



**2019  
5-YEAR ENERGY CONSERVATION  
AND DEMAND MANAGEMENT PLAN**

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## Revision History

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## Glossary of Terms

<b>BAS</b>	Building Automation System
<b>BPS</b>	Broader Public Sector
<b>BPT</b>	Balance Point Temperature
<b>CDD</b>	Cooling Degree-Days
<b>E-BILL</b>	Electronic bill
<b>ECDM(P)</b>	Energy Conservation and Demand Management (Plan)
<b>ECM</b>	Energy Conservation Measure
<b>EUI</b>	Energy Use Intensity
<b>FMS</b>	Facility Management Services
<b>FY</b>	Fiscal Year ( <i>September 1 – August 31</i> )
<b>GGRF</b>	Greenhouse Gas Reduction Fund
<b>GHG</b>	Greenhouse Gas
<b>HCDSB</b>	Halton Catholic District School Board
<b>HDD</b>	Heating Degree-Days
<b>HVAC</b>	Heating, Ventilation and Air-Conditioning
<b>LEED</b>	Leadership in Energy and Environmental Design
<b>OECDM</b>	Ontario Education Collaborative Marketplace
<b>POD</b>	Proceeds of Disposition
<b>PV</b>	Photovoltaic (solar)
<b>SCI</b>	School Condition Improvement
<b>SGF</b>	School Generated Funds
<b>SRA</b>	School Renewal Allocation
<b>UCD</b>	Utility Consumption Database
<b>VFD</b>	Variable Frequency Drive

## Introduction & Background Information

Since July 2013, municipalities and other broader public sector agencies have been reporting energy consumption for their key facilities or assets. The Green Energy Act (and Ontario Reg 397/11 under this Act) was established to help these same agencies, including school boards, develop conservation and demand management plans to help guide energy savings and investment.

Around this same time, the Ministry of Education implemented the Utility Consumption Database (UCD) to aid the 72 school boards across Ontario in compiling and organizing the necessary energy data to furnish these plans, as well as annual reports to the provincial government.

As a result, Facility Management Services at the Halton Catholic District School Board (HCDSB) furnished the 2014-18 5-Year Energy Conservation and Demand Management Plan (ECDMP) as a means to formalize current energy management practices, identify key performance indicators and areas for improved efficiency, and set conservation goals for the next five years. The ECDMP was also designed to leverage the existing funding sources – predominantly School Renewal Allocation (SRA) and School Condition Improvement (SCI) grants – towards implementing energy efficiency programs and initiatives.

In 2018, the Green Energy Act was repealed and replaced with the Electricity Act. For BPS organizations, the same requirements for energy reporting and planning carried forward under a new Ontario Regulation 507/18.

HCDSB presents this new 2019-23 5-Year ECDMP as a refinement of the continuous improvement philosophy established in the Board's previous 5-year plan, and an evolution of the framework HCDSB has long utilized for conservation planning and energy efficiency.

The development of the 2019-23 ECDMP is a continuous and evolving process. In other words, it will be a "living" document - designed to be revised regularly throughout this new reporting period to reflect changes born out of the continuous improvement process. Ultimately, the ECDMP is a comprehensive account of the Board's energy conservation strategies, as it:

- I. Evaluates actual portfolio energy performance during the previous reporting period and compares against the planned targets;
- II. Summarizes past and future investments in new, more efficient technologies, including renewables
- III. Clearly establishes the Board's future energy management goals and objectives;
- IV. Prioritizes planned energy conservation measures in order to meet the goals and objectives, and details an effective strategy for implementing these measures;
- V. Aligns with other Board plans and policy, including the Board's Long-Term Capital Plan, Environmental Stewardship Policy (V-15), and the Long-Term Facility Renewal Strategy;
- VI. Incorporates organizational and behavioural measures.

## Board Asset Profile

Over the course of the reporting period for the previous 5-year ECDMP, there were several fundamental changes to the original boundary conditions that the plan was based on, which partially mitigated the Board’s actual energy consumption savings when compared to the conservation targets set forth at the beginning of the period.

Table 1 summarizes the key metrics that influenced energy consumption and savings during the previous reporting period, as shown in the baseline year (FY2013), the end of the reporting period (FY2018), and FY2019 for comparison.

**Table 1 – HCDSB Asset Profile**

Key Metric (units)	FY2013	FY2018	Variance during Reporting Period	FY2019
Total Number of Buildings	57	60	+3	60
Total Number of Portables/Portapaks	135/3	171/2	+36/-1	200/2
Total Gross Floor Area (GFA) (m <sup>2</sup> )	329,500	386,000	+56,500	391,000
Nominal Operating Hours (per Week)	45	60	+15	60
Average Daily Enrolment	29,550	34,170	+4,620	35,600 <sup>1</sup>
Total Community Use Hours	61,688	72,510	+10,822	71,305
Childcare Facilities	9	10	+1	10
% Total GFA air-conditioned	97.5%	99.0%	+1.5%	99.4%

<sup>1</sup> Projected/Estimated value



## Board Energy Management Programs & Strategies

HCDSB is committed to energy conservation and the principles of sound energy management through its Environmental Stewardship Policy (V-15). The Board also has a long history of progressive decision-making surrounding energy efficiency measures, dating back to a time well before the previous ECDMP's reporting period. Indeed, HCDSB provides world-class learning environments for our students and staff, while still being routinely ranked among the most energy efficient school boards in Ontario<sup>2</sup>.

In total, HCDSB has devoted over \$27,000,000 to energy efficiency measures since FY2014. Appendix A contains a breakdown of these projects. Furthermore, HCDSB is planning to invest an additional \$26,000,000 in the next 5 years towards similar energy efficiency measures and initiatives, as shown in Appendix B. The actual and projected energy savings from these projects have been summarized in later sections of this plan.

Currently, energy conservation planning, management and analysis at HCDSB is being administered through Facility Management Services. The Energy Management Team referenced henceforth in this ECDMP is a group of key personnel within Facilities; the champion being the Board's in-house, full time Manager of Energy & Environment.

The following several sections detail HCDSB's energy management strategies, which have remained consistent from the previous reporting period to this current one.

### Design, Construction and Retrofit

All new facilities at HCDSB, up to and including schools that are currently in development today, follow a series of well-established tenets pertaining to efficient facility design, value-added engineering, and construction management.

- ❖ Full integration of a building automation system at all facilities, allowing HVAC equipment and lighting to be scheduled centrally from the main Board Office
- ❖ Central heating and cooling plants specified and designed for maximum efficiency
- ❖ Fan-powered mixing boxes at elementary schools, which can provide "free cooling" during shoulder seasons via economizers
- ❖ Four-pipe fan coil systems at secondary schools – with roof-top units in the common areas – allows for improved energy efficiency through operational flexibility when the building is only partially occupied (after hours community use groups), along with reduced maintenance costs
- ❖ Energy recovery installed in air handling equipment
- ❖ Variable frequency drives installed on larger fan and pump motors, to fine-tune the heat transfer in the building's air and water systems to match actual occupant demand
- ❖ Engineered lighting design, including the installation of the most efficient lighting technology available
- ❖ Upgraded windows, glazing and roofing materials to minimize heat loss
- ❖ Complete building commissioning including air and water balancing

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<sup>2</sup> Sustainable Schools – Top Energy Performing School Boards Report

- ❖ Real-time metering of all three utilities (electricity, gas and water - see section on Demand Management)

In FY2019, HCDSB took part in Union Gas' Savings By Design charrettes to further refine these principles for new construction of both elementary and secondary schools. When budgeting allows, future construction projects will look to incorporate additional energy efficient measures that were assessed at these charrettes.

When conducting a retrofit at a school, Facility Management Services' Facility Renewal Strategy takes advantage of the department's construction management expertise by combining needed refresh work with several energy efficiency projects such that overall cost efficiencies are realized. As an example, painting, flooring and locker refurbishments are packaged with the replacement of heat pumps, retrofitting of fluorescent lighting systems to LED, and VFD installation on pumping systems.

### Operating and Maintenance

Similar to the philosophy on new construction, HCDSB has a rigorous, standardized approach to the ongoing operation and maintenance of our facilities.

- ❖ **Building Automation** – allows the Energy Management Team to set operation schedules of all HVAC equipment centrally, sequence mechanical system startup for demand control and management, program night setback temperatures to further reduce energy consumption during period of low (or no) occupancy, and record trend data for troubleshooting and performance tracking.
- ❖ **Continuous Commissioning** – through the BAS, the Energy Management Team has ongoing oversight of all Board facilities such that operational issues can be resolved swiftly, occupant comfort is maintained, and energy use is optimized. A robust preventative maintenance plan further enhances operational effectiveness throughout the year
- ❖ **Energy & Utilities Management** – the Energy Management Team uses both monthly utility bills and real-time data to establish baselines for energy benchmarking and reporting. Recent upgrades like the alarming or sub-metering of the real-time system provides further enhancements of facility operation and oversight. Finally, internal assets have been developed for utility cost forecasting such that Facilities Management Services can frequently evaluate and re-prioritize operational expenditures, and exercise fiscal responsibility surrounding our allocated budgets
- ❖ **Maintenance Administration** – the aforementioned preventative maintenance plan, plus routine maintenance and repairs, are administered and tracked electronically by the Energy Management Team through a work order system, and/or via the service provider's web portal
- ❖ **Temporary Accommodation Strategy** – due to having school facilities in high-growth municipalities, HCDSB leases and operates an extreme number of portable classrooms. In FY2019, this number approached an average of almost 4 portables for every facility in the

Board, and is expected to continue to increase. To manage the additional electricity consumption, the Energy Management Team programs all temporary accommodations for night setback and occupancy control. Newly leased portable classrooms are also supplied with energy recovery systems and LED lighting. A refurbishment of many of the existing portables is planned for this new reporting period.

- ❖ **Document Control** – Facilities Management Services ensures that all engineering drawings and documentation related to building systems and equipment, scheduled and unscheduled maintenance, and safety procedures are kept current and up to date

### Demand Management

One of the main pillars of the energy conservation and demand management strategy at HCDSB is the use of a real-time utility metering and monitoring system. Originally installed back in 2010, this system supplies 15-minute interval data from the electricity and gas meter at each of the Board’s facilities to a common web interface. The Energy Management Team uses the data to continuously monitor building energy use, rather than waiting for a monthly invoice from the utility company.

During the previous ECDMP’s reporting period, HCDSB also added the following capabilities to the real-time utility monitoring system:

- ❖ **Alarming** – The alarming package automatically sends out an email to HCDSB staff when a building exceeds a certain threshold for that utility. Different thresholds are setup for summer, winter and shoulder seasons. This feature allows facilities staff to react quickly to most operating and maintenance issues, thereby conserving time and resources. Table 2 below summarizes the various utility alarms in place at all schools.

**Table 2 – Utility Alarms**

Electricity	Natural Gas	Water
Zero Electricity Usage (in case of power failure)	Zero Natural Gas Usage	Zero Water Usage
Maximum (unoccupied) Electricity Usage	Maximum Natural Gas Demand	Maximum (unoccupied) Water Usage
		Maximum Water Demand

- ❖ **Sub-system metering** – A further refinement of the current real-time monitoring system, sub-metering refers to tracking specific subsystems of the facility, rather than just the main utility meter. Examples include motors, pumps, lighting and portable classrooms. Utilities used by childcare centres can be monitored separately as well.

- ❖ **Main water meter tracking** – Between 2016 and 2019, and in partnership with the Halton Region, HCDSB added all schools' main water meter to the real-time utility monitoring system. Extraneous water use due to leaks and other plumbing or mechanical issues have been greatly reduced as a result.

For additional Demand Management strategies employed by HCDSB, please see the previous Section on Operating & Maintenance.

### Energy Management Infrastructure

As a complimentary system to the Utility Consumption Database (UCD), HCDSB's Energy Management Team has been working collaboratively with Natural Resources Canada to build a facility database in their proprietary RETScreen Expert software. RETScreen is an energy accounting software suite capable of performing advanced regression analysis and weather normalization, project feasibility studies, building portfolio management, and providing a central database for utility information.

With these features now implemented, the Energy Management Team is able to analyze and track building performance changes over time – whether due to planned/unplanned operational modifications or efficiency measures being implemented – with much greater accuracy, and enhance our ability to evaluate return on investment of a given project.

In FY2019, a bill-capturing software package was also purchased and commissioned at HCDSB. Developed by Elyxir Group Inc., their E-Billing program automatically scans our utility invoices for energy and cost data, for easy population into programs like RETScreen Expert or Microsoft Excel. The successful adoption of this bill capturing system at HCDSB has had a significant impact for the Energy Management Team. Thus, resources are now more effectively allocated, and greater opportunity costs have been realized.

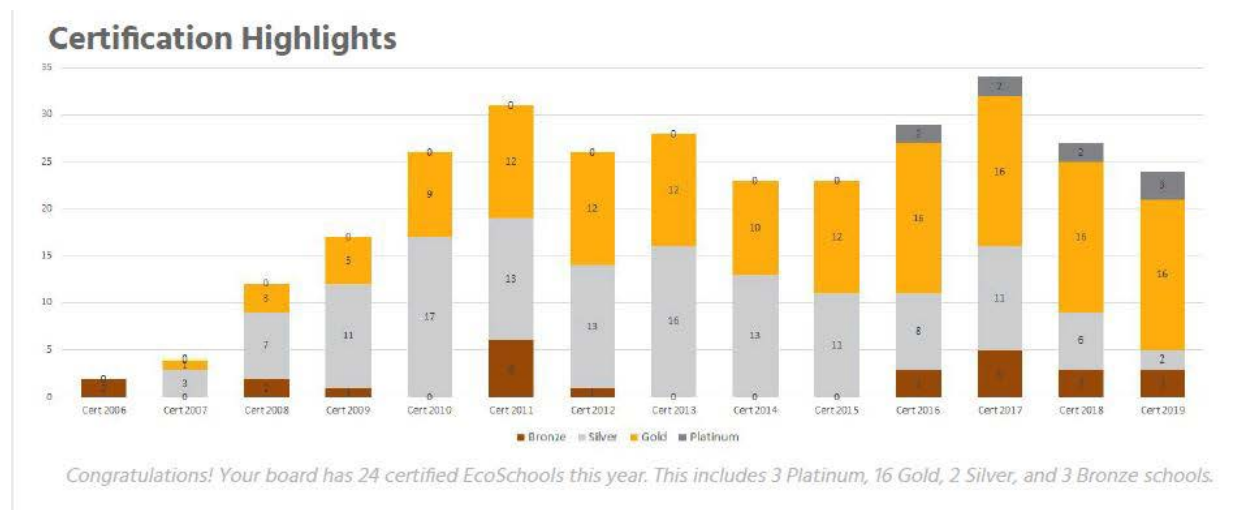
## Environmental Programs

The most recognized environmental program that our schools participate in – especially as it pertains to energy conservation – is Ontario EcoSchools.

Ontario EcoSchools (soon to be EcoSchools Canada) is an environmental education and certification program (from Kindergarten to Grade 12) that helps students, staff and the surrounding community develop their ecological literacy and practices, reduce their carbon footprint, and ultimately become environmentally responsible citizens.

In FY2019, 44% of the Board’s schools were certified EcoSchools<sup>3</sup>, with three of them awarded Platinum status for outstanding engagement with students, and recognition of their certification history and longevity.

**Figure 1 – Ontario EcoSchool Certification History**



HCDSB schools also participate in various other environmental initiatives that curb energy use or greenhouse gas emissions, such as Earth Hour/Week, Bike to School Week, and Waste Reduction Month. FY2019 saw the roll-out of the first, inaugural HCDSB Lights Off Challenge, where schools competed to see who could save the most energy during Earth Hour.

<sup>3</sup> 2018-19 Ontario EcoSchools “Year in Review” Report

## Greenhouse Gas Reduction

The investments HCDSB has made in energy efficiency retrofits and school renewal work – as summarized in Appendix A.1 to A.5 – have reduced the Board’s overall carbon footprint and greenhouse gas (GHG) emissions during the previous reporting period by approximately 30%<sup>4</sup>.

Additional funding for GHG reduction was made available to school boards starting in FY2017 through cap and trade proceeds via the Greenhouse Gas Reduction Fund (GGRF). Over the last two fiscal years, HCDSB apportioned the ~\$1.5 million in funding received by the Ministry towards various efficiency projects, concentrating on measures that resulted particularly in natural gas savings, like condensing boiler installations and demand control ventilation.

Waste diversion away from landfill due to our recycling and composting programs also has a positive impact on GHG emissions. The diversion rate Board-wide improved from 53% to 62% during FY2014 to FY2018<sup>5</sup>.

Beyond FY2019, the Energy Management Team plans to implement similar GHG-reducing measures as FY2013-18, along with exploring the feasibility of a variety of new programs, including, but not limited to car-charging stations, renewable energy projects and an idling ban on all HCDSB school premises.

## Renewables

Prior to the previous reporting period in 2011, HCDSB received funding from the Ministry of Education for four (4) renewable energy projects. As a result, a 10kW photovoltaic (solar) array was installed at four secondary schools under the Independent Electricity System Operator’s (IESO) MicroFIT program. Since their commissioning in FY2012, revenue has been generated at 80 cents per kWh, which was the contracted rate at the time.

In FY2017, a charging station for cell phones was installed at the “Green Station” in the atrium of Jean Vanier CSS, which utilizes a small array of PV panels installed on the roof during initial construction.

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<sup>4</sup> As submitted in the Board’s Annual Energy and GHG Reports

<sup>5</sup> As reported in the Board’s FY2014 and FY2018 annual waste audits

## Influencing Occupant Behaviour

To engage, and hopefully positively influence, students and school staff by informing them of their building’s energy use, televisions were installed in a central location at every school in the Board.

More recently, and with the help of the IT department, the Energy Management Team developed an “Energy Dashboard” platform to present a variety of school-specific information including real-time energy consumption, eco-related tips, trivia, and recycling/composting statistics. The school’s Twitter feed is also displayed as part of the dashboard. Some examples of dashboard content are shown below in Figure 2.

**Figure 2 – Energy Dashboard screens**



## Energy Procurement

As a member of OEMC, HCDSB’s Energy Management Team is kept informed on electricity sector developments by Jupiter Energy Advisors Inc. The Board currently purchases electricity directly from the local utility at the Hourly Ontario Energy Price (HOEP) for all facilities.

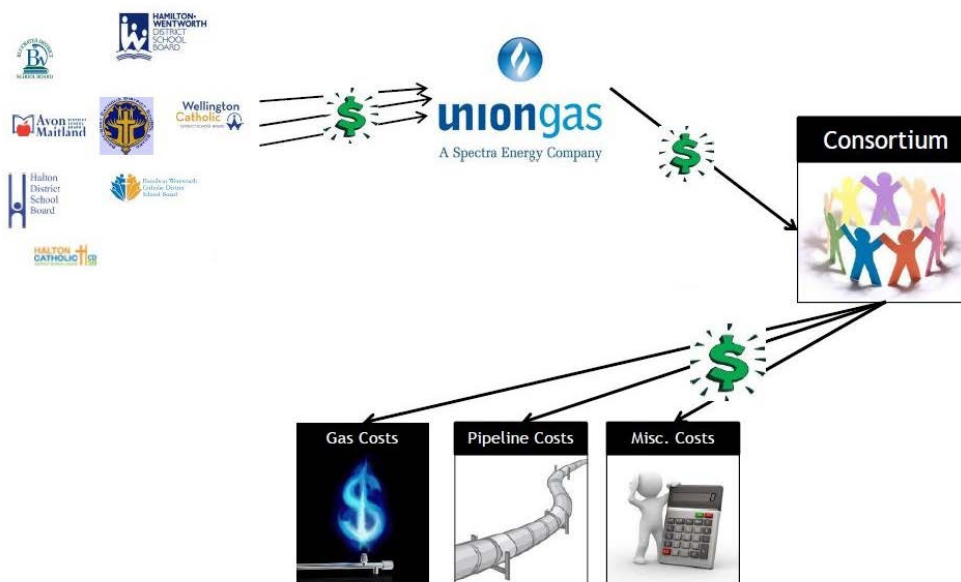
Under the Fair Hydro Act, facilities that have an annual electricity consumption of less than 250,000 kWh per year qualify to receive a discounted Global Adjustment (GA) and an 8% tax rebate. As of FY2019, a total of 16 HCDSB schools – over 25% of the portfolio – are enrolled in this program, which drastically reduces electricity costs. Moreover, several elementary schools are just slightly above this threshold, and thus are potential candidates for enrolment in upcoming fiscal years, due to planned efficiency projects.

For HCDSB’s natural gas requirement, Jupiter manages a bundled account of eight (8) Ontario school boards. This consortium of boards is known as the Catholic School Board Services Association; on behalf of the consortium, Jupiter purchases a “pool” or reserve of natural gas from marketers – at wholesale levels due to the economy of scale – to meet the demands of the bundled account. HCDSB in turn pays the distributor (Union Gas) to draw from this reserve.

Jupiter’s expertise also hedges the consortium’s exposure to volatility in natural gas pricing by setting risk thresholds, which maintains a level of budget certainty for the Board, while also allowing for cost savings if natural gas pricing trends downwards. The consortium meets with Jupiter several times per year to update and refine the risk management strategy. In FY2019, additional budgeting guidance was provided by Jupiter to prepare for the introduction of the Federal carbon tax levy.

The consortium purchasing arrangement is shown in Figure 3.

**Figure 3 – Natural Gas Purchasing Strategy**





## Energy Savings Analysis – FY2014-2018

### Energy Consumption & Intensity

A portfolio (Board-wide) level comparison of the annual energy consumption and intensity at the beginning and end of the previous reporting period is provided in Table 3.

- ❖ Electricity is shown in the common unit of *kilowatt-hours (kWh)*
- ❖ Natural Gas and Total Energy is shown in the common unit of *equivalent kilowatt-hours (ekWh)*
- ❖ Energy Intensity is shown in the common unit of *equivalent kilowatt-hours per square-meter (ekWh/m<sup>2</sup>)*

**Table 3 – Portfolio Energy Consumption**

Utility (units)	FY2013 <i>Baseline Year</i>	FY2018	Variance during Reporting Period
Total Electricity <sup>6</sup> (kWh)	28,586,689	28,761,872	+175,183
Total Natural Gas (ekWh)	27,183,664	28,354,619	+1,170,995
Total Energy Consumption (ekWh)	55,770,353	57,116,491	+1,346,178
Total Gross Floor Area (GFA) (m <sup>2</sup> )	329,500	386,000	+56,500
Energy Intensity (ekWh/m <sup>2</sup> )	169.3	148.0	-21.3

Positive = energy increase; Negative = energy savings

The data above illustrates the importance of considering energy intensity when evaluating energy performance. While total energy consumption has increased slightly over the reporting period, so has the amount of building area being served by the Board (ie. more facilities, higher number of portables, etc). The decrease in intensity over the 5-year reporting period (by approximately 21%) indicates that energy conservation and savings have been realized through various efficiency measures and projects.

However, Table 3 is populated with only “metered”<sup>3</sup> data, which does not compensate for the effects of weather from year to year. Extreme weather has been proven to have a significant impact on energy performance, at both a facility and portfolio level. Further refinements are required to precisely measure the total energy savings over the last 5 years at Halton Catholic DSB.

<sup>6</sup> Metered data is the consumption read directly from the utility meter. It does not include adjustment factors for transmission losses.

## Weather Normalization

Weather normalization is the process by which annual energy consumption data is calibrated to account for the effects of weather. According to the Ministry of Education, 25% to 35% of energy consumption is affected by weather in Ontario. Three key variables are required for this process:

- ❖ **Balance Point Temperature (BPT)** – the outdoor air temperature at which all heat gains in the building are equal to the heat losses. For the analysis in this Energy CDM Plan, 18°C is used by the UCD for the entire portfolio. BPT is shown in the common unit of degrees Celsius
- ❖ **Heating Degree-Days (HDD)** – measures the impact of cold weather on energy use. HDD is the number of degrees that a day’s average temperature is below the balance point temperature, or the temperature at which buildings need to be heated. HDD is unit-less.
- ❖ **Cooling Degree-Days (CDD)<sup>7</sup>** – measures the impact of hot weather on energy use. CDD is the number of degrees that a day’s average temperature is above the balance point temperature, or the temperature at which buildings need to be cooled. CDD is unit-less.

A baseline year is established – in this case FY2013, the year prior to the previous reporting period – and the energy consumption of subsequent years is adjusted to the baseline year, using the variables listed above.

Table 4 shows the weighted average of both HDD and CDD during the reporting period from the six most common weather stations across Ontario.

**Table 4 – Degree-Days in Ontario**

Type	FY2013	FY2014	FY2015	FY2016	FY2017	FY2018
HDD	3,698	4,285	4,091	3,355	3,583	3,989
CDD	289	217	271	462	303	432

Total portfolio energy savings that has been adjusted (or normalized) for the effects of weather is presented in Table 5. After this adjustment, the true effect of the Board’s investment in energy efficiency projects and initiatives during the previous reporting period can be measured.

A performance forecast for FY2019 is also included, when compared against the baseline year FY2013, to demonstrate that energy savings is continuing to be realized at the beginning of this new reporting period.

<sup>7</sup> The UCD only applies Cooling Degree-Days to a data set that demonstrates an increase in energy consumption due to air-conditioning

**Table 5 – Portfolio Energy Consumption – Weather Normalized to FY2013**

Utility (units)	FY2013 <i>Baseline Year</i>	FY2018	Variance during Reporting Period	FY2019 <i>Forecast</i>
Total Electricity (kWh)	28,586,689	28,440,990	-145,699	28,000,000
Total Natural Gas (ekWh)	27,183,664	26,390,741	-792,923	25,000,000
Total Energy Consumption (ekWh)	55,770,353	54,831,731	-938,622	53,000,000
Total Gross Floor Area (GFA) (m <sup>2</sup> )	329,500	386,000	+56,500	391,000
Energy Intensity (ekWh/m <sup>2</sup> )	169.3	142.1	-27.2	135.0

Positive = energy increase; Negative = energy savings

### Review of Conservation Goals and Achievements

The previous ECDMP established annual conservation targets for each of the years in the reporting period.

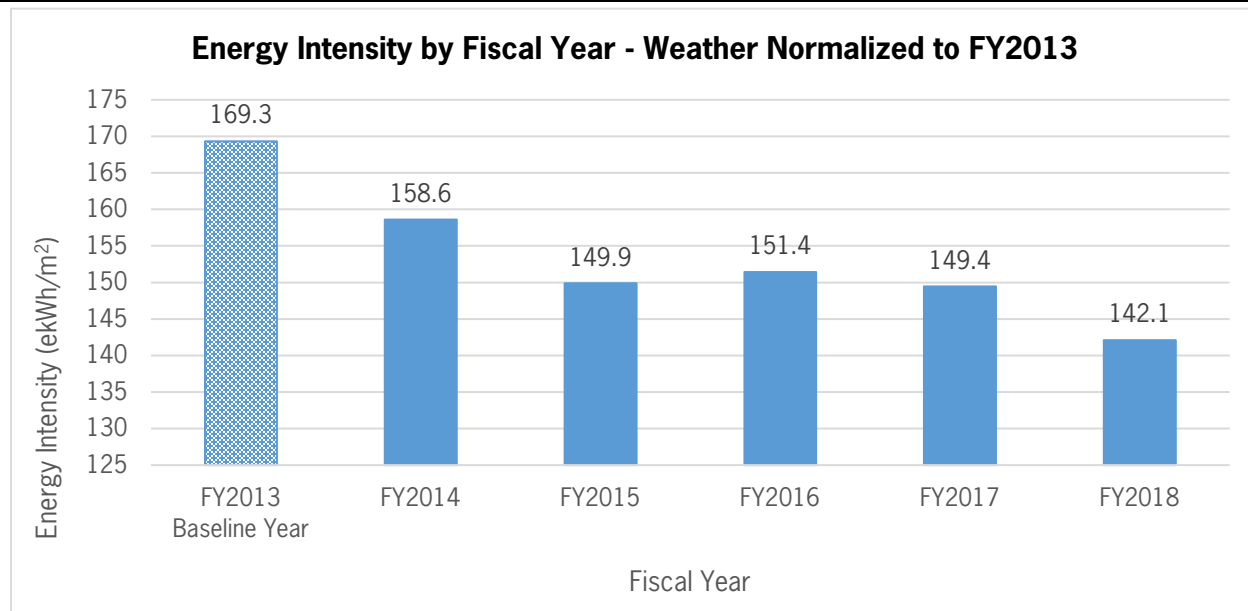
Tables 6 & 7 compares these targets against the actual weather-normalized savings that were realized.

**Table 6 – Cumulative Energy Savings for reporting period**

Savings Metric (units)	FY2013 to FY2018
TARGET Savings (%)	16%
ACTUAL Savings (%)	19%
TARGET Savings (ekWh/m <sup>2</sup> )	24.0
ACTUAL Savings (ekWh/m <sup>2</sup> )	27.2 (3.2 above target)

**Table 7 – Incremental Annual Energy Savings**

Savings Metric (units)	FY2013 to FY2014	FY2014 to FY2015	FY2015 to FY2016	FY2016 to FY2017	FY2017 to FY2018
TARGET Savings (%)	3%	3%	3%	3%	3%
ACTUAL Savings (%)	6.3%	5.5%	-1.0%	1.3%	4.9%
TARGET Savings (ekWh/m <sup>2</sup> )	5.0	4.9	4.8	4.7	4.5
ACTUAL Savings (ekWh/m <sup>2</sup> )	10.7	8.7	-1.6	2.0	7.4



The weather-normalized data clearly shows that significant improvements in energy efficiency were achieved every year at HCDSB, except between FY2015 and FY2016. This anomaly is easily explained. At the start of FY2016, a global change was made to all schools to accommodate the Before/After programs. As a result, the operating hours of each school’s HVAC equipment increased by ~30%, and in turn had a negative impact on overall energy intensity.

In conclusion, recent investments made by HCDSB in energy-efficiency – as shown in Appendix A.1 through A.5 – resulted in the Board surpassing our 5-year energy conservation targets by more than 3%, despite the introduction of several factors which had a tempering effect on the overall energy savings.

## Energy Efficiency Incentives – FY2014-19

Throughout the last 5 years, the Energy Management Team at HCDSB has participated in a variety of incentive programs that provide additional funding when installing energy efficient technologies. The revenue from the incentive programs is then re-invested to support subsequent conservation projects.

In total, by the end of FY2019, HCDSB will have received more than **\$470,000** in revenue from these incentive programs for the energy efficiency measures completed during the 5-Year ECDMP reporting period, with an additional **\$150,000** anticipated in FY2020.

The education sector retains an Incentive Program Advisor (IPA), who is invaluable to the Energy Management Team at HCDSB by providing supplementary expertise and resources during the applications process.

Moreover, in FY2017, the Energy Management Team investigated what it perceived to be an error in gas consumption and billing at St. Joan of Arc CES in Oakville, extending back to FY2012. Through a lengthy investigative process, it was determined HCDSB had in fact been considerably over-charged for gas consumption at this school. As a result, Union Gas reimbursed the Board for over **\$85,000** in 2017. This cost recovery payment was in addition to the returns received from the incentive programs.

For a school-by-school summary of the incentive revenue received in the last 5 years by the Board, please see Appendix C.

## Energy Conservation Projections and Savings Targets – FY2019-23

Facilities Management Services’ Long-Term Facility Renewal Strategy, in tandem with the Board’s Long Term Capital Plan, provides a roadmap for the ECDMP and the intended investment in energy efficient technologies over the next 5 fiscal years.

As budgets permit, the Energy Management Team has developed a strategy to focus on the following efficiency projects to meet our future conservation targets. For an annual breakdown of the planned investments, please see Appendix B.1 to B.5.

- ❖ High-efficiency heating and cooling plants and terminal units
- ❖ LED lighting retrofits and replacements
- ❖ New roofs with increased insulation
- ❖ Continuous (ongoing) commissioning of all facilities
- ❖ Improved control of large fans, pumps, heaters and ventilation
- ❖ More detailed oversight and management of temporary accommodation energy use

Just as the Board’s asset profile underwent marked changes in the last reporting period, it is expected to evolve considerably in the next 5 years as well. Table 8 shows that the key metrics, which caused us to re-contextualize our previous conservation goals, will have similar effect in the next period.

**Table 8 – Current and Projected HCDSB Asset Profile**

Key Metric (units)	FY2019	FY2023	Variance during Reporting Period
Total Number of Buildings	60	63	+3
Total Number of Portables/Portapaks	200/2	150/2	-50/0
Total Gross Floor Area (GFA) (m <sup>2</sup> )	391,000	425,000	+34,000
Nominal Operating Hours (per Week)	60	60	0
Average Daily Enrolment	35,600	40,670	+5,070
Total Community Use Hours	71,305	75,000	+3,700
Childcare Facilities	10	12	+2
% Total GFA air-conditioned	99.4%	100.0%	+0.6%

As a result of the planned investments in energy efficiency projects over the next five fiscal years, HCDSB has set the following energy conservation goals during that time period, summarized in Tables 9 through 11.

**Table 9 – Target Portfolio Energy Consumption Savings**

Utility (units)	FY2018 <i>Baseline Year</i>	FY2019 <i>Forecast<sup>8</sup></i>	FY2023 <sup>9</sup>	Variance during Reporting Period
Total Energy Consumption (ekWh)	57,116,491	57,500,000	55,810,000	-1,306,491
Total Gross Floor Area (GFA) (m <sup>2</sup> )	386,000	391,000	425,000	+34,000
Energy Intensity (ekWh/m <sup>2</sup> )	148.0	147.2	131.3	-16.7

**Table 10 – Target Cumulative Energy Savings**

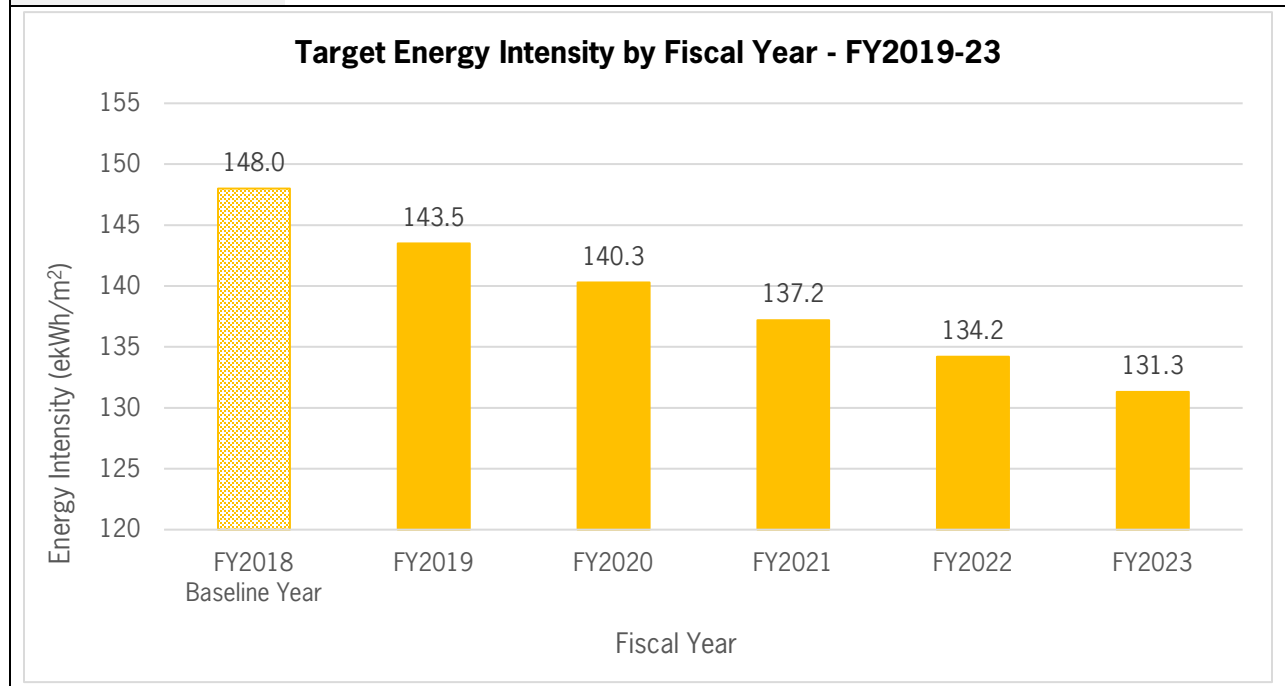
Savings Metric (units)	FY2019 to FY2023
TARGET Savings (%)	11%
TARGET Savings (ekWh/m <sup>2</sup> )	16.7

<sup>8</sup> FY2019 forecast is based on metered data; no weather-normalization has been applied to the baseline year (FY2018) at this time

<sup>9</sup> Includes estimated consumption of new builds at St. Nicholas CES, Milton #3 CSS & Milton #10 CES

**Table 11 – Target Incremental Annual Energy Savings**

Savings Metric (units)	FY2018 to FY2019	FY2019 to FY2020	FY2020 to FY2021	FY2021 to FY2022	FY2022 to FY2023
TARGET Savings (%)	3%	2%	2%	2%	2%
TARGET Savings (ekWh/m <sup>2</sup> )	4.5	3.2	3.1	3.0	2.9





## Approval

I confirm that HCDSB's senior management has reviewed and approved this 5-Year Energy Conservation and Demand Management Plan.

**Name:** Ryan Merrick

**Job Title:** Superintendent, Facility Management Services

**Date:** June 27, 2019

**Signed:**

A handwritten signature in blue ink, consisting of a series of connected loops and a final vertical stroke.

Appendix A.1 – Investments in Energy Efficiency FY2014-18 – Design, Construction & Retrofit

	FY2014	FY2015	FY2016	FY2017	FY2018
<b>Lighting</b>	<b>Investments in Energy Management Strategies</b>				
High-efficiency Lighting Systems including Occupancy and Daylighting Sensing, and Exterior Lighting	\$100,000	\$249,000	\$2,209,000	\$1,374,000	\$2,323,000
<b>HVAC</b>	<b>Investment in Energy Management Strategies</b>				
Efficient Boilers (near condensing)	\$10,000	\$ -	\$10,000	\$ -	\$ -
High-efficiency Boilers (condensing)	\$313,000	\$ -	\$195,000	\$280,000	\$185,000
Heat Recovery/Enthalpy Wheels	\$200,000	\$ -	\$100,000	\$ -	\$100,000
Energy Efficient HVAC Systems	\$650,000	\$ -	\$1,138,000	\$1,340,000	\$1,999,000
Energy Efficient Rooftop Units	\$ -	\$ -	\$190,000	\$300,000	\$137,000
High-efficiency Domestic Hot Water	\$ -	\$ -	\$5,000	\$70,000	\$70,000
Efficient Chillers and Controls	\$ -	\$ -	\$450,000	\$ -	\$ -
VFDs & High-efficiency Motors	\$50,000	\$ -	\$102,000	\$167,000	\$171,000
Demand Ventilation	\$10,000	\$ -	\$22,500	\$ -	\$5,000
Entrance Heater Controls	\$ -	\$ -	\$ -	\$15,000	\$ -
Cooling Tower & Controls	\$151,000	\$ -	\$ -	\$ -	\$ -

	FY2014	FY2015	FY2016	FY2017	FY2018
<b>Controls &amp; Automation</b>					
<b>Investment in Energy Management Strategies</b>					
Building Automation Systems - New	\$452,000	\$366,000	\$ -	\$231,000	\$238,000
Building Automation Systems - Upgrade	\$109,000	\$ -	\$288,000	\$255,000	\$475,000
Building Automation Systems – Maintenance	\$55,000	\$57,000	\$58,000	\$59,000	\$59,000
Other (Real time Utility Metering, Voltage Correction)	\$ -	\$ -	\$28,500	\$167,000	\$93,000
<b>Building Envelope</b>					
<b>Investment in Energy Management Strategies</b>					
New Roofing	\$ -	\$ -	\$869,000	\$1,960,000	\$698,000
<b>Total Investment</b>	<b>\$2,100,000</b>	<b>\$672,000</b>	<b>\$5,665,000</b>	<b>\$6,218,000</b>	<b>\$6,553,000</b>

Appendix A.2 – Investments in Energy Efficiency FY2014-18 – Operating and Maintenance

	FY2014	FY2015	FY2016	FY2017	FY2018
<b>Maintenance</b>	<b>Investment in Energy Management Strategies</b>				
HVAC maintenance	\$1,320,000	\$1,350,000	\$1,390,000	\$1,082,000	\$756,000
<b>Energy Audits/Operations</b>	<b>Investment in Energy Management Strategies</b>				
Building Commissioning – New Construction	\$45,000	\$42,000	\$ -	\$23,000	\$ -
Building Commissioning – Existing Building	\$56,000	\$53,000	\$68,000	\$72,000	\$65,000
Engineering Audits	\$ -	\$ -	\$2,000	\$ -	\$ -
<b>Total Investment</b>	<b>\$1,421,000</b>	<b>\$1,445,000</b>	<b>\$1,460,000</b>	<b>\$1,177,000</b>	<b>\$821,000</b>

Appendix A.3 – Investments in Energy Efficiency FY2014-18 – Occupant Behaviour

	FY2014	FY2015	FY2016	FY2017	FY2018
<b>Training and Education</b>	<b>Investment in Energy Management Strategies</b>				
Building Operator Training	\$ -		\$1,500	\$ -	\$ -
Ongoing Training and Awareness Programs for Energy Conservation	\$ -	\$2,500	\$2,500	\$500	\$1,500
Provide Detailed Information on Building Operational Costs	\$ -	\$ -	\$ -	\$2,000	\$2,000
Provide Detailed Information on Energy Consumption (e.g. via the Utility Consumption Database or other database)	\$40,000	\$ -	\$36,000	\$10,000	\$10,000
Participate in Environmental Programs, such as EcoSchools, Earthcare	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000
<b>Total Investment</b>	<b>\$42,000</b>	<b>\$4,500</b>	<b>\$42,000</b>	<b>\$14,500</b>	<b>\$15,500</b>

Appendix A.4 – Investments in Energy Efficiency FY2014-18 – Renewable Energy

	FY2014	FY2015	FY2016	FY2017	FY2018
<b>Renewable Energy</b>	<b>Investment in Energy Management Strategies</b>				
Solar Photovoltaic (maintenance)	\$ -	\$ -	\$2,000	\$2,000	\$5,000
Charging Stations (solar)	\$ -	\$ -	\$ -	\$ -	\$7,500
<b>Total Investment</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$2,000</b>	<b>\$2,000</b>	<b>\$12,500</b>

Appendix A.5 – Investments in Energy Efficiency FY2014-18 – Total Investments by Fiscal Year

	FY2014	FY2015	FY2016	FY2017	FY2018	FY2014 to FY2018
Investment Type	Investment in Energy Management Strategies					Total Investment
Design, Construction & Retrofit	\$2,100,000	\$672,000	\$5,665,000	\$6,218,000	\$6,553,000	\$21,208,000
Operations and Maintenance	\$1,421,000	\$1,445,000	\$1,460,000	\$1,177,000	\$821,000	\$6,324,000
Occupant Behaviour	\$42,000	\$4,500	\$42,000	\$14,500	\$15,500	\$118,500
Renewable Energy	\$ -	\$ -	\$2,000	\$2,000	\$12,500	\$16,500
<b>Total Investment</b>	<b>\$3,563,000</b>	<b>\$2,121,500</b>	<b>\$7,169,000</b>	<b>\$7,411,500</b>	<b>\$7,402,000</b>	<b>\$27,667,000</b>

Appendix B.1 – Planned Investments in Energy Efficiency FY2019-23 – Design, Construction & Retrofit<sup>10</sup>

	FY2019	FY2020	FY2021	FY2022	FY2023
<b>Lighting</b>					
<b>Planned Investments in Energy Management Strategies</b>					
High-efficiency Lighting Systems including Occupancy and Daylighting Sensing	\$1,635,000	\$690,000	\$600,000	\$600,000	\$1,050,000
Exterior Lighting – LED retrofits	\$ -	\$ -	\$50,000	\$50,000	\$50,000
LED re-lamping or retrofit of newer schools	\$ -	\$350,000	\$350,000	\$350,000	\$100,000
<b>HVAC</b>					
<b>Planned Investment in Energy Management Strategies</b>					
High-efficiency Boilers (condensing)	\$850,000	\$150,000	\$100,000	\$500,000	\$160,000
Heat Recovery/Enthalpy Wheels	\$ -	\$ -	\$200,000	\$100,000	\$100,000
Energy Efficient HVAC Systems	\$1,220,000	\$350,000	\$2,100,000	\$1,100,000	\$750,000
Energy Efficient Rooftop Units	\$ -	\$ -	\$ -	\$50,000	\$50,000
High-efficiency Domestic Hot Water	\$70,000	\$30,000	\$ -	\$ -	\$40,000
Efficient Chillers and Controls	\$80,000	\$ -	\$ -	\$250,000	\$400,000
VFDs & High-efficiency Motors	\$85,000	\$131,000	\$175,000	\$125,000	\$110,000
Demand Ventilation	\$15,000	\$ -	\$20,000	\$15,000	\$15,000
Entrance Heater Controls	\$45,000	\$10,000	\$20,000	\$35,000	\$35,000
Cooling Tower & Controls	\$233,000	Included in VFDs	Included in VFDs	\$ -	\$ -
Portable Classroom - HVAC Refurbishment	\$ -	\$15,000	\$15,000	\$15,000	\$15,000

<sup>10</sup> Subject to funding availability, local priorities and Board approval



	FY2019	FY2020	FY2021	FY2022	FY2023
<b>Controls &amp; Automation</b>					
<b>Planned Investment in Energy Management Strategies</b>					
Building Automation Systems - New	\$150,000	\$ -	\$650,000	\$200,000	\$200,000
Building Automation Systems - Upgrade	\$385,000	\$450,000	\$ -	\$ -	\$ -
Building Automation Systems - Maintenance	\$60,000	\$65,000	\$65,000	\$65,000	\$70,000
Real-time Utility Metering	\$88,000	\$63,000	\$60,000	\$63,000	\$63,000
<b>Building Envelope</b>					
<b>Planned Investment in Energy Management Strategies</b>					
New Roofing	\$ -	\$1,500,000	\$ -	\$1,000,000	\$500,000
<b>Total Investment</b>	<b>\$4,916,000</b>	<b>\$3,804,000</b>	<b>\$4,405,000</b>	<b>\$4,518,000</b>	<b>\$3,708,000</b>

Appendix B.2 – Planned Investments in Energy Efficiency FY2019-23– Operating and Maintenance

	FY2019	FY2020	FY2021	FY2022	FY2023
<b>Policy/Planning/Maintenance</b>	<b>Planned Investment in Energy Management Strategies</b>				
New School Design/Construction Guidelines and Specifications	\$4,000	\$ -	\$ -	\$ -	\$ -
Night-time Blackout of Sites (Interior and Exterior)	\$2,000	\$7,000	\$ -	\$ -	\$ -
HVAC & Lighting maintenance	\$1,000,000	\$900,000	\$800,000	\$750,000	\$750,000
<b>Energy Audits/Operations</b>	<b>Planned Investment in Energy Management Strategies</b>				
Building Commissioning – New Construction	\$22,500	\$ -	\$65,000	\$25,000	\$25,000
Building Commissioning – Existing Buildings	\$55,000	\$45,000	\$45,000	\$45,000	\$45,000
Engineering Audit	\$11,500	\$5,000	\$ -	\$ -	\$ -
<b>Total Investment</b>	<b>\$1,095,000</b>	<b>\$957,000</b>	<b>\$910,000</b>	<b>\$820,000</b>	<b>\$820,000</b>

Appendix B.3 – Planned Investments in Energy Efficiency FY2019-23 – Occupant Behaviour

	FY2019	FY2020	FY2021	FY2022	FY2023
<b>Training and Education</b>	<b>Planned Investment in Energy Management Strategies</b>				
Energy Benchmarking Program (Energy Star)	\$ -	\$5,000	\$ -	\$ -	\$ -
Ongoing Training and Awareness Programs for Energy Conservation	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000
Provide Detailed Information on Building Operational Costs	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000
Provide Detailed Information on Energy Consumption (e.g. via the Utility Consumption Database or other database)	\$10,000	\$8,000	\$4,000	\$4,000	\$4,000
Participate in Environmental Programs, such as EcoSchools, Earthcare	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000
<b>Total Investment</b>	<b>\$15,000</b>	<b>\$18,000</b>	<b>\$9,000</b>	<b>\$9,000</b>	<b>\$9,000</b>

Appendix B.4 – Planned Investments in Energy Efficiency FY2019-23 – Renewable Energy

	FY2019	FY2020	FY2021	FY2022	FY2023
<b>Renewable Energy</b>	<b>Planned Investment in Energy Management Strategies</b>				
Solar Photovoltaic – Net-meter Feasibility Study	\$ -	\$ -	\$25,000	\$ -	\$ -
Solar Photovoltaic (Maintenance)	\$7,000	\$3,000	\$3,000	\$3,000	\$3,000
Charging Stations (solar)	\$ -	\$10,000	\$ -	\$ -	\$ -
<b>Total Investment</b>	<b>\$7,000</b>	<b>\$13,000</b>	<b>\$28,000</b>	<b>\$3,000</b>	<b>\$3,000</b>

Appendix B.5 – Planned Investments in Energy Efficiency FY2019-23 – Total Investments by Fiscal Year

	FY2019	FY2020	FY2021	FY2022	FY2023	FY2019 to FY2023
Investment Type	Planned Investment in Energy Management Strategies					Total Investment
Design, Construction & Retrofit	\$4,916,000	\$3,804,000	\$4,405,000	\$4,518,000	\$3,708,000	\$21,351,000
Operations and Maintenance	\$1,095,000	\$957,000	\$910,000	\$820,000	\$820,000	\$4,602,000
Occupant Behaviour	\$15,000	\$18,000	\$9,000	\$9,000	\$9,000	\$60,000
Renewable Energy	\$7,000	\$13,000	\$28,000	\$3,000	\$3,000	\$54,000
<b>Total Investment</b>	<b>\$6,033,000</b>	<b>\$4,792,000</b>	<b>\$5,352,000</b>	<b>\$5,350,000</b>	<b>\$4,540,000</b>	<b>\$26,067,000</b>

Appendix C – Energy Efficiency Incentives Revenue – By School

SCHOOL	Incentive Amount					
	FY2014	FY2015	FY2016	FY2017	FY2018 <sup>11</sup>	FY2019 <sup>12</sup>
Adult Learning Center			\$2,300			
Ascension CES						
Assumption CSS						\$25,200
Bishop P.F. Reding CSS					\$45,000	\$30,000
Canadian Martyrs CES						\$33,000
Christ the King CSS				\$5,500	\$2,115	
Corpus Christi CSS				\$4,500	\$2,240	
Guardian Angels CES				\$500		\$1,000
Holy Cross CES						
Holy Family CES						
Holy Rosary (Burlington) CES			\$17,600			
Holy Rosary (Milton) CES			\$380			
Holy Trinity CSS				\$22,800	\$3,300	
Jean Vanier CSS					\$3,500	
Lumen Christi CES						
Notre Dame CSS					\$42,500	
Our Lady of Fatima CES						
Our Lady of Peace CES			\$43,500			
Our Lady of Victory CES						
Queen of Heaven CES						
Sacred Heart of Jesus CES			\$9,000			
St. Andrew CES			\$6,120			
St. Anne CES						
St. Anthony of Padua CES				\$500		\$1,000
St. Benedict CES						

<sup>11</sup> Some incentive for FY2018 still pending

<sup>12</sup> FY2019 incentives are projections only

SCHOOL	Incentive Amount					
	FY2014	FY2015	FY2016	FY2017	FY2018 <sup>11</sup>	FY2019 <sup>12</sup>
St. Bernadette CES			\$30,500			
St. Brigid CES				\$31,300		
St. Catherine of Alexandria CES				\$500		\$1,000
St. Christopher CES				\$500		\$1,000
St. Dominic CES						
St. Elizabeth Seton CES				\$500		\$1,000
St. Francis of Assisi CES						
St. Gabriel CES						\$40,000
St. Gregory the Great CES			\$9,800			
St. Ignatius of Loyola CSS						
St. Nicholas (St. James) CES						
St. Nicholas CES (new 2020)						\$16,220
St. Joan of Arc CES				\$84,000 <sup>13</sup>	\$1,350 <sup>5</sup>	
St. John (Burlington) CES		\$12,900				
St. John (Oakville) CES						
St. John Paul II CES				\$500		\$1,000
St. Joseph (Oakville) CES						
St. Joseph (Acton) CES						
St. Luke CES				\$19,250		
St. Marguerite d'Youville CES				\$23,800		
St. Mark CES					\$38,000	
St. Mary CES						
St. Matthew CES				\$9,600		
St. Michael CES					\$10,200	
St. Patrick CES						
St. Paul CES						

<sup>13</sup> Cost recovery from Union Gas for incorrect billing

SCHOOL	Incentive Amount					
	FY2014	FY2015	FY2016	FY2017	FY2018 <sup>11</sup>	FY2019 <sup>12</sup>
St. Peter CES						\$1,250
St. Raphael CES						
St. Scholastica CES					\$32,160	
St. Teresa of Calcutta CES			\$6,120			
St. Thomas Aquinas CSS						
St. Timothy CES				\$24,100		
St. Vincent CES			\$8,940			
<b>TOTAL</b>	<b>N/A</b>	<b>\$12,900</b>	<b>\$134,260</b>	<b>\$227,850</b>	<b>\$180,365</b>	<b>\$151,670</b>