2019-2023 Energy Conservation and Demand Management Plan

Runnymede Healthcare Centre

FINAL • JUNE 2019

BUILDING TOWARDS A SUSTAINABLE FUTURE

Under Ontario Regulation 507/18, Ontario's broader public sector organizations are required to develop and publish an Energy Conservation and Demand Management (ECDM) Plan by July 1, 2019. Technical advice and analysis for this ECDM Plan were provided by Enerlife Consulting Inc.

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Executive summary

Runnymede Healthcare Centre (RHC) has prepared this Energy Conservation and Demand Management (ECDM) plan (the Plan) that will reduce energy consumption and greenhouse gas (GHG) emissions, lower utility costs, upgrade building systems and provide a positive economic return on investment. The Plan presents energy savings achieved and lessons learned since the previous plan was posted in 2014, and lays out the goals, strategy and business case for the Hospital's energy efficiency investments over the next five years. We are committed to improving our energy efficiency, while maintaining occupant comfort and meeting the expectation of the general public and the Ministry of Health to efficiently deliver the highest quality healthcare services to our community.

The Plan forms an integral part of the Hospital's public reporting.

In the previously approved ECDM plan posted July 1, 2014, RHC set an ambitious goal to reduce electricity and natural gas by 21% (in utility cost) over the plan's 5-year term. Water use was not addressed in the 2014 plan, but measures to improve water use efficiency have been tackled.

Table 1 presents actual results achieved. A total of 18% utility cost reduction (20% electricity, 22% natural gas, and 9% water savings) were recorded in 2018 compared to our 2013 weather-normalized baseline, lowering 2018 utility costs by $127,447 and making RHC one of the top-achievers among the Greening Health Care member hospitals[1]. Further details on the measures implemented can be found in Part 3 of the Plan.

Table 1 Electricity, gas, and water cost and GHG emissions savings (target vs actual)

	2013 Target Savings		2018 Actual Savings (vs 2013 baseline)	
Electricity Reduction (kWh)	899,805	24%	760,072	20%
Natural Gas Reduction (m3)	229,069	34%	149,016	22%
Water Reduction (m3)	-	0%	2,363	9%
Total Energy Reduction (ekWh)	3,270,670		2,302,383	21%
Total Cost Reduction ($)	$149,538	**21%**	$127,447	**18%**
GHG reduction (tonnes CO2e)	544.4	31%	254	14%

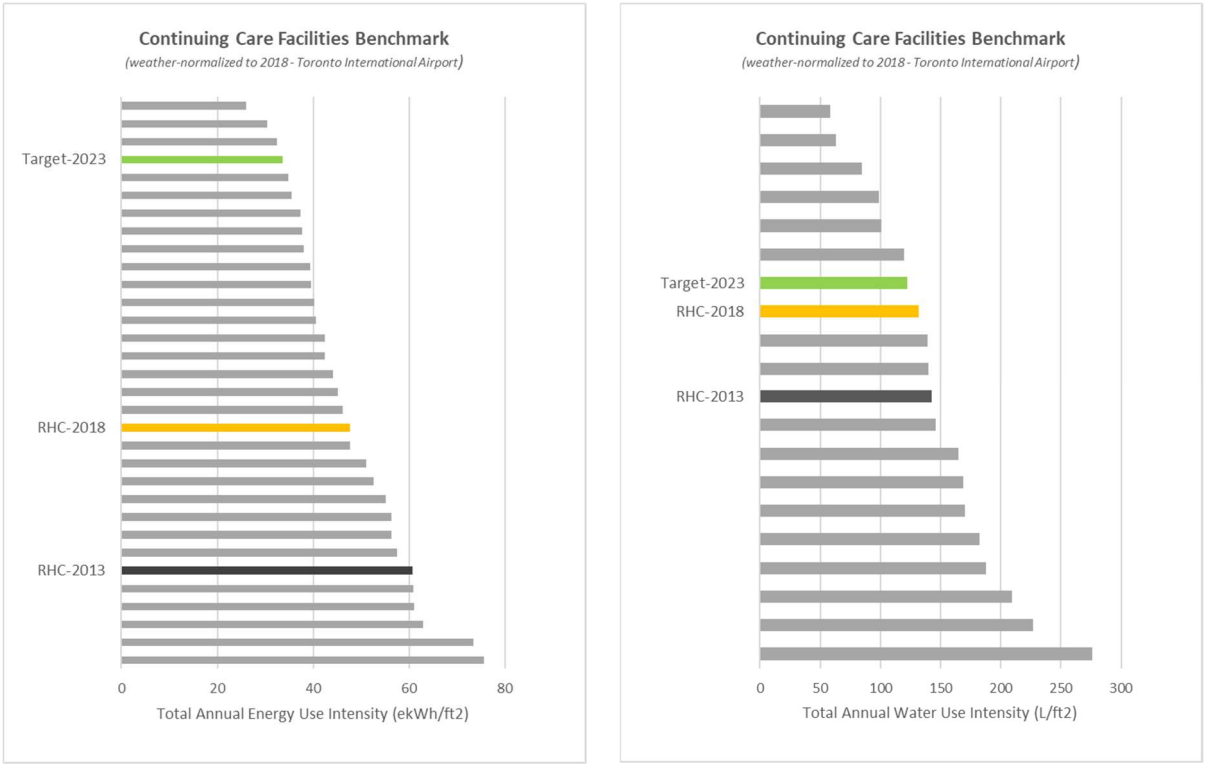
Our progress to date has been among the best for Ontario hospitals. Lessons learned over the past 5 years can help us do even better in future and have been incorporated into the Plan. Key among these are a focus on long-term planning and building the capacity of an integrated team within the organization with training and engagement. RHC has done well in organizing community-based events and had success in the past with a corporate energy team ("Sustainability Forum"). We would like to continue involving the staff and patient community to build a learning organization with an integrated and dynamic team. Champions and key personnel capabilities will be identified, and a long-term capacity building and

[1] Founded in 2003, Greening Health Care is the largest and longest serving program of its kind in North America, helping hospitals work together to lower their energy costs, raise their environmental performance and contribute to the health and well-being of their communities.

succession planning framework will help the organization evolve through learning. Further effort in the next 5 years will be focused on developing energy data reporting and communication, solidifying the Sustainability Forum, and organizing sustainability themed events. These lessons are reviewed in detail in Part 2, Section 3 - Lessons learned.

Our goal for the next five years (2019 to 2023) is to further reduce energy use by 28% and cut water consumption by an additional 8% measured against the new 2018 baselines. These improvements will move RHC into the top quartile of the benchmark chart of top-performers as shown in Figure 1 below.

Figure 1 RHC energy and water benchmarks for 2013, 2018, and 2023 target



The planned improvements prioritize operational efficiencies and management systems for long-term maintenance of savings, along with targeted investments in high-savings potential energy and water efficiency projects as described in Part 3. Capital renewal projects are to incorporate high-performance energy efficiency standards and all new builds and renovations will establish and achieve high-performance energy efficiency targets. Where practical, Health Infrastructure Renewal Fund capital will be directed to projects which can deliver energy and water savings as well as replacement and upgrading of end-of-life building equipment and systems.

The table below summarizes the energy and water efficiency improvements included in the scope of the Plan. Implemented measures are projected to bring in $85,000 of utility company incentives and yield electricity and natural gas savings worth over $133,000 per year at current utility rates. The associated GHG emissions reduction is 365 tonnes CO2e per year.

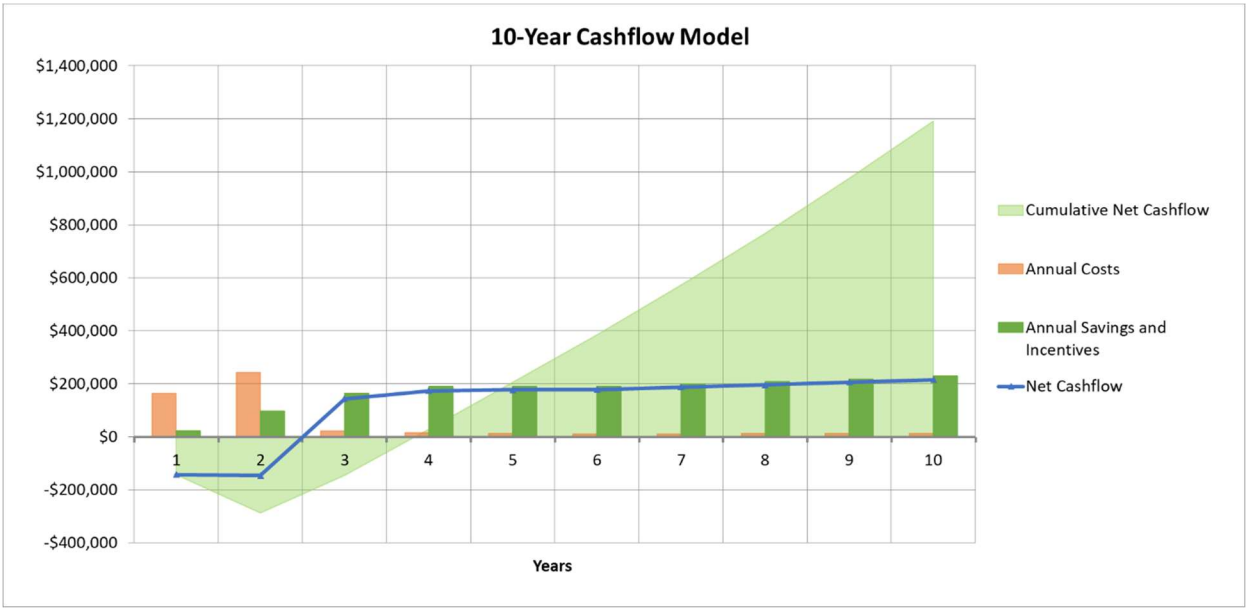
Table 2 Energy and Water Efficiency Projects Summary

Measure	Description	Payback	Project Cost ($)	Total Savings ($)	Estimated Incentives ($)	GHG Emissions Reduction (tonnes CO2e)
AHU5 and AHU6 optimization	Rebalance & Thermal wheel optimization	2.3	$145,000	$48,156	$32,104	78
Chiller controls	Automate controls logic & Incorporate peak efficiency calculations and temperature reset	1.4	$70,000	$34,500*	$23,333	10
Heating system controls	Radiant loop and boiler plant controls optimization	2.0	$100,000	$35,000	$29,754	276
Water fixture upgrades	Washroom and shower aerators	0.9	$14,228	$16,022		1
	TOTAL		**$329,228**	**$133,678***	**$85,192**	**365**

*Includes the savings that were obtained by manual chiller optimization in 2018. The reprogramming will make permanent those savings and achieve further optimization.

The business case for investment is summarized in the cash flow forecast presented in Figure 3. The forecast incorporates all project and ECDM program management costs, along with utility cost savings and estimated incentives phased in over the 5-year period. The forecast accounts for inflation as well as current utility cost escalation forecasts. Cumulative net cash inflow is shaded green with breakeven in year 3 and net positive cash of $176,638 at the end of 5 years. Continuing, escalating savings yield a total net cashflow of almost $1.2 million at the end of 10 years after payment of all implementation costs.

Figure 2 Cash flow forecast



The rationale for investment is that this money is going to be spent anyway. RHC chooses to spend it on upgrading building systems, organizational resources and long-term savings rather than inefficient energy and water consumption.

Part 1: Introduction

1 About RHC

RHC is a continuing-care facility converted from a 1945 school building in 2009, consisting of one basement level, four above-grade floors, and an outdoor parking lot. With a total area of 179,070 square feet, RHC houses 206 beds and 495 staff. Development projects in progress:

1) Plans are being developed to enclose the balconies and create additional space for patient care—in design phase.
2) Two courtyard development projects are on hold.
3) Long-term care redevelopment planning in process—spring 2020 start construction (soil sampling now), project completion June 2022.

RHC has a long history of energy conservation initiatives. Our senior management is fully supportive of energy conservation projects and has a focus on the total life cycle costs of equipment replacements. Funding is made available for energy and water conservation initiatives and the savings generated have been shown to repay these investments.

2 Planning horizon and scope

RHC would like to implement the projects within the 5-year planning horizon preferably within the first 2 years given the financial attractiveness of the projects and the staff engagement of the program overall.

3 Other goals

RHC aims to be a leader in energy efficiency and corporate sustainability among our peers. We have achieved the 5% Club Award, Leadership Award, and Rising Star Award from the GHC, and recognized by the Canadian College of Health Leaders (CCHL) for our achievements. RHC will continue to strive for leading organizational changes towards sustainability by engaging in community events such as the Earth Day, the Nursing Week, and hosting the Engineering Week to solidify a strong community team of sustainability champions.

Part 2: Results from the past 5 years (2014-2018)

1 Energy and water progress compared to targets

In the previously approved ECDM plan posted July 1, 2014, RHC set a goal to reduce total energy (electricity and natural gas) cost by 21% over the plan's 5-year term.

Table 3 presents actual results achieved. A total of 18% utility cost reduction (20% electricity, 22% natural gas, and 9% water savings) were recorded in 2018 compared to our 2013 weather-normalized baseline, lowering 2018 utility costs by $127,447 and making RHC one of the top-achievers among the Greening Health Care member hospitals. Cumulative savings over the five-year period total $299,186 with an associated reduction of 1,009 tonnes CO2e of greenhouse gas emissions.

Table 3 Electricity, gas, and water cost and GHG emissions savings (target vs actual)

	2013 Target Savings		2018 Actual Savings (vs 2013 baseline)	
Electricity Reduction (kWh)	899,805	24%	760,072	20%
Natural Gas Reduction (m3)	229,069	34%	149,016	22%
Water Reduction (m3)	-	0%	2,363	9%
Total Energy Reduction (ekWh)	3,270,670		2,302,383	21%
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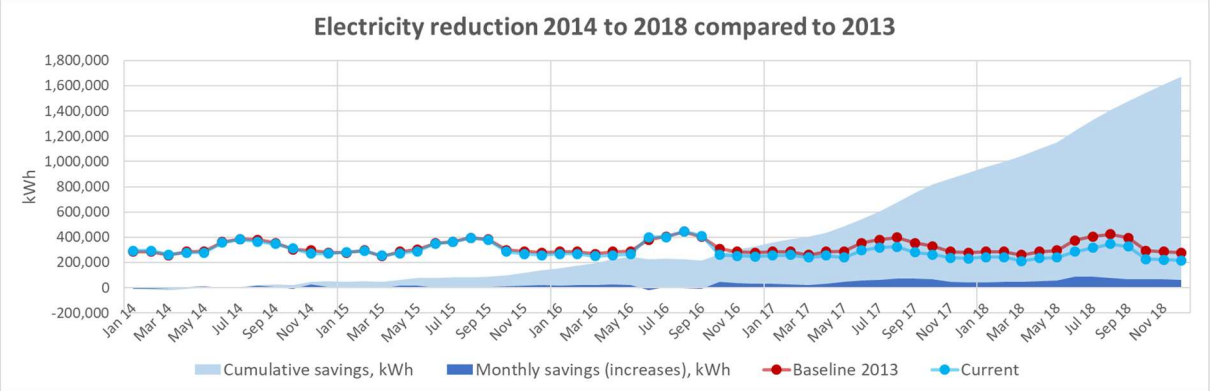
The weather-normalized energy consumption trends shown in figures below demonstrate the overall improvement through this period, with occasional setbacks which are discussed under lessons learned. Savings in 2018 and over the last 5 years are summarized in the tables below.

Figure 3 Electricity usage (kWh) 2014 to 2018 compared to 2013 baseline



Electricity use has been improving visibly since late 2015, with slight setbacks in the summer of 2016 due to an issue with the 2nd chiller not shutting down at night. The problem has since been addressed and, with improved operation and phased lighting retrofit projects, both demand and consumption savings have been accumulating.

Figure 4 Electricity demand (kW) 2014 to 2018 compared to 2013 baseline

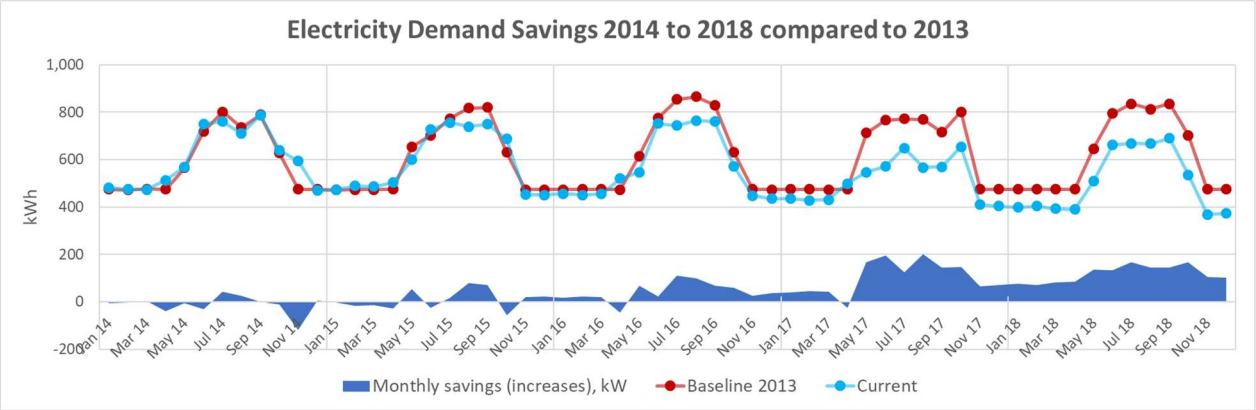
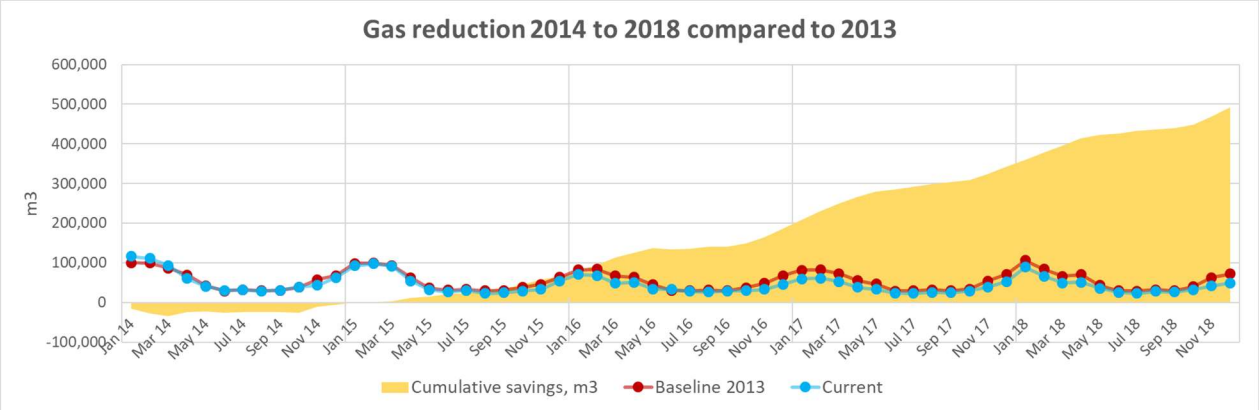


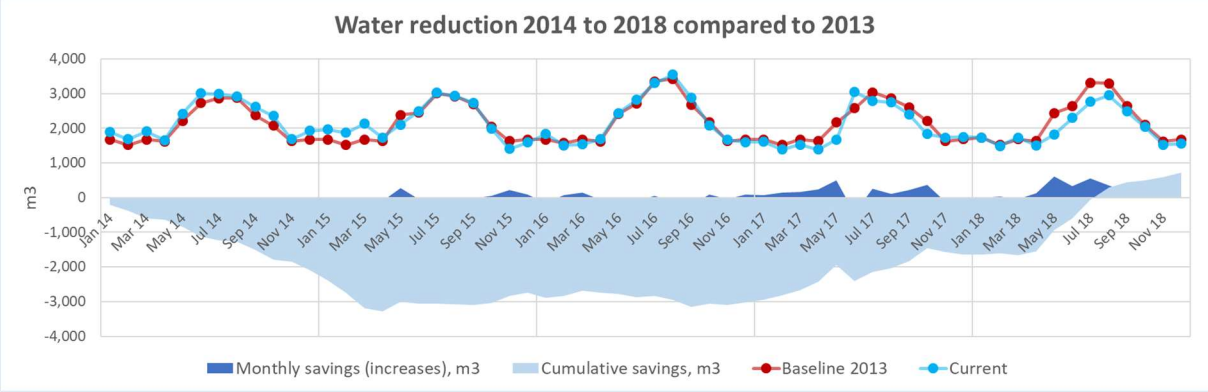
Figure 5 Gas usage (m3) 2014 to 2018 compared to 2013 baseline



The natural gas trend over the last 5 years indicates steady improvement in the heating season compared with the 2013 baseline. The increase in the summer months of 2014 improved in 2017 and 2018. Base thermal usage (consistent year-round gas use) is still prominent and has significant savings potential compared with other continuing care facilities.

The reduced load due to removal of sterilizers as well as improved thermal wheel and ventilation controls has resulted in cumulative savings of 400,000 m3 of natural gas over this period.

Figure 6 Water usage (m3) 2014 to 2018 compared to 2013 baseline



Water use trends over the last 5 years demonstrate an increase in 2014 but improvements since, with steady savings since late 2017 compared with the 2013 baseline.

2 Measures implemented between 2014-2018

The biggest contribution to energy and water savings has been the thoughtful examination of current system operations, including chillers and ventilation systems operations and controls, and tackling them through step-by-step optimization.

The following measures have been implemented during the period of the 2014 ECDM Plan:

2.1 LED lighting conversion

RHC has been working on LED lighting conversions since 2014.

- 60% of the T8 fixtures have been converted to LED with the rest expected to be completed over the next few months.
- Conversion of corridor U-tube fluorescent fixtures to LEDs is already planned with expected completion date in early 2019

2.2 Chiller controls optimization

In 2017 and the summer of 2018, RHC has been working on optimizing chiller controls and has developed strategies to substantially reduce summer cooling electricity usage while maintaining occupant comfort.

Since 2017 the chillers have been controlled manually while monitoring to satisfy space temperature and relative humidity requirements. The following strategies have been manually implemented:

- Limiting chiller VFD speed to <70%
- Supply water temperature reset while monitoring AHUs' RAT/RH: loop temperature increased to 7.5 - 8.0 degC while ensuring that space requirements are still satisfied
- Supply air temperature reset on AHUs to delay lag chiller turning on as much as possible
- Closely monitoring the operation: in Sept-Oct 2017 the chiller wasn't shutting off at night. This was corrected
- Forecasting and controlling chiller operation considering the forecasted temperature and relative humidity to decide whether lag chiller needs to be enabled
- Investigating new outdoor relative humidity sensors and connecting to local weather stations for predictive control based on weather as well as enthalpy

This 2-year optimization testing proved the concept that controls optimization with reset and demand limiting can achieve energy savings while ensuring patient and worker comfort. It has set the stage to program optimized sequences in the BAS to maintain savings from the optimized chiller operation.

2.3 Ventilation systems optimization

RHC has started down the path of ventilation systems optimization.

- VFDs were installed on Air Handling Units. All AHUs now have VFDs and are ready to begin the next stage of balancing, reset, and scheduling
- Kitchen exhaust fan has been equipped with VFD and scheduled

3 Lessons learned

There have been many successes over the past five years and many lessons learned which will help us make even progress in future. These lessons have informed the development of the Plan, and are summarized as follows:

1. The manual trial-and-error chiller optimization has shown clear results and it is now time for implementing the changes in re-programming.
2. Breaking down large projects and sequencing them in logical steps are key to tackling ventilation and heating plant optimization.
3. Reducing base thermal energy (summer gas usage) will further reduce cooling loads chiller demand and energy consumption.
4. Listening to staff and implementing their ideas on ways to save energy and water, along with support from management, has created a positive culture of conservation. Our whole team has become energy conscious and continues to look for new opportunities to improve systems and eliminate waste. We've been able to send our staff for further training at half the cost through utility company support. Our staff have been empowered to run with an idea until a solution is found and to keep trying new methods if the first solution isn't feasible.
5. BAS is an integral part of the optimization. Having knowledgeable staff and engaging service contractors are keys to success.
6. Our membership in Greening Health Care can help with identifying the best measures, sharing experience with other hospitals, supporting staff training and reporting and being recognized for our accomplishments.

Valuable lessons are learned on organizational levels that help shape the plan for the next 5 years:

1. Long-term planning:
    - Long-term and advance planning of projects is important to secure funding and resources required, and also be prepared when Ministry's funding becomes available on short notice.
2. Training and engagement
    - Staff and operator training are essential for project success. Ongoing, step-by-step training for operating staff will be planned for to implement operational changes and simple diagnosis of system faults.
    - Sustainability Forum with champions from each floor coming together to discuss ways to improve sustainability at the hospital was an initiative that had good traction but hasn't seen much progress in the past two years. It'll be desirable to bring it back into action.

- Improvement on energy data reporting and communication is needed. Currently using Greening Healthcare's reporting system on a quarterly basis. More timely feedback of energy progress will be helpful to engage senior leadership and prioritize energy through measurement and verification. Providing timely energy feedback to operators will also help them learn strategies for better operation.
- The hospital has always prioritized patient care and listen to patient and staff needs. Operators routinely conduct random comfort checks in the morning and follow through a work order system to resolve issues. Prioritizing patient and staff needs has helped to implement operational changes and working as a team to address problems as they arise.
- Various social events, including nursing week, facility week, provide an opportunity to engage in two-way conversations on how to improve the hospital environment, and for the facility staff to explain services available for staff and patients. Project plans are also provided to staff and their feedback is taken into consideration before implementation. This creates a cooperative environment and removes barriers for project buy-in.
- Succession planning for facility staff and sustainability champions need to be considered as progress depends a lot on individual's knowledge, experience, and drive.

Part 3: The plan for the next 5 years (2019-2023)

RHC is working towards top-quartile positioning in the Greening Health Care energy efficiency/savings potential benchmark charts. The hospital is aiming for a further total energy reduction of 28% by 2023 compared with the 2018 baseline, together with an 8% reduction is water use. The projects and management/organizational measures described below are together designed to achieve this goal along with utility cost savings worth $133,678/year at 2018 rates and GHG emissions reduction of 365 tonnes CO2e/year.

1 2018 baseline

The table below presents 2018 energy and water use, costs and emissions for RHC.

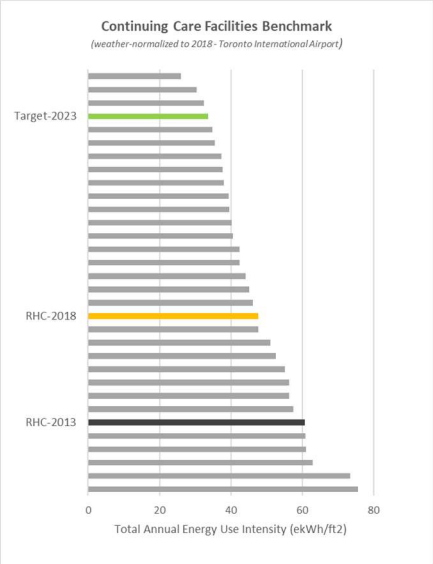
Table 4 RHC's 2018 energy and water use

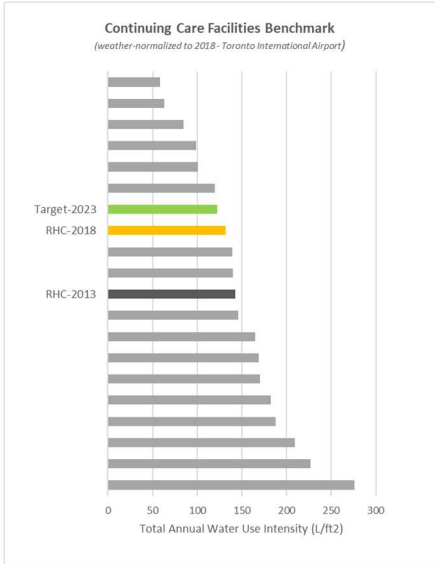
	2018 Consumption	2018 Cost	GHG Emission (tonnes CO_2e)
Electricity (kWh)	3,117,048	$467,557	125
Gas (m3)	505,613	$166,852	968
Water (m3)	23,770	$94,844	0.6
Total		**$729,253**	**1,093**

2 Benchmark positioning and targets

Greening Health Care sets good practice energy and water targets for its 65 member hospitals based on top-quartile performance of comparable buildings in the Greening Health Care database and adjusted for weather and material site specific variables. The figure below shows RHC positioning in 2013, 2018 and at the performance level which is the goal for the Plan.

Figure 7 2018 total energy and water use intensity benchmark charts





The table below presents RHC actual energy intensities and energy intensity targets with overall savings potential of 28%. Achievement of these targets will result in $118,856 in annual utility cost savings. Targeted water savings potential of 8% is worth an additional $7,378/year.

The targeted savings potential is further separated by energy components, which help direct efforts to the building systems with the biggest opportunities:

- Base electricity systems are fans, pumps, equipment and lighting with modest savings potential;
- Cooling electricity systems are chiller plants and local AC units with considerable further savings potential notwithstanding results to date;
- Base thermal systems are domestic hot water, sterilizers, kitchens and reheat in ventilation systems with big savings potential;
- Heating thermal systems are space and ventilation heating and humidification with modest savings potential.

Table 5 Hospital energy and water targets

	Energy Usage Intensity (ekWh/ft2)		Target Savings vs 2018*	
	Actual	Target	%	$
Base Electricity	15.4	14.1	8%	$32,501
Electric Cooling	2.1	1.2	44%	$24,152
Base Thermal	17.7	7.8	56%	$56,452
Heating Thermal	11.5	10.5	9%	$5,752
Total Energy	**46.6**	**33.6**	**28%**	**$118,856**
Water (liters/ft2)	132.7	122.4	8%	$7,378
Total				**$126,234**

*Includes savings that were obtained by manual chiller optimization in 2018. The reprogramming will make permanent those savings and achieve further optimization. The total savings is higher than the 2018 target indicating a portion of the cooling savings were achieved in 2018 through the manual process.

3 Retrofit projects

Table 6 Planned measures

Measure	Description	Payback	Project Cost ($)	Total Savings ($)	Total Incentives ($)	GHG Reduction (tonnes CO2e)
AHU5 and AHU6 optimization	Rebalance & Thermal wheel optimization	2.3	$145,000	$48,156	$32,104	78
Chiller control logic	Automate controls logic & Incorporate peak efficiency calculations and temperature reset	1.4	$70,000	$34,500	$23,333	10
Base thermal usage reduction	Radiant loop shut off Boiler plant and controls optimization	2.0	$100,000	$35,000*	$29,754	276
Water fixture upgrades	Washroom and shower aerators	0.9	$14,228	$16,022		1
	TOTAL		**$329,228**	**$133,678***	**$85,192**	**365**

*Includes savings that were obtained by manual chiller optimization in 2018. The reprogramming will make permanent those savings and achieve further optimization. The total savings is higher than the 2018 target indicating a portion of the cooling savings were achieved in 2018 through the manual process.

3.1 Air handling systems: AHU5 and AHU6 optimization

AHU5 and AHU6 are 100% outside air systems with thermal wheels that serve the patient floors. The two systems operate 24/7 and account for 20% of the total electricity and 40% of the total gas usage in the hospital costing around $150,000 per year. Optimizing these two air-handling units will lead to significant energy and cost savings.

Recommendations

Capital

Re-balance air supply volume on patient floors to CSA requirements

The air change rate on the patient floors averages 5.1 air changes per hour (ACH), which is excessive compared to CSA requirement of 4 ACH for systems supplying 100% outside air. Energy savings from re-balancing the individual supply boxes to lower the supply and return air volumes, consequently reducing fan power on AHU 5/6, as well as heating and cooling energy usage, reprogramming thermal wheel, are estimated to be $48,156 per year.

Operational

The thermal wheels in AHU5 and AHU6 shall be optimized to achieve their full potential. The current operation shuts down the thermal wheels during free cooling season (in September and October) when wheel modulates below 30% and relies on fuel heat both inside the air handling units as well as terminal reheat and radiant panels to satisfy space heating needs. On a 10°C day the thermal wheel was limited to operate at 30% while topping up with heating coil (Figure 8). The downstream reheat coils and radiant panels were also providing heating to the majority of the spaces, with radiant valves opening at 100% in more than 60% of the perimeter spaces at the time of the visit.

In the heating season the preheat coil heats up outside air to 1°C before entering the wheel, leaving the wheel with a reduced capacity to recover energy from exhaust air.

Sensor calibration is recommended as the first step. A programming change to implement the optimized sequence of operation integrating frost control will reduce preheat, maximize enthalpy recover, and reset supply air temperature to reduce terminal reheat and radiant panel operation.

3.2 Lighting

RHC has purchased the remaining LED T8 bulbs and will finish installation by early 2019. Corridor U-tubes LED conversion is 70% complete with 114 fixtures to go, and the hospital aims to complete the remainder in 2019. There are approximately 420 pot light fixtures in patient rooms with 2x13W CFL bulbs that the hospital intends to convert to 2x9W LED. The project will be initiated in 2019. The applied incentives will be removed from baseline energy usage during the M&V process.

3.3 Heating plant

Base thermal usage is the year-round gas usage that is constant regardless of weather conditions. In Runnymede base thermal usage represents a 50% reduction potential, or $35,000 in cost.

- The 2 steam boilers serve 1) humidifiers, 2) soup kettles and dish washers in the kitchen, and 3) clothes dryers.
- The 3 hot water boilers serve 1) radiant loop, 2) domestic hot water, 3) reheat coils and glycol coils in the ventilation system, and 4) a high temperature tank serving the washing machines, dishwashers, and pot washing sinks.

Excess gas usage means either low boiler plant efficiency or excessive heat being added to the building. The Greening Health Care program has published a Boiler Plant Best Practices Guide to help hospitals identify inefficiencies and optimize heating systems to operate at their best efficiency. When excessive heat is being added to the building during cooling season, the chiller plant has to use more electricity to remove the heat from the building. This also cascades into the ventilation systems running at higher volumes to provide more air into the space to satisfy cooling demands.

Reducing the base thermal portion of the gas consumption can reduce electricity in terms of boiler pumping power, chiller plant operation, as well as air handling systems' electricity usage.

Recommendations

1) Radiant loop shut off

The radiant loop feeds the ceiling radiant panels in perimeter rooms designed to top up the heating in the case that the reheat coils in the terminal VAV boxes do not satisfy space heating needs. In the summer circulating this loop throughout the facility results in line losses and creates simultaneous heating and cooling conditions. In winter using the hot water to provide space reheat also reduces the thermal wheel's potential to recover waste heat.

Consider shutting down the radiant loop in summer and leave it off for as long as possible, only activating when ventilation heating and space reheat aren't able to keep up with perimeter heating needs.

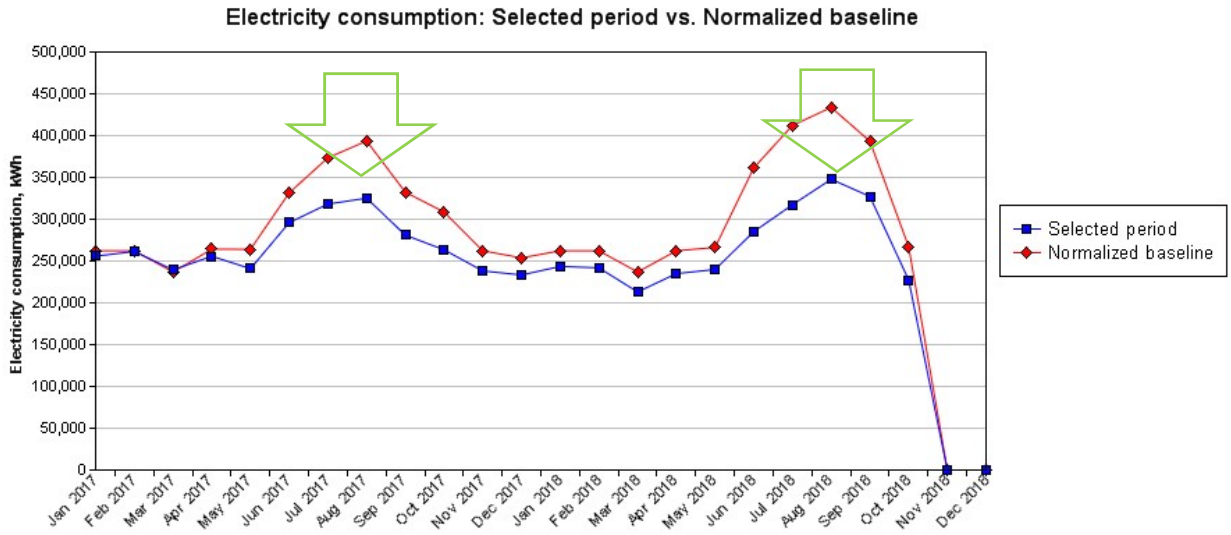
2) Hot water boiler and steam boiler plant optimization

More detailed examination of the systems' operation will determine the strategy to optimize the boilers while meeting the building's hot water and steam needs in the summer months.

3.4 Cooling plant

As detailed in Section 3.2, Runnymede has been developing and testing controls optimization on the chillers with a manual approach. The energy savings from the improved control sequence shall be sustained by integrating these changes in the BAS control sequence.

Figure 8 Cooling electricity reduction in 2017 and 2018 compared to 2016 baseline



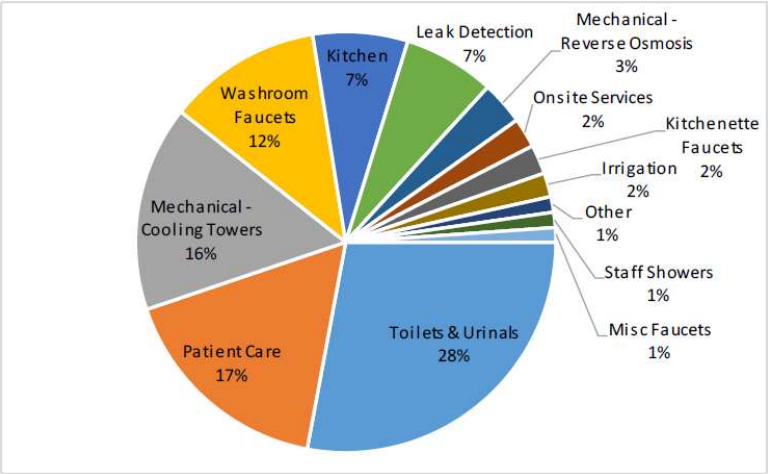
The weather-normalized cooling energy savings in the summer of 2018 compared to 2016 totaled 230,000 kWh worth $34,500. The results provided proof of concept of chiller sequence optimization that was performed manually in 2017 and 2018 in test trials. The sequence shall be implemented and automated through chiller controls reprogramming.

Further improvement can be achieved by 1) incorporating the calculation of chiller performance efficiency curve and pump power usage to control lag chiller operation and VFD setting, and 2) resetting chilled water supply and return temperature setpoints with feedback from air-handling units' cooling demand while avoiding the low delta-T syndrome.

3.5 Water systems

The audit offered through Toronto Water identified the breakdown of current usage, opportunity areas, and measures with cost and savings calculations.

Figure 9 Water usage breakdown (from Toronto Water audit report)



The audit identified fixture upgrades measures and leak detection, with a total cost of $14,228 and estimated annual cost savings of $16,022. The overall payback is under 1 year.

Table 7 Proposed water efficiency measures (Toronto Water audit report)

Location	Proposed Measure	Estimated Water Savings (m3)	Estimated Annual Cost Savings ($)	Capacity Buyback Incentive ($)	Total Cost ($)	Simple Payback (years)	Net Present Value ($)2
Staff Washrooms	4.1 Aerator - 1.9 lpm	460	$1,748	Not Eligible	$600	0.3	$18,836.05
Common Washrooms	4.1 Aerator - 1.9 lpm	351	$1,333	Not Eligible	$320	0.2	$14,505.59
Staff Washrooms	4.2 Toilets - 4.8 lpf	389	$1,479	Not Eligible	$7,880	5.3	$12,225.12
Common Washrooms	4.2 Toilets - 4.8 lpf	175	$666	Not Eligible	$1,970	3	$7,086.46
Kitchenettes	4.3 Aerator - 5.7 lpm	132	$501	Not Eligible	$200	0.4	$5,368.76
Shower Rooms	4.3 Aerator - 5.7 lpm	641	$2,437	Not Eligible	$480	0.2	$26,610.06
Facility	4.3 Aerator - 5.7 lpm	65	$246	Not Eligible	$2,160	8.8	$574.01
Kitchen	4.3 Aerator - 5.7 lpm	104	$394	Not Eligible	$120	0.7	$4,259.53
Cafeteria (hand washing)							
Kitchen (hand washing)							
ADL Room	4.3 Aerator - 5.7 lpm	1	$3	Not Eligible	$40	14.8	-$9.98
Staff Locker Rooms	4.4 Showerhead - 6.6 lpm	74	$283	Not Eligible	$295	4.5	$2,854.50
Kitchen	4.5 Spray Valve - 4.0 lpm	66	$250	Not Eligible	$163	0.7	$2,615.54
Facility	4.6 Leak Detection3	1,757	$6,682	Not Eligible	$ -	0	$ -
	Total	**4,215**	**$16,022**		**$14,228**	**0.89**	**$94,925.64**

3.6 Building automation system

Utility (electricity and water) meters will be integrated into the building automation system to enable visibility and tracking.

3.7 Renewable energy

There are no existing renewable or geothermal installations at this facility, and none are planned for the term of this ECDM Plan.

4 Management and organizational alignment

Key to RHC's success to date has been the engagement and active involvement of its facility operations team. The following management and organizational developments form an essential part of the Plan to enable and support ongoing efficiency improvements and sustaining savings over time.

4.1 Strategic alignment

Consideration of specific reference to energy and environmental performance in RHC's quality improvement and other strategic reporting.

4.2 Energy management and reporting

Enhancing transparency and motivation by regular communication of actual savings results to all stakeholders, in particular facility operations staff. Begin with monthly savings and progress towards weekly reporting. Conduct regular team meetings to review results, identify solutions and brainstorm new ideas, document action items and follow up on implementation.

4.3 Staff training and support

Enhancing staff competency in energy management and building automation by defining expectations and working with service providers to provide necessary training and support.

4.4 Facility renewal and renovations

Ensuring that equipment replacements and facility renovations meet high performance design and operational standards through an integrated design, review and M&V process.

4.5 Project management support

Putting in place resources necessary to successfully implement the projects, along with renovations, equipment replacements and new-builds, considering:

- integrated design and building performance teams
- concept and design development, budgeting, procurement, implementation and commissioning
- business case development
- incentives management
- documentation
- outcomes-based service contracts

4.6 Occupant engagement and communications

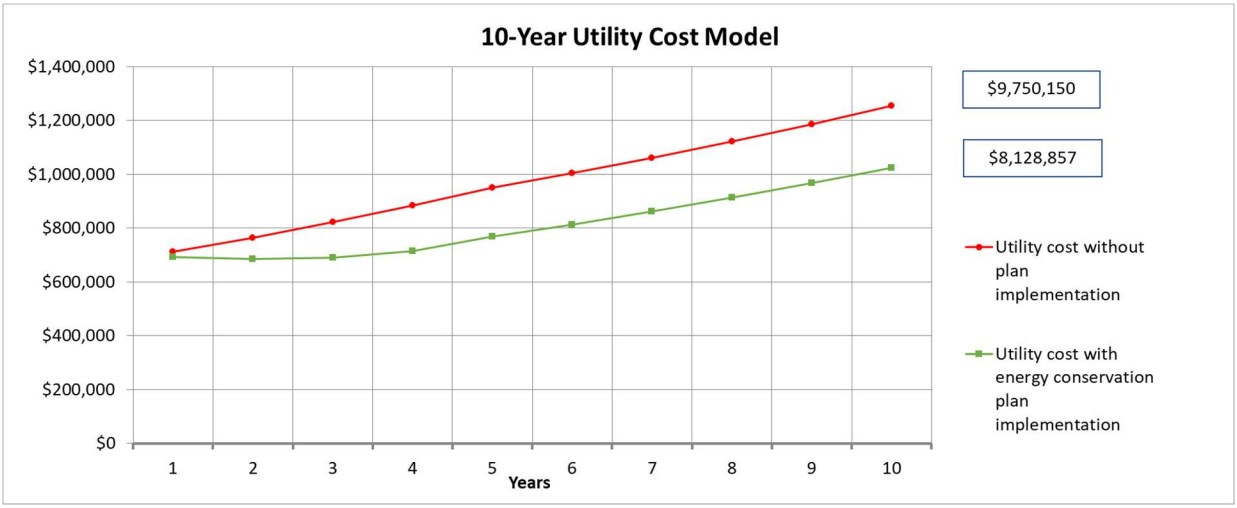
- formalize departmental input into operating schedules and project development
- communicate results achieved together with how occupants can help with further energy and water efficiency improvements

5 Project timelines and financial forecast

5.1 Utility cost forecast

Figure 10 shows the 10-year annual utility cost forecast for RHC, with and without implementation of the project.

Figure 10 Utility cost forecast over the next 10 years



With current utility price escalation forecasts, the hospital's annual utility costs (electricity, natural gas and water) can be expected to rise from $0.7 million in 2018 to $1.25 million in 2028, for a ten-year total spend of $9.75 million. Implementation of the ECDM Plan is projected to lower that expenditure by almost $580,000 over the 5-year period of the Plan, while maintaining those savings over 10 years will provide cumulative savings of over $1.6 million due to implementation of the measures. These utility cost savings will fully repay the total investment in energy and water efficiency improvements and provide a positive net cash flow to hospital operations.

5.2 Phasing of work and annual implementation costs

Table 8 below summarizes project completion % in each year, while Table 9 shows annual project and ECDM program management costs over the 5-year period of the Plan (accounting for inflation). The program management costs include the additional cost to build organizational capacity in terms of training, reporting and communication.

Table 8 Project phasing

Measure	Y1	Y2	Y3	Y4	Y5
AHU5 and AHU6 optimization	25%	100%			
Chiller control logic	75%	100%			
Base thermal usage reduction	25%	100%			
Water fixture upgrades	100%				

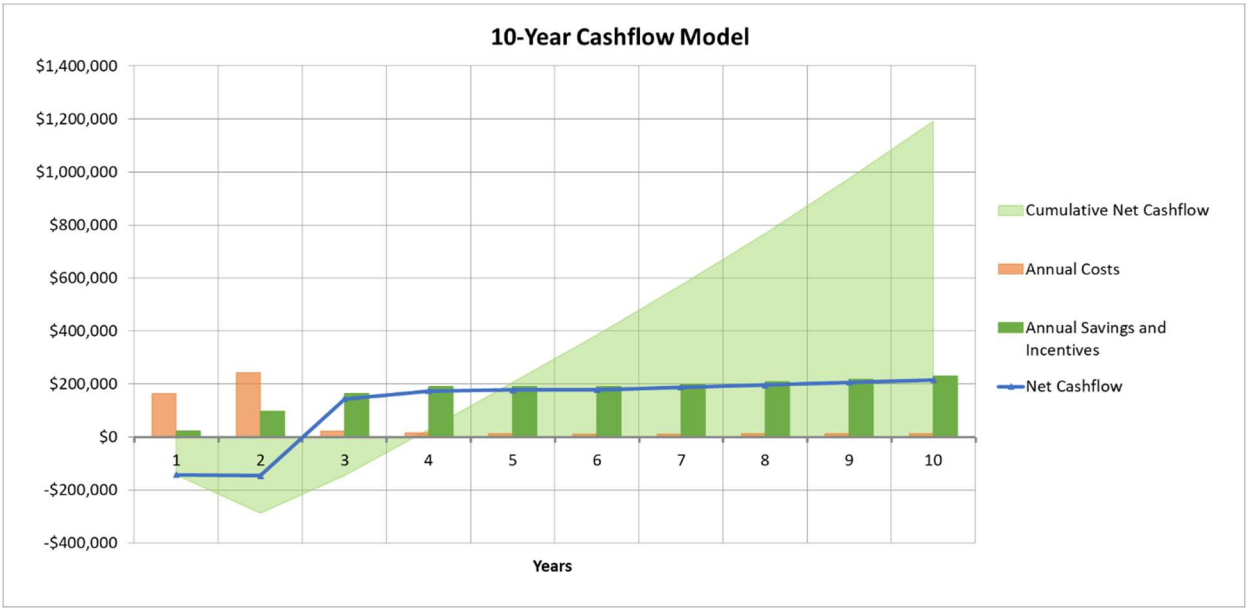
Table 9 Annual costs

	Y1	Y2	Y3	Y4	Y5	Total
Project cost (with inflation)	$127,978	$206,281				$334,259
ECDM program management cost (with inflation)	$35,000	$35,875	$21,013	$16,153	$13,798	$121,839
Total cost	**$162,978**	**$242,156**	**$21,013**	**$16,153**	**$13,798**	**$456,098**

5.3 Cash flow and ROI

The cashflow model in the figure below includes input from project cost, energy savings and utility incentives, and ECDM program management costs. The current model has an internal rate of return of 46% and payback period of 4.4 years.

Figure 11 Cashflow model



The 10-year costs, savings, and incentives as well as key assumptions are summarized below.

Table 10 Cashflow model

	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Total
Total cost	$162,978	$242,156	$21,013	$16,153	$13,798	$11,314	$11,597	$11,887	$12,184	$12,489	$515,568
Incentives	$3,500	$18,653	$32,328	$22,051	$8,660	-	-	-	-	-	$85,192
Savings	$17,500	$77,739	$132,335	$168,100	$181,776	$190,136	$198,953	$208,254	$218,070	$228,430	$1,621,293
Total incentives + savings	$21,000	$96,392	$164,663	$190,152	$190,436	$190,136	$198,953	$208,254	$218,070	$228,430	$1,706,484
Net cashflow	-$141,978	-$145,764	$143,650	$173,998	$176,638	$178,822	$187,356	$196,367	$205,886	$215,941	

Cumulative net cashflow	-$141,978	-$287,742	-$144,092	$29,907	$206,545	$385,366	$572,722	$769,089	$974,975	$1,190,916	

Assumptions

Inflation	2.5%	Elec. rate at 1st year ($/kWh)	$0.15
Electricity escalation rate	6.5%	Gas rate at the 1st year($/M3)	$0.33
Demand escalation rate	6.5%	Water rate at 1st year ($/M3)	$3.99
Gas escalation rate for years 1-5	10%	Electricity incentives ($/kWh)*	$0.10
Gas escalation rate for years 6-10	2.5%	Gas incentives ($/M3)*	$0.20
Water escalation rate	8%		

**Rates are based on current utility company incentive program structure, subject to change.*

6 Immediate next steps

6.1 Sustainability Forum

Sustainability is a team effort. Having an active energy team that involves facility management, hospital staff and patients is an important factor for success. RHC would like to reinstate this initiative to identify champions on each floor, and have regular meetings to identify projects, discuss lessons learned, and engage in communication with the hospital-wide group. This helps form a learning organization that will continuously improve through community effort and exceed its own goals.

6.2 Pilot ventilation project

The proposed ventilation project for AHU-5 and 6 in Section 3.1 will be implemented in three manageable stages. The first stage is to conduct a pilot test on one air handling unit by adjusting its VAV boxes' airflow on the BAS. Occupant responses will be monitored to fine-tune required airflow and achieve desired comfort requirements. Once the setpoints are established, the next stage is for the BAS contractor to physically program the airflow values into terminal units so their settings will remain permanent.

6.3 Thermal wheel controls

The thermal wheel optimization in AHU-5 and 6 can also be completed in stages. The first step is to adjust the temperature setting on the BAS to reduce preheat temperature in the supply air entering the wheel. This will minimize fuel heat and maximize heat recovery. A pilot will be conducted to determine the optimum preheat temperature and avoid frost.

Management sign-off

I confirm that Runnymede Healthcare Centre's senior management has reviewed and approved this 2019 - 2023 Energy and Conservation and Demand Management Plan.

Signature: _____

Name: _____ Date: _____

Title: _____