



THUNDER BAY CATHOLIC
DISTRICT SCHOOL BOARD

THUNDER BAY CATHOLIC DISTRICT SCHOOL BOARD
Energy Conservation and Demand Management Plan



celebrating 50 years

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Education Sector Background

Funding and Energy Management Planning

All school boards receive 100% of their funding from the Ministry of Education.

The Ministry announces each Board's funding assignment in March for the next school board Fiscal Year (September 1st to August 31st). The Ministry gives funding only on a year-by-year basis.

While a board may have a five-year energy management strategy, the ability to implement their strategy depends on the funding that's received for each of the five years covered by their plan.

Asset Portfolios and Energy Management Planning

The education sector is unique in that a board's asset portfolio can experience important changes that crucially impact a board's energy consumption over a five-year period.

The following is a list of some of the most common variables and metrics that change in the education sector.

Facility Variables:

- *Construction*
 - *Year built*
 - *Number of floors*
 - *Orientation of the building*
- *Building Area*
 - *Major additions*
 - *Sites sold/closed/demolished/leased*
 - *Portables*
 - *Installed*
 - *Removed*
 - *Areas under construction*

- *Equipment/Systems*
 - *Age*
 - *Type of technology*
 - *Lifecycle*
 - *Percentage of air-conditioned space*
- *Site Use*
 - *Elementary school*
 - *Secondary school*
 - *Administrative building*
 - *Maintenance/warehouse facility*
 - *Community Hubs*
- *Shared Site Use (For example: two or more boards share common areas and/or partnered with a municipality)*
 - *Swimming pools*
 - *Libraries*
 - *Lighted sports fields*
 - *Sports domes*

Other Variables:

- *Programs*
 - *Child care*
 - *Before/After School Programs*
 - *Summer School*
 - *Community Use*
- *Occupancy*
 - *Significant increase or decrease in number of students*
 - *Significant increase in the hours of operation*
 - *New programs being added to a site*
- *Air Conditioning*
 - *Significant increase in air-conditioned space*
 - *Portables*

PART I: A REVIEW OF PROGRESS & ACHIEVEMENTS in the PAST FIVE YEARS

A. The Board's Asset Portfolio

The following table outlines the energy-related variables and metrics in the Board's asset portfolio that changed from the baseline Fiscal Year 2012 to 2013 to the end of the five-year reporting period Fiscal Year 2017 to 2018.

Table 1: Board's Asset Portfolio

<i>Key Metrics</i>	<i>(Baseline Year) Fiscal Year 2012 to 2013</i>	<i>Fiscal Year 2017 to 2018</i>	<i>Variance</i>
<i>Total Number of Buildings</i>	21	21	0
<i>Total Number of Portables/Portapaks</i>	20	16	-4
<i>Total Floor Area (m2)</i>	89,513	89,314	-199
<i>Average Daily Enrolment</i>	7,350	7,473	-123
<i>Other Relevant Changes in the Operation of Assets: Child Care, Before and After School</i>	5,620	7,773	2,153

B. Energy Usage Data for the Board

The following table lists the "metered"¹ consumption values in the common unit of Equivalent Kilowatt Hours (ekWh) and Kilowatt Hours (kWh).

Table 2: Metered Usage Values

<i>Utility</i>	<i>Fiscal Year 2012 to 2013 (Baseline year)</i>	<i>Fiscal Year 2017 to 2018</i>
<i>Total Electricity (kWh)</i>	7,653,308	7,026,906
<i>Total Natural Gas (ekWh)</i>	16,575,150	16,244,450

¹ Metered consumption is the quantity of energy used and does not include a loss adjustment value (the quantity of energy lost in transmission).

C. Weather Normalized Energy Consumption Values

In Ontario, 25% to 35% of energy consumption for a facility is affected by weather.

To demonstrate the effect of weather, the following table shows the Weighted Average Heating Degree Days (HDD)² and Cooling Degree Days (CDD)³ for the six most common Environment Canada weather stations in the Ontario education sector.

Table 3: Ontario Degree-days

Ontario Degree Days	Fiscal Year 2012 to 2013	Fiscal Year 2013 to 2014	Fiscal Year 2014 to 2015	Fiscal Year 2015 to 2016	Fiscal Year 2016 to 2017	Fiscal Year 2017 to 2018
HDD	3698	4285	4091	3355	3583	3989
CDD	289	217	271	462	303	432

The best way to compare energy usage values from one year to another is to use weather normalized values as they take into consideration the impact of weather on energy performance and allows an “apple-to-apple” comparison of consumption across multiple years.

However, a straight comparison of Total Energy Consumed between one or more years does not take into consideration changes in a board’s asset portfolio, such as changes in buildings’ features (refer to the Facility Variables listed on pages 5 and 6), and newly implemented programs (refer to the Note to Readers on pages 10-12) which will greatly impact energy consumption.

As a result, weather normalized Energy Intensity⁴ is the most accurate measurement that allows the evaluation of a board’s energy use from one year to another as it cancels out any change in floor area.

² Heating Degree Day (HDD) is a measure used to quantify the impact of cold weather on energy use. In the data above, HDD are the number of degrees that a day’s average temperature is below 18C (the balance point), the temperature at which most buildings need to be heated.

³ Cooling Degree Day (CDD) is a measure used to quantify the impact of hot weather on energy use. In the data above, CDD are the number of degrees that a day’s average temperature is above 18C, the temperature at which most buildings need to be cooled. It should be noted that not all buildings have air conditioning and some buildings have partial air conditioning. The UCD only applies CDD to meters that demonstrate an increase in consumption due to air conditioning.

⁴ Energy Intensity (known as EI) is the quantity of total energy consumed divided by the total floor area. EI is typically expressed as equivalent kilowatt hours per square foot (ekWh/ft2), gigajoule per square metre (GJ/m2), etc., depending on the user’s preference.

Table 4: Weather Normalized Values

<i>Weather Normalized Values</i>	<i>Fiscal Year 2012 to 2013 (Baseline Year)</i>	<i>Fiscal Year 2017 to 2018 (Most Recent Data Available)</i>
<i>Total Energy Consumed (ekWh)</i>	<i>24,228,460</i>	<i>23,271,350</i>
<i>Energy Intensity (ekWh/m2)</i>	<i>270.67</i>	<i>260.56</i>

D. Review of Previous Energy Conservation Goals and Achievements

In 2014, the Board set annual energy conservation goals for the following five fiscal years. The following table compares the Energy Intensity Conservation Goal with the Actual Energy Intensity Reduced for each year.

Table 5: Comparison of Energy Intensity Conservation Goal and Actual Energy Intensity Reduced

<i>Fiscal Year</i>	<i>Conservation Goal ekWh/m2</i>	<i>Conservation Goal Percentage</i>	<i>Actual Energy Savings ekWh/m2</i>	<i>Actual Energy Percentage</i>
<i>2013 to 2014</i>	<i>2.11</i>	<i>0.83%</i>	<i>8.71</i>	<i>-3.22%</i>
<i>2014 to 2015</i>	<i>2.11</i>	<i>0.83%</i>	<i>4.32</i>	<i>-1.55%</i>
<i>2015 to 2016</i>	<i>2.11</i>	<i>0.83%</i>	<i>1.67</i>	<i>-0.59%</i>
<i>2016 to 2017</i>	<i>2.11</i>	<i>0.83%</i>	<i>-2.80</i>	<i>0.98%</i>
<i>2017 to 2018</i>	<i>2.11</i>	<i>0.83%</i>	<i>270.67</i>	<i>7.79%</i>

NOTE TO READERS:

The Conservation Goals were forecasted in Spring 2014. Since then several factors, which impact energy use, have been introduced to the education sector that may either raise or limit a board’s ability to make the forecasted Conservation Goals. Some of these factors include:

Full Day Kindergarten (also known as FDK)

The introduction of FDK created many new spaces through new additions or major renovations of existing facilities. The result was more floor area and sometimes more energy-intensive designs due to factors such as:

- *Higher ventilation requirements,*
- *Use of air conditioning, etc.*

These factors increase the energy intensity of a building. Under FDK, spaces for more than 470,000 new students were added to the education sector.

Before and After School Programs

These programs were implemented to help the introduction of FDK spaces. However, Before-School and After-School Programs need a facility's Heating, Conditioning, and Air Conditioning (also known as HVAC) system to operate for an extended period of time on a daily basis, which will increase the overall energy intensity.

Community Use of Schools

The Ministry of Education introduced funding to all school boards, so they can make school space more affordable for use after hours. Both indoor and outdoor school space is available to not-for-profit community groups at reduced rates, outside of regular school hours. The use of spaces in schools, typically gymnasiums and libraries, increased to maximum usage. The use of these spaces during non-school hours requires a facility's HVAC system to operate for an extended period of time on a daily basis, which will increase the overall energy intensity.

Community Hubs

In 2016, the Ministry of Education introduced funding for boards to carry out Community Hubs within their asset portfolios. As a result, many schools now offer a greater range of:

- *events (cultural),*
- *programs (arts, recreation, childcare), and*
- *services (health, family resource centres).*

The dramatic increase in community use means that many schools now run from 6:00 a.m. until 11:00 p.m. during weekdays and are open many times on weekends. The use of these

spaces during non-school hours requires a facility's HVAC system to operate for an extended period of time on a daily basis, which will increase the overall energy intensity.

Air Conditioning

Historically, schools have not had air conditioning, or it has been a minimal space in the facility. However, with changing weather patterns, "shoulder seasons" such as May, June and September are experiencing higher than normal temperatures. Parents are demanding that schools have air conditioning. Air conditioning significantly increases a facility's energy use, three schools with some office space and one building with air conditioning.

Compliance with current Ontario Building Code (also known as OBC)

When renovations or an addition is built onto an existing school, in-place equipment such as HVAC systems, lighting etc., may be required to meet up-to-date OBC standards which may result in increased energy use.

For example under the OBC, buildings built today have increased ventilation requirements, meaning more outside air is brought into a facility. As a result, HVAC systems need to work longer to heat or cool the outdoor air to bring it to the same temperature as the standard indoor temperature for the building.

E. Cumulative Energy Conservation Goal

The following table compares the 2014 Forecasted Cumulative Energy Intensity Conservation Goal with the Actual Cumulative Energy Intensity Reduced Savings.

Table 6: Cumulative Energy Intensity Goal from Fiscal Year 2013 to 2014 through Fiscal Year 2017 to 2018

<i>Cumulative Energy Intensity</i>	<i>(ekWh/m2)</i>	<i>Variance</i>
<i>Forecasted. Cumulative Energy Intensity Conservation Goal of Fiscal Year 2013 to 2014 through Fiscal Year 2017 to 2018</i>	10.56	
<i>Forecasted Cumulative Energy Intensity Conservation Goal as a Percentage</i>		5%
<i>Actual Cumulative Energy Intensity Reduced or Increased from Fiscal Year 2013 to 2014 through Fiscal Year 2017 to 2018 – Weather Normalized</i>	10.11	
<i>Variance between 2014 Forecast Cumulative Conservation Goal and Actual Cumulative Energy Intensity– Weather Normalized</i>	0.48	
<i>% of Cumulative Energy Intensity Conservation Goal Achieved - Weather Normalized</i>		95.76%

F. Measures Implemented from Fiscal Year 2012 to 2013 to Fiscal Year 2017 to 2018

*A list of the measures implemented, the related costs, and the fiscal year that the measure was implemented within the Board are outlined in **Appendix: Investments in Energy Efficiency between Fiscal Year 2013 and Fiscal Year 2018**. Here is the list of sheets:*

- 1. Design, Construction and Retrofit Investments*
- 2. Operations and Maintenance Investments*
- 3. Occupant Behaviour Investments*
- 4. Renewable Energy Investments*
- 5. Summary of All Investment Types*

NOTE TO READERS:

Important Consideration - *It takes a minimum of one full year after an energy management strategy has been implemented before an evaluation can figure out the related actual energy savings achieved.*

PART II – ENERGY CONSERVATION and DEMAND MANAGEMENT PLAN for FISCAL YEAR 2018 to 2019 to FISCAL YEAR 2023 to 2024

Part II outlines the board's plan to reduce energy consumption through renewable energy and energy management strategies including:

- 1. Design, Construction and Retrofit;*
- 2. Operations and Maintenance; and lastly*
- 3. Occupant Behavior.*

Background

- 1. To date the Board's energy management strategy has included the following:*

The Board has been actively engaged in energy management since 2005. In 2005 the Board entered into a contract with Honeywell to identify and implement energy conservation and savings opportunities within the Board's Schools. The Board invested \$2.8 million into energy retrofit project in June 2005 with a goal of reducing annual energy consumption by approximately 15% or \$237,000 annually. By October 2013 the Board had achieved cumulative monitored savings of \$2,707,554 or approximately 167% of our target.

In 2009, the Board entered into a Phase 2 energy retrofit project with Honeywell. A total of \$3.3 million was invested in projects designed to increase energy efficiency and indoor comfort. Additional savings of \$110,000 annually were projected. Included in the project were two solar photovoltaic projects each generating approximately 10,000 kwh annually.

In 2011 received funding from the Ministry of Education to install an 80,000 annual kwh solar photovoltaic project.

As a result of the above measures the Board was recognized by Ontario Power Authority for its conservation efforts.

In 2016 and 2017 the Board entered into Phase 3 and 4 of the energy retrofit project with Honeywell. An additional \$7,658,434 was invested into energy efficiencies. As a result of these investments expected annual savings of \$468,000.

In addition, the Board has an active conservation committee which has resulted in nine of twenty schools become EcoSchool certified.

2. *The Board has an energy management position which includes the following options.*

- In-house including:*
- a. *Full time*
 - b. *Part time*
 - c. *Shared job function*
- Contracted third party, or*
- None*

3. *Energy Management Strategies*

Energy management strategies fall into four key categories:

1. *Renewable Energy*
2. *Design/Construction/Retrofit*
3. *Operations and Maintenance*
4. *Occupant Behaviour*

Renewal Energy

Definition

Renewal energy is a strategy to cut down a board's energy use from the province's electricity grid and includes:

- *solar panels*
- *wind turbines, etc.*

*For a list of the Board's renewable energy projects, please refer to the **Calculating Energy Conservation Goals Fiscal Year 2019 to Fiscal Year 2023** explained in **Appendix A: Renewable Energy**.*

Design/Construction/Retrofit

Definition

Design, construction, and retrofit includes the original and ongoing intent of how a building and its systems are to work through the combination of disciplines such as architecture and engineering.

*For the Board's relevant projects over the next five years, please refer to **Calculating Energy Conservation Goals Fiscal Year 2019 to Fiscal Year 2023, Appendix B: Design, Construction, and Retrofit.***

Operations and Maintenance

Definition

*Operations and maintenance include the strategies the Board uses to make sure that the existing buildings and equipment performs at maximum efficiency. For the Board's relevant projects over the next five years, please refer to **Calculating Energy Conservation Goals Fiscal Year 2019 to Fiscal Year 2023, Appendix C: Operations and Maintenance.***

Occupant Behaviour

Definition

*Strategies that the Board uses to teach occupants, including staff, students and community users, with an emphasis on changing specific actions to reduce energy consumption. For the Board's relevant projects over the next five years, please refer to **Calculating Energy Conservation Goals Fiscal Year 2019 to Fiscal Year 2023, Appendix D: Occupant Behaviour.***

A. Future Energy Conservation Goals

The Board has set out the following energy intensity reduction conservation goals for the next five fiscal years.

Table 7: Annual Energy Intensity Conservation Goals

<i>Annual Energy Intensity Conservation Goal</i>	<i>Fiscal Year 2018 to 2019</i>	<i>Fiscal Year 2019 to 2020</i>	<i>Fiscal Year 2020 to 2021</i>	<i>Fiscal Year 2021 to 2022</i>	<i>Fiscal Year 2022 to 2023</i>
<i>ekW/m2</i>	<i>2.47</i>	<i>2.61</i>	<i>2.61</i>	<i>2.61</i>	<i>2.61</i>
<i>Percentage Decrease</i>	<i>.95%</i>	<i>1.00%</i>	<i>1.00%</i>	<i>1.00%</i>	<i>1.00%</i>

The following table shows the Board’s Cumulative Energy Intensity Conservation Goal for the next five fiscal years.

Table 8: Cumulative Conservation Goal

<i>Cumulative Conservation Goal</i>	<i>Fiscal Year 2018 to 2019 through Fiscal Year 2022 to 2023</i>
<i>ekWh/m2</i>	<i>12.92</i>
<i>Percentage Decrease</i>	<i>4.95%</i>

NOTE TO READERS:

There are many factors that influence a board’s ability to meet energy conservation goals. A list of some of these factors includes; but is not limited to, in the following changes:

1. Changes in Programming

For example:

- Introduction of Before and After School Programs to schools meant that the number of hours that a facility’s HVAC system operates daily was expanded by four or more hours per weekday to reflect the longer occupancy hours.

2. Changes to the Ontario Building Code

For example:

- *Regular changes/updates to the Ontario Building Code can impact energy use. For example, an increase in levels of ventilation in newly constructed buildings or other requirements. As a result, more fresh air is brought into a school to meet the ventilation requirements throughout the day requires heating and cooling of the air (dependent on the season) to meet standard classroom temperatures.*

3. Changes to School Board Funding Models

- *Forecasted Conservation Goals are based on current funding models being in place throughout the next five years.*
- *All boards' funding is determined on an annual basis. Any changes to the funding model will impact forecasted values.*

4. Changes in Technology

- *Forecasted Conservation Goals are based on current technologies and related energy savings. If new technologies become available, anticipated energy savings may increase.*

B. Environmental Programs

In Fiscal Year 2018 to 2019, schools within the Board participated in environmental programs.

1. *Eco Schools:*
9 *number of schools participate*
2. *Earth Care Schools:*
 number of schools participate
3. *Enbridge: The School Energy Challenge*
 number of schools participate

C. Energy Efficiency Incentives

1. *The Board applies to incentive programs to support the implementation of energy efficient projects on a regular basis.*

Yes No

If yes, between Fiscal Year 2013 to 2014 and Fiscal Year 2017 to 2018, the Board has applied for \$275,000 in incentive funding from different agencies to support the implementation of energy efficient projects.

2. *The Board uses the services of the sector's Incentive Programs Advisor (IPA).*

Yes No

D. Energy Procurement

1. *The Board participates in a consortia arrangement to purchase electricity.*

Yes No

If yes,

OECM's Strategic Electricity Management and Advisory Services

Other:

Provide Name of Consortia: Lakehead Purchasing Consortium

2. *The Board participates in a consortia arrangement to purchase natural gas.*

Yes No

If yes,

Ontario Education Collaborative Marketplace's (also known as OECM) Natural Gas Management and Advisory Services

Catholic School Board Services Association' (also known as CSBSA) Natural Gas Management and Advisory Services

Other:

Provide Name of Consortia: Lakehead Purchasing Consortium

E. Demand Management

1. *The Board uses the following method(s) to monitor electrical Demand:*

- Invoices*
 - Real-time data*
 - Online data from the Local Distribution Company (LDC)*
 - Other:*
-

2. *The Board uses the following methodologies to cut down electrical Demand:*

- Equipment scheduling*
 - Phased/staged use of equipment*
 - Demand-limit equipment*
 - Deferred start-up of large equipment (e.g. chiller start-up in spring)*
 - Other:*
-

F. Senior Management Approval of this Energy Conservation and Demand Management Plan

I confirm that Thunder Bay Catholic District School Board's senior management has reviewed and approved this Energy Conservation and Demand Management Plan.

Full Name: Sheila Chiodo

Job Title: Superintendent of Finance and Corporate Services

Date: June 28, 2019

Investments in Energy Management Strategies

Design, Construction and Retrofit Strategies

	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
Lighting	Investments in Energy Management Strategies	Investment in Energy Management Strategies	Investment in Energy Management Strategies	Investment in Energy Management Strategies	Investment in Energy Management Strategies
High-efficiency Lighting Systems (T-8, T-5, CFL, LED ...)	\$ 100,000	\$ 20,000	\$ 20,000	\$ 901,110	\$ -
Daylight Sensors	\$ -	\$ -	\$ -	\$ -	\$ 500,862
Outdoor Lighting	\$ 20,000	\$ 10,000	\$ -	\$ 93,110	\$ -
Occupancy Sensors	\$ -	\$ -	\$ -	\$ -	\$ -
Daylight Harvesting	\$ -	\$ -	\$ -	\$ -	\$ -
Other (Describe)	\$ -	\$ -	\$ -	\$ -	\$ -

	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
HVAC	Investment in Energy Management Strategies	Investment in Energy Management Strategies	Investment in Energy Management Strategies	Investment in Energy Management Strategies	Investment in Energy Management Strategies
Efficient Boilers (near condensing)	\$ -	\$ -	\$ -	\$ -	\$ -
High-efficiency Boilers (condensing)	\$ 100,000	\$ -	\$ -	\$ -	\$ -
High-efficiency Boiler Burners	\$ -	\$ -	\$ -	\$ -	\$ -
Geothermal	\$ -	\$ -	\$ -	\$ -	\$ -
Heat Recovery/Enthalpy Wheels	\$ -	\$ -	\$ -	\$ -	\$ -
Economizers	\$ -	\$ -	\$ -	\$ -	\$ -
Energy Efficient HVAC Systems	\$ -	\$ -	\$ 160,000	\$ 2,601,877	\$ -
Energy Efficient Rooftop Units	\$ -	\$ -	\$ -	\$ 694,728	\$ -
High-efficiency Domestic Hot Water	\$ -	\$ -	\$ -	\$ 7,500	\$ -
Efficient Chillers and Controls	\$ -	\$ 20,000	\$ -	\$ 12,346	\$ -
High-efficiency Motors	\$ -	\$ -	\$ -	\$ -	\$ -
VFD	\$ -	\$ -	\$ -	\$ 96,844	\$ -
Demand Ventilation	\$ 50,000	\$ 60,000	\$ -	\$ -	\$ -
Entrance Heater Controls	\$ -	\$ -	\$ -	\$ -	\$ -
Other (Describe)	\$ -	\$ -	\$ -	\$ -	\$ -

	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
Controls	Investment in Energy Management Strategies	Investment in Energy Management Strategies	Investment in Energy Management Strategies	Investment in Energy Management Strategies	Investment in Energy Management Strategies
Building Automation Systems - New	\$ -	\$ -	\$ -	\$ -	\$ -
Building Automation Systems - Upgrade	\$ 30,000	\$ 30,000	\$ 30,000	\$ 30,000	\$ -
Other (Describe)	\$ -	\$ -	\$ -	\$ -	\$ -

Investments in Energy Management Strategies

	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
Building Envelope	Investment in Energy Management Strategies	Investment in Energy Management Strategies	Investment in Energy Management Strategies	Investment in Energy Management Strategies	Investment in Energy Management Strategies
Glazing	\$ 25,000	\$ -	\$ -	\$ -	\$ -
Increased Wall Insulation	\$ 25,000	\$ 45,000	\$ 45,000	\$ 45,000	\$ -
New Roof	\$ -	\$ 410,000	\$ 600,000	\$ 75,000	\$ -
New Windows		\$ 33,000	\$ -	\$ -	\$ 242,310
Treatments	\$ -	\$ -	\$ -	\$ -	\$ -
Shading Devices	\$ -	\$ -	\$ -	\$ -	\$ -
Other (Describe)	\$ -	\$ -	\$ -	\$ -	\$ -
Total Investment in Design, Construction and Retrofit Strategies	\$ 350,000	\$ 628,000	\$ 855,000	\$ 4,557,515	\$ 743,172

Investments in Energy Management Strategies

Operations and Maintenance Strategies

	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
Policy and Planning	Investment in Energy Management Strategies	Investment in Energy Management Strategies	Investment in Energy Management Strategies	Investment in Energy Management Strategies	Investment in Energy Management Strategies
New School Design/Construction Guidelines and Specifications	\$ -	\$ -	\$ -	\$ -	\$ -
Day and Night Temperature Guidelines for all Schools	\$ -	\$ -	\$ -	\$ -	\$ -
Nighttime Blackout of Sites - Interior	\$ -	\$ -	\$ -	\$ -	\$ -
Nighttime Blackout of Sites - Exterior	\$ -	\$ -	\$ -	\$ -	\$ -
Procures Only Energy Star Certified Appliances	\$ -	\$ -	\$ -	\$ -	\$ -
Daylight Harvesting (servicing)	\$ -	\$ -	\$ -	\$ -	\$ -
Demand Ventilation (servicing)	\$ 25,000	\$ 25,000	\$ 25,000	\$ 25,000	\$ 25,000
Other (Describe)	\$ -	\$ -	\$ -	\$ -	\$ -

	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
Energy Audits	Investment in Energy Management Strategies	Investment in Energy Management Strategies	Investment in Energy Management Strategies	Investment in Energy Management Strategies	Investment in Energy Management Strategies
Walk Through Audit	\$ -	\$ -	\$ -	\$ -	\$ -
Engineering Audit	\$ -	\$ -	\$ -	\$ -	\$ -
Other (Describe)					
Total Investment in Operations and Maintenance Strategies	\$ 25,000	\$ 25,000	\$ 25,000	\$ 25,000	\$ 25,000

Investments in Energy Management Strategies

Occupant Behaviour Strategies

	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
Training and Education	Estimated Cost of Implementation	Estimated Cost of Implementation	Estimated Cost of Implementation	Estimated Cost of Implementation	Estimated Cost of Implementation
Building Operator Training	\$ -	\$ -	\$ -	\$ -	\$ -
NRCan Benchmarking Program	\$ -	\$ -	\$ -	\$ -	\$ -
Building Automation Training (site specific)	\$ 2,000	\$ 2,000	\$ 2,000	\$ 2,000	\$ 2,000
Ongoing Training and Awareness Programs for Energy Conservation	\$ -	\$ -	\$ -	\$ -	\$ -
Provide Detailed Information on Building Operational Costs	\$ -	\$ -	\$ -	\$ -	\$ -
Provide Detailed Information on Energy Consumption (e.g. via the Utility Consumption Database or other database)	\$ -	\$ -	\$ -	\$ -	\$ -
Participate in Environmental Programs, such as EcoSchools, Earthcare	\$ -	\$ -	\$ -	\$ -	\$ -
Other tools (Define)	\$ -	\$ -	\$ -	\$ -	\$ -
Total Investment in Occupant Behaviour Strategies	\$ 2,000	\$ 2,000	\$ 2,000	\$ 2,000	\$ 2,000

Investments in Energy Management Strategies

Summary of Investment by Type

	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018	2013/2014-2017/2018
Total Investments in Energy Management Strategies FY 2012-13 to FY 2017-18	Investment in Energy Management Strategies	Investment in Energy Management Strategies	Investment in Energy Management Strategies	Investment in Energy Management Strategies	Investment in Energy Management Strategies	Total Investment in Energy Management Strategies
Design, Construction and Retrofit Investments Total	\$ 350,000	\$ 628,000	\$ 855,000	\$ 4,557,515	\$ 743,172	7,133,687
Operations and Maintenance Investments Total	\$ 25,000	\$ 25,000	\$ 25,000	\$ 25,000	\$ 25,000	125,000
Occupant Behaviour Investments Total	\$ 2,000	\$ 2,000	\$ 2,000	\$ 2,000	\$ 2,000	10,000
Renewable Energy Investments Total	\$ -	\$ -	\$ -	\$ -	\$ -	0
Total Investment Per Fiscal Year	\$ 377,000	\$ 655,000	\$ 882,000	\$ 4,584,515	\$ 770,172	7,268,687

Design, Construction and Retrofit Strategies

Lighting	Quantity of Time that Measure will be in place (years)	2018-2019		2019-2020		2020-2021		2021-2022		2022-2023		2018/2019-2022/2023		Energy Payback Period	% related to Electricity	%related to Natural Gas
		Estimated Cost of Implementation	Estimated Annual Energy Savings from all projects (ekWh)	Estimated Cost of Implementation	Estimated Annual Energy Savings from all projects (ekWh)	Estimated Cost of Implementation	Estimated Annual Energy Savings from all projects (ekWh)	Estimated Cost of Implementation	Estimated Annual Energy Savings from all projects (ekWh)	Estimated Cost of Implementation	Estimated Annual Energy Savings from all projects (ekWh)	Estimated Total Accumulated Energy Savings (ekWh)				
High Efficiency Lighting Systems	10	\$ -	-	\$ -	-	\$ -	-	\$ -	-	\$ -	-	-	-	7	100	0
Outdoor Lighting	15	\$ -	-	\$ -	-	\$ -	-	\$ -	-	\$ -	-	-	-	7	100	0
Occupancy Sensors	10	\$ -	-	\$ -	-	\$ -	-	\$ -	-	\$ -	-	-	-	0	100	0
Other (Describe)		\$ -	-	\$ -	-	\$ -	-	\$ -	-	\$ -	-	-	-	0		100

H.V.A.C.	Quantity of Time that Measure will be in place	2018-2019		2019-2020		2020-2021		2021-2022		2022-2023		2018/2019-2022/2023		Energy Payback Period	% related to Electricity	%related to Natural Gas
		Estimated Cost of Implementation	Estimated Annual Energy Savings from all projects (ekWh)	Estimated Cost of Implementation	Estimated Annual Energy Savings from all projects (ekWh)	Estimated Cost of Implementation	Estimated Annual Energy Savings from all projects (ekWh)	Estimated Cost of Implementation	Estimated Annual Energy Savings from all projects (ekWh)	Estimated Cost of Implementation	Estimated Annual Energy Savings from all projects (ekWh)	Estimated Total Accumulated Energy Savings (ekWh)				
Efficient Boilers (near condensing)	30	\$ -	-	\$ -	-	\$ -	-	\$ -	-	\$ -	-	-	-	15	5	85
High-efficiency Boilers (condensing)	15	\$ 25,000	69,507	\$ 25,000	69,507	\$ 25,000	69,507	\$ 25,000	69,507	\$ 25,000	69,507	1,042,608	10	5	85	
High-efficiency Boiler Burners	10	\$ -	-	\$ -	-	\$ -	-	\$ -	-	\$ -	-	-	-	5	0	95
Geothermal	20	\$ -	-	\$ -	-	\$ -	-	\$ -	-	\$ -	-	-	-	35	100	0
Heat Recovery/Enthalpy Wheels	30	\$ -	-	\$ -	-	\$ -	-	\$ -	-	\$ -	-	-	-	8	20	80
Economizers	15	\$ -	-	\$ -	-	\$ -	-	\$ -	-	\$ -	-	-	-	7.5	50	50
Energy Efficient HVAC-systems	30	\$ 20,000	2,619	\$ 20,000	2,619	\$ 20,000	2,619	\$ 20,000	2,619	\$ 20,000	2,619	39,283	75	80	50	
Energy Efficient Rooftop Units	15	\$ -	-	\$ -	-	\$ -	-	\$ -	-	\$ -	-	-	-	30	50	50
High Efficiency Domestic Hot Water	15	\$ -	-	\$ -	-	\$ -	-	\$ -	-	\$ -	-	-	-	10	15	85
Efficient Chillers and Controls	25	\$ -	-	\$ -	-	\$ -	-	\$ -	-	\$ -	-	-	-	100	100	0
High-efficiency Motors	30	\$ -	-	\$ -	-	\$ -	-	\$ -	-	\$ -	-	-	-	10	100	0
VFD	15	\$ 10,000	14,450	\$ 10,000	14,450	\$ 10,000	14,450	\$ 10,000	14,450	\$ 10,000	14,450	216,743	5	75	25	
Demand Ventilation	10	\$ 5,000	9,821	\$ 5,000	9,821	\$ 5,000	9,821	\$ 5,000	9,821	\$ 5,000	9,821	147,312	5	50	50	
Entrance Heater Controls	20	\$ -	-	\$ -	-	\$ -	-	\$ -	-	\$ -	-	-	-	5	50	50
Demineralization Fans	15	\$ -	-	\$ -	-	\$ -	-	\$ -	-	\$ -	-	-	-	7	100	0
Other (Describe)		\$ -	-	\$ -	-	\$ -	-	\$ -	-	\$ -	-	-	-	0		100

Controls	Quantity of Time that Measure will be in place	2018-2019		2019-2020		2020-2021		2021-2022		2022-2023		2018/2019-2022/2023		Energy Payback Period	% related to Electricity	%related to Natural Gas
		Estimated Cost of Implementation	Estimated Annual Energy Savings from all projects (ekWh)	Estimated Cost of Implementation	Estimated Annual Energy Savings from all projects (ekWh)	Estimated Cost of Implementation	Estimated Annual Energy Savings from all projects (ekWh)	Estimated Cost of Implementation	Estimated Annual Energy Savings from all projects (ekWh)	Estimated Cost of Implementation	Estimated Annual Energy Savings from all projects (ekWh)	Estimated Total Accumulated Energy Savings (ekWh)				
Building Automation Systems - New	10	\$ -	-	\$ -	-	\$ -	-	\$ -	-	\$ -	-	-	-	15	50	50
Building Automation Systems - Upgrade	10	\$ -	-	\$ -	-	\$ -	-	\$ -	-	\$ -	-	-	-	15	50	50
Real-time energy data for operators to identify and diagnose building issues	10	\$ 10,000	32,736	\$ 10,000	32,736	\$ 10,000	32,736	\$ 10,000	32,736	\$ 10,000	32,736	491,039	3	50	50	
Voltage Harmonizers	15	\$ -	-	\$ -	-	\$ -	-	\$ -	-	\$ -	-	-	-	7	100	0
Other (Describe)		\$ -	-	\$ -	-	\$ -	-	\$ -	-	\$ -	-	-	-	0		100

Building Envelope	Quantity of Time that Measure will be in place	2018-2019		2019-2020		2020-2021		2021-2022		2022-2023		2018/2019-2022/2023		Energy Payback Period	% related to Electricity	%related to Natural Gas
		Estimated Cost of Implementation	Estimated Annual Energy Savings from all projects (ekWh)	Estimated Cost of Implementation	Estimated Annual Energy Savings from all projects (ekWh)	Estimated Cost of Implementation	Estimated Annual Energy Savings from all projects (ekWh)	Estimated Cost of Implementation	Estimated Annual Energy Savings from all projects (ekWh)	Estimated Cost of Implementation	Estimated Annual Energy Savings from all projects (ekWh)	Estimated Total Accumulated Energy Savings (ekWh)				
Glazing	2	\$ -	-	\$ -	-	\$ -	-	\$ -	-	\$ -	-	-	-	80	20	80
Increased Wall Insulation	50	\$ 10,000	4,316	\$ 10,000	4,316	\$ 10,000	4,316	\$ 10,000	4,316	\$ 10,000	4,316	64,744	40	20	80	
New Roof	25	\$ -	-	\$ -	-	\$ -	-	\$ -	-	\$ -	-	-	-	200	20	80
New Windows	30	\$ 20,000	4,316	\$ 15,000	3,237	\$ 15,000	3,237	\$ 15,000	3,237	\$ 15,000	3,237	83,964	80	20	80	
Treatments	10	\$ -	-	\$ -	-	\$ -	-	\$ -	-	\$ -	-	-	-	10	20	80
Shading Devices	30	\$ -	-	\$ -	-	\$ -	-	\$ -	-	\$ -	-	-	-	20	100	0
Other (Describe)		\$ -	-	\$ -	-	\$ -	-	\$ -	-	\$ -	-	-	-	0		100

Design, Construction & Retrofit Strategies Total	Quantity of Time that Measure will be in place	2018-2019		2019-2020		2020-2021		2021-2022		2022-2023		2018/2019-2022/2023		Energy Payback Period	% related to Electricity	%related to Natural Gas
		Estimated Cost of Implementation	Estimated Annual Energy Savings from all projects (ekWh)	Estimated Cost of Implementation	Estimated Annual Energy Savings from all projects (ekWh)	Estimated Cost of Implementation	Estimated Annual Energy Savings from all projects (ekWh)	Estimated Cost of Implementation	Estimated Annual Energy Savings from all projects (ekWh)	Estimated Cost of Implementation	Estimated Annual Energy Savings from all projects (ekWh)	Estimated Total Accumulated Energy Savings (ekWh)				
Total		\$ 100,000	137,766	\$ 95,000	136,686	\$ 95,000	136,686	\$ 95,000	136,686	\$ 95,000	136,686	2,055,683				

Keys	
colour: yellow	= Default value
colour: blue	= Calculated Value
\$ 0.173	= cost of 1 ekWh electricity
\$ 0.0597	= cost of 1 ekWh natural gas
0.0955	m³ = 1 ekWh (as per NRCan conversion table)
\$0.30	= cost of 1 m³ of natural gas

Calculating Energy Conservation Goals for FY 2019 to FY 2023

Operations and Maintenance Strategies		2018-2019		2019-2020		2020-2021		2021-2022		2022-2023		2018/2019-2022/2023		Energy Payback Period	% related to Electricity	% related to Natural Gas
Policy and Planning	Quantity of Time that Measure will be in place (years)	Estimated Cost of Implementation	Estimated Annual Energy Savings from all projects (kWh)	Estimated Cost of Implementation	Estimated Annual Energy Savings from all projects (kWh)	Estimated Cost of Implementation	Estimated Annual Energy Savings from all projects (kWh)	Estimated Cost of Implementation	Estimated Annual Energy Savings from all projects (kWh)	Estimated Cost of Implementation	Estimated Annual Energy Savings from all projects (kWh)	Estimated Total Accumulated Energy Savings (kWh)				
New School Design/Construction Guidelines and Specifications	5	\$ -	-	\$ -	-	\$ -	-	\$ -	-	\$ -	-	-	5	50	50	
Day and Night Temperature Guidelines for all Schools	10	\$ -	-	\$ -	-	\$ -	-	\$ -	-	\$ -	-	-	5	20	80	
Nighttime Backout of Sties - Interior	10	\$ -	-	\$ -	-	\$ -	-	\$ -	-	\$ -	-	-	7	100	-	
Nighttime Backout of Sties - Exterior	10	\$ -	-	\$ -	-	\$ -	-	\$ -	-	\$ -	-	-	7	100	-	
Purchased Only Energy Star Certified Appliances	5	\$ -	-	\$ -	-	\$ -	-	\$ -	-	\$ -	-	-	5	100	-	
Demand Ventilation (learning)	3	\$ 10,000	19,645	\$ 20,000	39,283	\$ 20,000	39,283	\$ 20,000	39,283	\$ 20,000	39,283	491,039	5	50	50	
HVAC Optimization (cool blowing, recalibration of equipment)	3	\$ 10,000	48,104	\$ -	-	\$ -	-	\$ -	-	\$ -	-	245,519	2	50	50	
Commissioning (info and re)	10	\$ -	-	\$ -	-	\$ -	-	\$ -	-	\$ -	-	-	10	50	50	
Other (Disinfect)	5	\$ -	-	\$ -	-	\$ -	-	\$ -	-	\$ -	-	-	0	-	100	
		2018-2019		2019-2020		2020-2021		2021-2022		2022-2023		2018/2019-2022/2023				
Energy Audits	Quantity of Time that Measure will be in place	Estimated Cost of Implementation	Estimated Annual Energy Savings from all projects (kWh)	Estimated Cost of Implementation	Estimated Annual Energy Savings from all projects (kWh)	Estimated Cost of Implementation	Estimated Annual Energy Savings from all projects (kWh)	Estimated Cost of Implementation	Estimated Annual Energy Savings from all projects (kWh)	Estimated Cost of Implementation	Estimated Annual Energy Savings from all projects (kWh)	Estimated Total Accumulated Energy Savings (kWh)	Energy Payback Period	% related to Electricity	% related to Natural Gas	
Walk Through Audit	5	\$ -	-	\$ -	-	\$ -	-	\$ -	-	\$ -	-	-	100	50	50	
Engineering Audit	5	\$ -	-	\$ -	-	\$ -	-	\$ -	-	\$ -	-	-	100	50	50	
Other (Disinfect)	5	\$ -	-	\$ -	-	\$ -	-	\$ -	-	\$ -	-	-	0	-	100	
		2018-2019		2019-2020		2020-2021		2021-2022		2022-2023		2018/2019-2022/2023				
Operations and Maintenance Strategies Total	Quantity of Time that Measure will be in place	Estimated Cost of Implementation	Estimated Annual Energy Savings from all projects (kWh)	Estimated Cost of Implementation	Estimated Annual Energy Savings from all projects (kWh)	Estimated Cost of Implementation	Estimated Annual Energy Savings from all projects (kWh)	Estimated Cost of Implementation	Estimated Annual Energy Savings from all projects (kWh)	Estimated Cost of Implementation	Estimated Annual Energy Savings from all projects (kWh)	Estimated Total Accumulated Energy Savings (kWh)				
Total	5	\$ -	-	\$ -	-	\$ -	-	\$ -	-	\$ -	-	19,645				

Keys	
\$1.175	= cost of 1 kWh electricity
\$0.025	= cost of 1 kWh natural gas
\$ 0.050	= cost of 1 gal of natural gas
\$ 0.30	= cost of 1 gal of natural gas

Occupant Behaviour Strategies

Training and Education	Quantity of Time that Measure will be in place (years)	2018-2019		2019-2020		2020-2021		2021-2022		2022-2023		2018/2019-2022/2023		Energy Payback Period	% related to Electricity	% related to Natural Gas
		Estimated Cost of Implementation	Estimated Annual Energy Savings from all projects (ekWh)	Estimated Cost of Implementation	Estimated Annual Energy Savings from all projects (ekWh)	Estimated Cost of Implementation	Estimated Annual Energy Savings from all projects (ekWh)	Estimated Cost of Implementation	Estimated Annual Energy Savings from all projects (ekWh)	Estimated Cost of Implementation	Estimated Annual Energy Savings from all projects (ekWh)	Estimated Total Accumulated Energy Savings (ekWh)				
Building Operator Training	3	\$ 2,000	5,724	\$ 5,000	14,311	\$ 5,000	14,311	\$ 5,000	14,311	\$ 5,000	14,311	171,733	3	60	40	
Energy Benchmarking Program	5	\$ -	-	\$ -	-	\$ -	-	\$ -	-	\$ -	-	-	1000	50	50	
Building Automation Training (site specific)	3	\$ 1,000	6,587	\$ 5,000	42,933	\$ 5,000	42,933	\$ 5,000	42,933	\$ 5,000	42,933	472,265	1	60	40	
Ongoing Training and Awareness Programs for Energy Conservation	5	\$ -	-	\$ -	-	\$ -	-	\$ -	-	\$ -	-	-	10	90	10	
Detailed Information on Building Operational Costs	1	\$ -	-	\$ -	-	\$ -	-	\$ -	-	\$ -	-	-	1000	50	50	
Detailed Information on Energy Consumption (e.g. via the Utility Consumption Database or other database)	1	\$ 10,000	98	\$ 10,000	98	\$ 10,000	98	\$ 10,000	98	\$ 10,000	98	1,473	1000	50	50	
Participate in Environmental Programs, such as EcoSchools, Earthcare	1	\$ -	-	\$ -	-	\$ -	-	\$ -	-	\$ -	-	-	5	90	10	
Other Tools (Define)		\$ -	-	\$ -	-	\$ -	-	\$ -	-	\$ -	-	-	0		100	
Occupant Behaviour Strategies Total		\$ 13,000	14,409	\$ 20,000	57,342	\$ 20,000	57,342	\$ 20,000	57,342	\$ 20,000	57,342	645,471				

Keys	
\$0.175	= cost of 1 ekWh electricity
\$0.0287	= cost of 1 ekWh natural gas
0.0955	m ³ = 1 ekWh
\$0.30	= cost of 1 m ³ of natural gas

Calculating Energy Conservation Goals for FY 2019 to FY 2023

Conservation Goal		FY 2018	
Total Building Area (includes portables) (m²)	89,314	Enter from UCD. - use square meters	1 ft² = 0.0929 m²
Total Building Area (includes portables) (ft²)	961,361	Enter from UCD - use square feet	
Energy Consumption for the board (ekWh)	23,271,350	Enter from UCD	

	2018-2019		2019-2020		2020-2021		2021-2022		2022-2023		2018/2019-2022/2023
	Estimated Cost of Implementation	Estimated Annual Energy Savings from all projects (ekWh)	Estimated Cost of Implementation	Estimated Annual Energy Savings from all projects (ekWh)	Estimated Cost of Implementation	Estimated Annual Energy Savings from all projects (ekWh)	Estimated Cost of Implementation	Estimated Annual Energy Savings from all projects (ekWh)	Estimated Cost of Implementation	Estimated Annual Energy Savings from all projects (ekWh)	Estimated Total Accumulated Energy Savings (ekWh)
Appendix B: Design, Construction and Retrofit Strategies Total	\$ 100,000	137,765	\$ 95,000	136,686	\$ 95,000	136,686	\$ 95,000	136,686	\$ 95,000	136,686	2,055,683
Appendix C: Operations and Maintenance Strategies Total	\$ 20,000	68,745	\$ 20,000	39,283	\$ 20,000	39,283	\$ 20,000	39,283	\$ 20,000	39,283	736,558
Appendix D: Occupant Behaviour Strategies Total	\$ 13,000	14,409	\$ 20,000	57,342	\$ 20,000	57,342	\$ 20,000	57,342	\$ 20,000	57,342	645,471
TOTAL	\$ 133,000	220,920	\$ 135,000	233,311	\$ 135,000	233,311	\$ 135,000	233,311	\$ 135,000	233,311	3,437,712
Percentage reduction		0.95		1.00		1.00		1.00		1.00	4.96
Conservation Goal (ekWh/m²)		2.47		2.61		2.61		2.61		2.61	12.92
Conservation Goal (ekWh/ft²)		0.23		0.24		0.24		0.24		0.24	1.20
	Note		Note		Note		Note		Note		
	Check the total in cell B15 to confirm validity of estimated amount to be spent during that year		Check the total in cell D15 to confirm validity of estimated amount to be spent during that year		Check the total in cell F15 to confirm validity of estimated amount to be spent during that year		Check the total in cell H15 to confirm validity of estimated amount to be spent during that year		Check the total in cell J15 to confirm validity of estimated amount to be spent during that year		