ENERGY CONSERVATION AND DEMAND MANAGEMENT (CDM) PLAN

Erie Shores HealthCare

2019-2024

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INTRODUCTION

The overall purpose of Erie Shores HealthCare's CDM plan and policies is to promote good stewardship of our environment and community resources. In keeping with our core values of compassion, respect, trust and accountability, Erie Shores HealthCare's CDM plan will ultimately result in reduced operating costs and enable the Hospital to provide compassionate service to a greater number of persons in the community.

- Utility and energy related costs are a significant part of overall operating costs
  - Utility costs in the 2018/19 fiscal year were $562,835.00.
  - Facility related O&M costs are $1,580,000.00 annually
  - Facility capital project costs are projected at $2.5 million over 5 years

GUIDING PRINCIPLES FOR STRATEGIC ENERGY MANAGEMENT

Taking A Strategic Approach: While Erie Shores HealthCare actively manages energy and utility costs by implementing opportunities as they are identified, by acting strategically, the Hospital can significantly improve its energy-related performance. Internalizing energy and utility Management into our organization's every-day decision-making, policies, and operating procedures will help assure substantial and long-lasting reductions in energy use throughout

Supporting Mission-Critical Goals: Strategic energy management will directly support Erie Shores HealthCare mission-critical goals of caring for the environment and the community. It will also help the Hospital to optimize the healing and working environment; improve the hospital's financial bottom line by reducing unnecessary energy and utility costs; and optimize the capacity of existing energy systems to meet current and expanding operational needs. The impacts of Erie Shores HealthCare's energy management efforts on those goals will be tracked and reported wherever possible.

Pursuing Long-Term Change to Core Business Practices: The core of a strategic approach is the consistent incorporation of energy and utility management into our organization's core practices and decision making, such as the strategic planning and budgeting processes. Change in energy-related business practice will cover all applications of energy management – new construction and major renovations, existing facility operations and upgrades, and economic analysis and procurement practices.

Obtaining Solid Economic Returns: Energy management investments will yield solid economic returns that meet Erie Shores HealthCare's expectations on Internal Rate of Return and Return on Investment. Erie Shores HealthCare will apply consistent financial analysis methods that consider life-cycle costs that reduce total cost of facility ownership and operation.

Using Available Resources and Assistance: Erie Shores HealthCare will use national, regional, and local sources of strategic, technical, and financial assistance to help achieve our energy management goals. These include programs through local distribution companies, the Ontario Power Authority, ENERGYSTAR, saveONenergy, the Canadian Coalition for Green Health Care, The Canadian Healthcare Engineering Society, and EnerCan.

ENERGY MANAGEMENT GOALS

The following outlines some of the energy management goals that will be pursued by Erie Shores HealthCare. They include, but are not limited to, the following:

- Senior Management Approval, Resources to Implement
- Implement Financial Practices and Decision Making Processes; Establish Funding Resources
- Implement Strategic Energy Management Practices
  - Purchasing/Procurement Procedures and Specifications
  - Enhanced Design & Construction Practices
  - Enhanced Facility Operating Practices
  - Cost-Effective Facility Upgrades
  - Active Commodity Management
- Monitoring, Track, & Improve Performance

Goal: Senior Management Approval, Resources to Implement

- Executive approval process adjustments and resource allocations to support initiatives.
- Support from key staff (financial management, purchasing/procurement, construction, building operations, etc.).
- Creation of mechanisms/processes to make resources available.
- Clarification and communication of staff roles and responsibilities, performance goals, and energy management reporting.

Goal: Implement Financial Practices and Decision Making Processes

- Money spent to achieve energy efficiency is viewed as an investment, not a cost.
    - Financial decision makers consistently use life cycle cost analysis (LCCA) on all new construction, major renovations, and equipment replacements over lowest cost
    - Internal rate of return (IRR) as "pre-approved" by the Hospital Board and Administration.
    - Train staff on Life Cycle Cost Analysis (LCCA) and financial requirements and decision making process.
- Decisions about energy management investments will be part of Erie Shores HealthCare's high-level, long range process of budgeting for capital and operations.

Goal: Establish Purchasing Specifications for Energy Efficient Equipment and Services

- Establish and consistently use purchasing specifications that minimize life-cycle costs for energy efficient equipment and services.
- Establish efficiency specifications for standard equipment routinely replaced (e.g. lights, motors, and unitary HVAC equipment).
- Establish efficiency guidelines that apply LCCA for custom equipment purchases (e.g. chillers).
- Establish efficiency standards for design and construction, and for building operations and maintenance services.

Goal: Implement Enhanced Design & Construction (D&C) Practices

- Implement improved new construction practices in all capital projects that specify early team collaboration and "integrated design" (ID).
    - Integrated design required for funding.
    - RFPs, contract terms & conditions, & fee structures will support ID.
    - Apply LCCA and financial hurdle rates described above to design decisions.
    - Apply established purchasing procedures and specifications.
    - Include incentives and tax credits wherever available.
    - Educate all owner's project managers or construction managers and contractors on integrated design and their respective roles in master planning pre-design, design, construction, testing, commissioning, and monitoring.

- Set and meet clear energy performance targets for new build projects; measure and improve over time.
    - Establish baseline for measuring performance goals (e.g. code, or national reference standards like ASHRAE 90.1).
    - Set targets.
    - Measure performance and improve over time.

- Specify commissioning as a standard procedure.
    - Retain the services of an independent third-party commissioning agent.
    - 100 percent of fundamental building systems and elements will be designed, installed, and calibrated to operate as designed.
    - Design team, commissioning agent, and building operators will work closely throughout the design process and occupancy to ensure good transition.

Goal: Improve Building Operating Performance

- Equipment tune-up and improved operations and maintenance (O&M) could achieve the following results while supporting patient care, and facility comfort and safety.
    - Achieve reductions in utility related operating costs for existing facilities by an average of 10% over 5 years and continue to improve by 1% per year for 5 years thereafter.
    - Improve ENERGYSTAR rating.

Goal: Implement Cost-Effective Facility Upgrades

- Implement equipment and system upgrades where justified by life-cycle cost analysis.
- Expand use of qualified service providers as needed. Develop standard RFP documents, contract terms, and reporting standards.

Goal: Actively Manage Energy & Utility Commodities

- Minimize utility costs and exposure to market risks. Utility costs include natural gas, electricity, water, and sewer.
- Participate in the energy/utility regulatory process.

Goal: Monitor, Track, and Reward Progress

- Track progress on Energy and Demand Management Plan
- Track energy reductions monthly and report annually.
- Reward staff for successes.

BASELINE ENERGY USE

The baseline energy profile has been selected using data from 2018. This baseline was used to calibrate energy end-use estimates and as the reference case for calculating energy savings.

UTILITY ANALYSIS AND BENCHMARKING

The following sections detail the energy and water analysis that was performed on the facility at 194 Talbot Street West, Leamington, ON, and includes a utility analysis, energy breakdown, and benchmarking. These elements were examined in an attempt to compare this building to other similar buildings, identify trends or anomalies, spot areas where improvements are possible, and establish a baseline year.

UTILITY ANALYSIS

The utility analysis examines past electricity, natural gas, and water consumptions. In addition to this analysis, a total cost per unit was established for each utility that takes into account both historical and recent prices. These costs will be used throughout the report when estimating costs and savings and are summarized in the following table. It should be noted that natural gas and electricity are distributed by the local utility but purchased from a separate retailer. In the case of electricity an invoice is only issued by the utility, however in the case of natural gas invoices are issued by the retailer and local utility. The monthly invoice from the utility is generally based on metered usage while invoice from retailer is based on estimated usage. The difference between estimated and actual usage is reconciled once a year. As a result the paid cost per unit of natural gas on a monthly basis does not reflect the actual price paid due to the end of year reconciliation. The natural gas unit cost was calculated to reflect the end of year reconciliation and reflects the price of natural gas consumed.

UTILTIY COSTS PER UNIT

Utility	Cost	Unit
Natural Gas	0.17	$\$/m^3$
Water	3.18	$\$/m^3$
Electricity	0.12	$/kwh

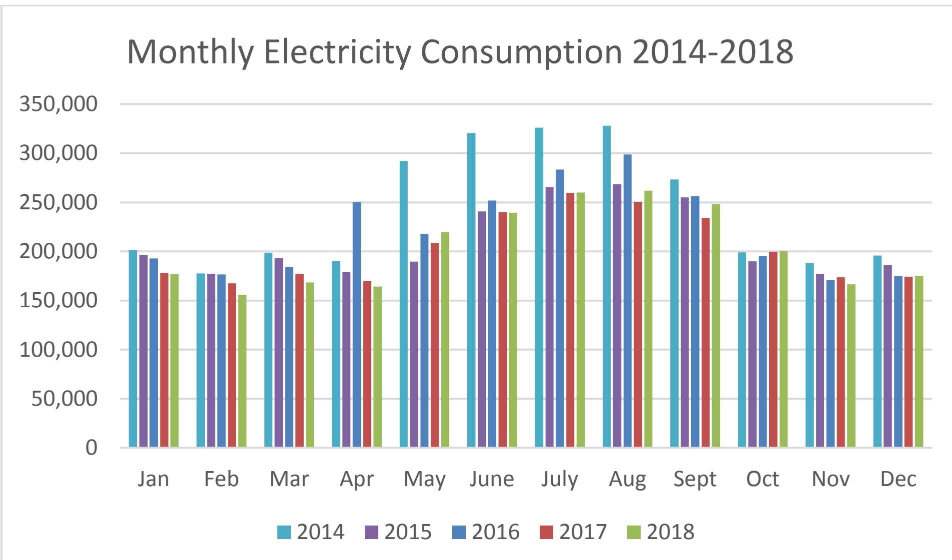
Another aspect of this utility section involves using a linear regression analysis to determine the baseline year consumptions for both electricity and natural gas. These consumption values are modified annual values intended to reflect a typical year with respect to weather conditions. This type of analysis ensures that benchmarking and savings calculations are based on a normal year and not one with an irregular number of elevated or decreased degree days. The equations used, as well as the resulting baseline values are summarized in the following table.

BASELINE YEARS FOR EACH UTILITY

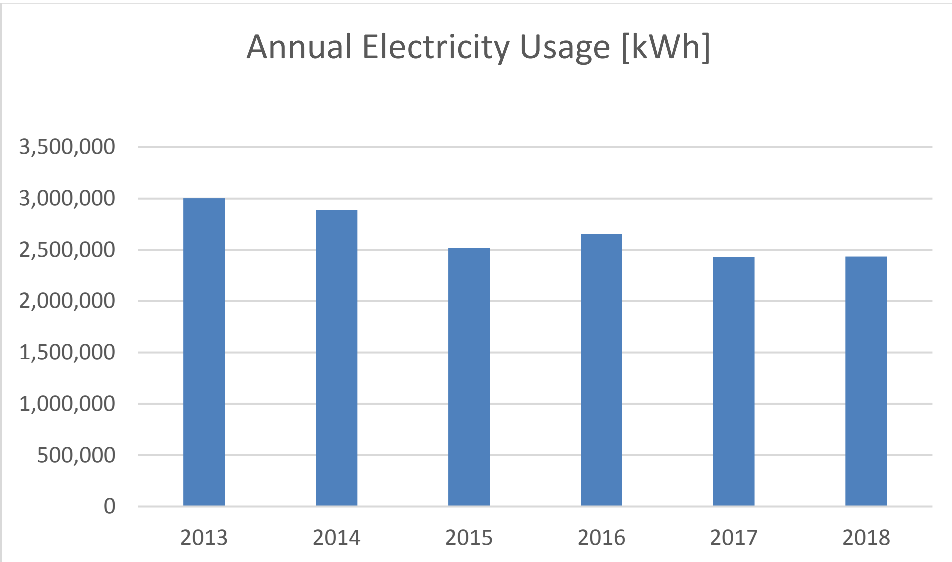
Utility	Equation	Baseline Consumption
Electricity	Annual kWh =(6975.9*365)+(944.16*CDD)	2,610,349 kWh/year
Natural Gas	Annual m^3 =(43.203*HDD)+(754.67*365)	400,910 m^3/year

ELECTRICITY

Electricity consumption data was plotted according to the data collected. A graph illustrating consumption has been generated detailing monthly by year as well as yearly. The figure below demonstrates the electrical consumption on site.



ELECTRICITY DEMAND BY MONTH



Demand is elevated during the cooling season and relatively consistent otherwise. The periods of increased demand may be attributed to bringing increased cooling equipment online to help with the cooling load.

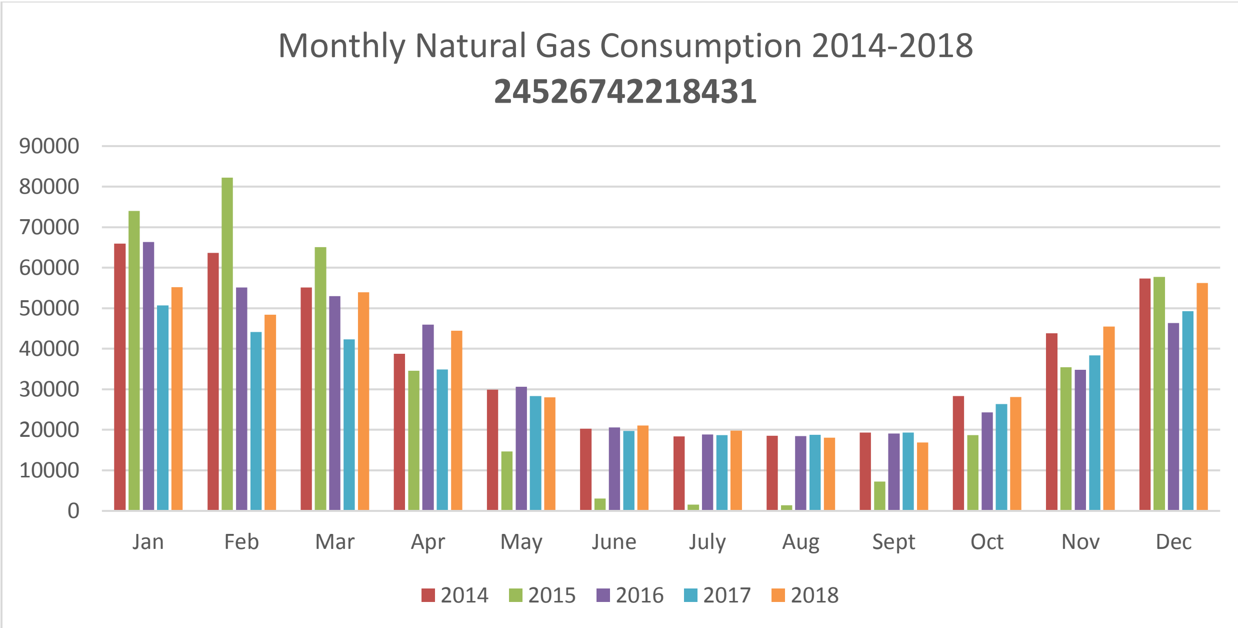
TOTAL COST SAVINGS OF ELECTRICITY

The total cost associated with electricity fluctuates as consumption changes from month to month. This is expected and helps visualize the effect of consumption in financial terms rather than units of energy.

Electrical conservation efforts from 2013 to 2018 have resulted in a significant reduction in electricity usage. Based on the 2013 rate of usage, we had achieved a savings of 2080817 kWh by 2018. At 2018 prices, this created $208, 081.17 in savings or a 23% drop in electricity usage.

NATURAL GAS

Natural gas consumption data was plotted according to the data collected. A graph illustrating consumption has been generated, as well as monthly consumption figures. The figure below demonstrates the natural gas consumption on site.



The previous figure clearly illustrates the correlation between natural gas use and heating degree days. It is evident that as the number of heating degree days increases and the need for heating becomes greater, consumption will increase. This trend is to be expected. It should be noted some of the consumption values where estimated due to billing information not being available for that month.

TOTAL COSTS OF NATURAL GAS

As discussed above natural gas is distributed by the local utility but is purchased from a third party retailer. There are two invoices issued for natural gas one is from the local utility and the other is from the retailer. The utility invoice is generally based on metered usage while the retailer invoices based on estimated usage. The estimated usage is reconciled with actual usage once a year. Due to this costing model the cost paid per month for natural gas does not reflect the actual cost for natural gas due to the annual reconciliation.

UTILITY RATE STRUCTURE

The main utilities for the facility are water, electricity and natural gas.

Water is provided by the local municipality and with the metering and billing functions contracted to Essex Power Services (Essex Powerlines Corporation). The rates for the water and sewer usage are set by the municipality. Natural gas and electricity is distributed by the local utilities (Union Gas and Essex Powerlines Corporation respectively) and are purchased from ECNG Energy L.P. ECNG Energy purchases electricity and natural gas form a variety of sources at different rates. As such the rate paid for these utilities fluctuates based on time of year, time of purchase, demand and market conditions.

BUILDING SUMMARY

The facility located at 194 Talbot Street West in Leamington, ON consists of a four storey acute care hospital with 2 complex chronic care beds and 10 rehab beds. The facility which has undergone many renovations since its original construction in 1950. The building has a gross floor area of 12,330 m^2 (132,725 ft^2), and a gross roof area of 4,505 m^2 (48,500 ft^2). The hospital is located on 1.73 hectares of land, located between Talbot Street West, Fader Avenue, Brown Street & Armstrong Drive. In addition to the building and access roads, the property has open parking for approximately 213 cars. Several areas, such as the emergency area and patient rooms, are continuously occupied; whereas, the remaining areas are generally occupied between 7AM and 4PM. The hospital has a capacity of approximately 100 beds, but currently only operates 58 beds. The exterior cladding of the building generally consists of brick masonry; however, the building envelope is currently being replaced with metal cladding with a vapour barrier, metal stud framing, and rigid insulation. The roofing in this building consists of a conventional built-up, multi-ply tar and felt membrane system (BUR) with pea gravel topping. A building automation system is present at the subject facility which is generally used to diagnose trouble calls and/or complaints. The system as currently configured allows for centralized control of certain set points as well as some ON/OFF capabilities.

BUILDING PERFORMANCE AND BENCHMARKING

The Building Energy Performance Index (BEPI) is used to express the total amount of energy used in a building on an annual basis in relation to the building's gross floor area. In other words it is a measure of the energy intensity in a building. The BEPI is calculated by dividing the total annual energy used (all energy utilities in common units) by the gross floor area. The BEPI at this facility was calculated to be 596.29 ekWh/m^2/year, or 2.15 GJ/m^2/year.

The table below compares the BEPI calculated at this facility to benchmarks established by different organizations and branches of government for buildings with similar operations.

Source	Value (ekWh/m^2/year)	Value (GJ/m^2/year)
Calculated in Utility Analysis	596.29	2.15
OEE- Healthcare and Social Assistance	772	2.78

MECHANICAL SYSTEMS CHARACTERISTICS

The entire building's heating and process steam requirements are currently met with the use of three high pressure steam boilers located in the Main Boiler Room on the Ground floor level. The steam generation plant consists of two Indeck Volcano two drum multi-pass watertube boilers (each rated at approximately 75 HP), and one Cleaver Brooks two drum three-pass watertube boiler (rated at approximately 143 HP).

Steam is generated at a pressure of 100 PSI, to minimize main distribution piping sizes, and distributed throughout the Hospital utilizing a system of piping and condensate control devices. The high pressure steam is reduced to lower pressures, depending on the function or the system served. Typically 60 PSI steam is used for sterilizing equipment and is provided in the CSR area and in the two Sub-Sterile rooms located between the main Operating Rooms on the first level of the South Wing. Steam at 30 PSI pressure is provided to the Kitchen Ware washing area on Level 1, and 15 PSI is utilized for steam heating, humidification on air handling systems and generating hot water for both the hydronic heating system and domestic water use.

The hydronic heating system consists of reheat coils, perimeter hot water radiators and heating coils within some of the air handling units. Generally the larger Cleaver Brooks (CB) boiler is utilized during the winter heating system, with either of the two Indeck Volcano boilers being used as supplemental capacity on the days when the building's requirements exceeds the capabilities of the CB boiler. During the warmer spring/summer months when there is no heating requirements, either one of the two 75HP boilers is adequate to meet steam requirements.

The physician offices on the 3rd level are serviced by a packaged gas fired units.

Cooling System

The facility utilizes a variety of cooling systems which depends on the location of the area being serviced and the cooling requirements of the area.

The majority of the cooling for the facility is provided by a chilled water system. Chilled water is produced by a water cooled chiller located in the main boiler room. The chiller is a single stage semi hermetic design and is manufactured by TurboCor and has a capacity of 292 tons. Heat rejection for the chiller system is provided by a single cooling tower. The cooling tower is manufactured by Marley and is equipped with a VFD drive to match the cooling tower operations to the heat rejection load. The chilled water is feed to chilled water coils in air handling units located throughout the facility.

The air handling units for the Operating Rooms and Laboratory/Nuclear Medicine contain both chilled water coils and DX coils. The reason for this combination is these areas require all year cooling. During the winter months when the chiller is not operational the DX system cools the space. There are two DX systems each have a capacity of 7.5 tons and are manufactured by Trane.

The physician offices on the third level are cooled by packed units. There are two units both are manufactured by Carrier and have a capacity of 7.5 tons. The data centre on the third floor is partially conditioned a packaged DX cooling unit. The unit is manufactured Carrier and has a capacity of 2 tons.

There are numerous ductless DX split systems located in various locations throughout the building. These systems consist of a fan coil unit in the area to be cooled and an air cooled condenser located on the exterior of the facility. There are also some through the window portable air conditioning systems. These systems are generally located in areas which require supplemental cooling due to high equipment loads or are in spaces not connected to the main system.

Ventilation System

A ducted air system distributes a mixture of fresh air and returned air throughout the facility. Depending on the vintage of the addition there are different ducted air systems. There are both dual duct and single duct systems. The systems are also a mixture of constant flow and variable air volume designs.

Fresh air is supplied to the building from a variety of supply fans that reported provide a constant level of fresh air. Air is exhausted from the facility by a series of exhaust fans.

The exception to the central ducting system is found on the third floor of the facility. The system in this area is a ducted system connected to rooftop packaged units. The system works on a variable volume and temperature system that uses room thermostats to modulate duct mounted control dampers open and closed to adjust air volumes to satisfy the space requirements.

Domestic Hot Water System

Domestic hot water within the facility is generated from the steam heating loop. The steam from the heating loop is fed into a heat exchanger that heats the domestic hot water. The domestic hot water is stored in one of four storage tanks.

Building Automation Systems

The facility is equipped with a building automation system (BAS). It was reported the system is a hybrid system with both pneumatic and direct digital control components. The space temperature and schedule is reportedly controlled by local users.

The third floor offices serviced by the packaged units are reportedly controlled by local controls.

Electrical Systems Characteristics

Interior Lighting Systems

The interior lighting consists of T8 linear fluorescent and LED fixtures in the basement and first floor, and four and two foot T8 linear fluorescent and LED fixtures on the second and third floors. Patient room contain one 126 Watt T5 fixture for each bed, and incandescent and compact fluorescent lamps in the washrooms. All lighting is manually controlled by local switches.

Exterior Lighting System

Exterior lighting consists of wall-mounted and pole-mounted high pressure sodium fixtures. It was reported that exterior lighting is controlled by photo cell sensors.

Conveying System

The facility is serviced by four overhead traction elevators.

ENERGY CONSERVATION STRATEGIES

Conservation measures can be generally grouped into two categories; low cost/no cost measures, and measures requiring some level of capital investment. Low cost/no cost measures are often associated with the modification of behaviors and/or practices or maintenance related improvements. Measures requiring some level of capital investment include all those measures that would not be included in the typical preventative maintenance and/or operations budgets.

ECM1 – SCHEDULING OF HVAC SYSTEMS

Simple payback – 0.9 years

The Building Automation System (BAS) as currently configured allows for centralized control of certain set points as well as some ON/OFF capabilities. Scheduling can be taken advantage of with the addition of more sensors, VFD's and controls. Aside from the patient floors where occupancy is constant, many areas of the hospital operate under daily schedules. For those areas, scheduling major equipment would result in savings for not only distribution equipment, but also through a reduction in load on the heating and cooling plants.

ECM's 2-5 all require that the LDMH plan for and obtain additional capital investment budgets outside of the annual operations and maintenance budgets. However, if implemented, these measures will contribute to energy savings as well as potential improvements to occupant comfort and system maintainability.

ECM2 – KITCHEN HEAT RECOVERY

Simple Payback – 10.4 years

In the current state, the exhaust hoods located in the kitchen exhaust conditioned air to the environment. The installation of a heat recovery system would allow for some of the thermal energy contained within the exhausted air to be captured and returned to the facility through the fresh air system(s). Implementation of this measure would contribute to a reduction in heating load to the main steam boiler plant.

ECM3 - DEDICATED DHW BOILER

Simple Payback – 4.3 years

Domestic hot water is currently generated using a series of four, steam-to-water, DHW generators. During the summer months, the steam plant continues to operate. While steam is also required to service the two autoclaves, it is currently being generated as high pressure steam where the DHW generators require only low pressure steam. Replacing the existing steam-to-water DHW generators with dedicated DHW boilers may result in a net savings in natural gas associated with a reduction in steam load during all seasons.

ECM4 – EXTERIOR LIGHTING UPGRADES

Simple Payback – 29.4 years

Exterior lighting consists of wall-mounted and pole-mounted high pressure sodium fixtures which operate on a photocell system. More energy efficient systems are currently available to illuminate the exterior of the facility. Some possible replacements for the HPS fixtures that could yield energy savings are induction or LED fixtures. It is recommended that the exterior light fixtures and lamps be converted to LED due to the higher level of energy savings.

ECM5 – PLUMBING FIXTURE REPLACEMENT

Simple Payback – 1.4 years

Plumbing fixtures in the facility consist of high-flow water closets (13.2 LPF), high-flow urinals (5.7LPF), high-flow showers (9.5 LPM) and lavatories with high-flow aerators (7.6 LPM). It is recommended to replace the high-flow fixtures with their low-flow and ultra low flow equivalents: water closets (6 LPF), urinals (0.5 LPF), showers (3.8 LPM) and Lavatories aerators (1.4 LPM).

COMPLETED ENERGY PROJECTS

Interior Light Replacement

The majority of the building was illuminated with 40 W and 34 W T12 and 32 W T8 fluorescent fixtures. Replacement of the fixtures with a more energy conscious technology such as T8 LED fixtures involved a large capital expenditure; however, it resulted in a reduction of approximately 300000 kwh of electricity which is equivalent to $30,000 in savings or a reduction of 33 metric tonnes of CO_2.

Greenhouse Gas Emissions

Greenhouse gas emissions are calculated based on 2018 usage.

UTILITY	USAGE	GREENHOUSE GAS
Electricity	3002327 kwh	330 metric tonnes
Natural Gas	2080817 m3	3933.5 metric tonnes