hot water use.

Replacing old, inefficient pre-rinse sprayers with high-efficiency ones can save a typical commercial kitchen more than 7,000 gallons of water per year on average. That's equivalent to the amount of water needed to wash nearly 4,800 racks of dishes. Because kitchens use hot water to rinse dishes, installing a high-efficiency, pre-rinse spray valve can reduce a commercial kitchen's annual natural gas use by more than 5,700 cubic feet per year.

Siemens proposes to retrofit and/or replace domestic plumbing fixtures with modern, high-efficiency fixtures. Siemens will provide a detailed count after the Comprehensive Energy Audit.

Siemens also recommends replacing the existing pre-rinse sprayers with 0.6 GPM straight sprayers.

Project Action Plan

Project Development

Audit Kick-off – Management / Facilities
Baseline / Field Work
Savings Calculations
Project Scope Verification / Development / Priorities
Project Pricing / Bidding
Finalize Scope
Develop Project Financials

Finalize Project for SED Submission

SED Project Number
Detailed Energy Audit Report
Contract / Legal Review
Finalize Design Documents
SED FP-F Forms
Lighting Mockups

District 3rd Party Consultant Review

SED Review

SED Submission
SED Engineering Review
SED Review / Approval

RFP Financing

Solicit RFP
Review Proposals
Review Lease Documents

Project Construction

Program Benefits

› Program is self-funded through energy retrofits

› Energy work funds additional capital needs

› Uses Lease Purchase financing **“no impact to debt cap”**

› State Building Aid included

› New York State utility incentives, NYSERDA P-12

› Performance-based program over 18-year term

Appendix

NEW YORK STATE ENERGY LAW ARTICLE 9 - ENERGY PERFORMANCE CONTRACTS

IN CONNECTION WITH PUBLIC BUILDINGS AND FACILITIES

Section

§ 9-101. Purpose

The purpose of this article is to obtain long-term energy and cost savings for agencies and municipalities by facilitating prompt incorporation of energy conservation improvements or energy production equipment, or both, in connection with buildings or facilities owned, operated or under the supervision and control of agencies or municipalities, in cooperation with providers of such services and associated materials from the private sector. Such arrangements will improve and protect the health, safety, security, and welfare of the people of the state by promoting energy conservation and independence, developing alternate sources of energy, and fostering business activity.

§ 9-102. Definitions

For the purposes of this article, the following words and phrases shall have the following meanings unless a different meaning is plainly required by the context.

1. "Agency" means any state department, agency, board, commission, office, or division.
2. "Municipality" means a municipal corporation, as defined in section two of the general municipal law, school district, board of cooperative educational services, fire district, District Corporation or special improvement district governed by a separate board of commissioners.
3. "Public authority" means any public authority, public benefit corporation, or the port authority of New York and New Jersey, to the extent its facilities are located within the state of New York.
4. "Energy performance contract" means an agreement for the provision of energy services, including but not limited to electricity, heating, ventilation, cooling, steam or hot water, in which a person agrees to install, maintain or manage energy systems or equipment to improve the energy efficiency of, or produce energy in connection with, a building or facility in exchange for a portion of the energy savings or revenues.

§ 9-103. Energy performance contracts

1. Notwithstanding any other provision of law, any agency, municipality, or public authority, in addition to existing powers, is authorized to enter into energy performance contracts of up to thirty-five years duration, provided, that the duration of any such contract shall not exceed the reasonably expected useful life of the energy facilities or equipment subject to such contract.

2. Any energy performance contract entered into by any agency or municipality shall contain the following clause: "This contract shall be deemed executory only to the extent of the monies appropriated and available for the purpose of the contract, and no liability on account therefore shall be incurred beyond the amount of such monies. It is understood that neither this contract nor any representation by any public employee or officer creates any legal or moral obligation to request, appropriate or make available monies for the purpose of the contract."

3. In the case of a school district or a board of cooperative educational services, an energy performance contract shall be an ordinary contingent expense, and shall in no event be construed as or deemed a lease or lease-purchase of a building or facility, for purposes of the education law.

4. Agencies, municipalities, and public authorities are encouraged to consult with and seek advice and assistance from the state energy office and the New York state energy research and development authority concerning energy performance contacts.

5. Notwithstanding any other provision of law, in order to convey an interest in real property necessary for the construction of facilities or the operation of equipment provided for in an energy performance contract, any agency, municipality or public authority may enter into a lease of such real property to which it holds title or which is under its administrative jurisdiction as is necessary for such construction or operation, with an energy performance contractor, for the same length of time as the term of such energy performance contract, and on such terms and conditions as may be agreeable to the parties thereto and are not otherwise inconsistent with law, and notwithstanding that such real property may remain useful to such agency, municipality or public authority for the purpose for which such real property was originally acquired or devoted or for which such real property is being used.

6. In lieu of any other competitive procurement or acquisition process that may apply pursuant to any other provision of law, an agency, municipality, or public authority may procure an energy performance contractor by issuing and advertising a written request for proposals in accordance with procurement or internal control policies, procedures, or guidelines that the agency, municipality, or public authority has adopted pursuant to applicable provisions of the state finance law, the executive law, the general municipal law, or the public authorities law, as the case may be.

7. Sections one hundred three and one hundred nine-b of the general municipal law shall not apply to an energy performance contract for which a written request for proposals is issued pursuant to subdivision six of this section.

8. In the case of a school district or a board of cooperative educational services, an energy performance contract shall be developed and approved pursuant to the requirements of this section and pursuant to regulations promulgated by the commissioner of education in consultation with the New York state energy research and development authority. Such regulations shall include, but shall not be limited to: a list of the appropriate type of projects that qualify as energy performance contracts; an approval process that includes review of the type and nature of the proposed project, the scope and nature of the work to be performed, and a detailed breakdown of the energy savings to be derived each year and for the duration of the energy performance contract; and a process for ensuring that districts have obtained financing at the lowest cost possible. Such regulations shall require that all energy performance contracts which contain maintenance and monitoring charges as part of the energy performance contract price state such maintenance and monitoring charges separately in the contract in a clear and conspicuous manner. Such regulations shall not apply to energy performance contracts entered into prior to the effective date of such regulations, nor shall they apply to energy performance contracts for which a request for proposals was issued prior to such effective date.

Added L. 1985, c. 733, § 2; amended L. 1989, c. 638, §§ 1,2; amended L. 1994, c. 368, §§ 1,2; amended L. 1995, c.83, §47; amended L. 1997, c. 436, §78.