Energy Conservation and Demand Management Plan

Table of Contents

Table of Figures

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
    - Outdoor ice rinks
- 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

Key Metrics	(Baseline Year) Fiscal Year 2012 to 2013	Fiscal Year 2017 to 2018	Variance
Total Number of Buildings	99	97	2
Total Number of Portables/Portapaks	90	84	6
Total Floor Area	4,351,295.28 ft^2	4,322,885.34 ft^2	28,409.94 ft^2
Average Operating Hours	57	57	0
Average Daily Enrolment	21,176.45	21,048.5	127.95

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

Utility	Fiscal Year 2012 to 2013 (Baseline year)	Fiscal Year 2017 to 2018
Total Electricity (kWh)	36,722,710	28,118,630
Total Natural Gas (ekWh)	43,294,350	42,679,960
Total Heating Fuel (Type 1 and 2) (ekWh)	4,228,893	3,606,336

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.

1 Metered consumption is the quantity of energy used and does not include a loss adjustment value (the quantity of energy lost in transmission).
[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 building have partial air conditioning. The UCD only applies CDD to meters that demonstrate an increase in consumption due to air conditioning.

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 Intensity[4] 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. The unit of measurement used is either equivalent kilowatt hours per square foot (ekWh/ft2) or equivalent kilowatt hours per square metre (ekWh/ft2).

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

Weather Normalized Values	Fiscal Year 2012 to 2013 (Baseline Year)	Fiscal Year 2017 to 2018 (Most Recent Data Available)
Total Energy Consumed (ekWh)	82,771,180	69,661,730
Energy Intensity (eKWh/ft2)	17.14	14.18
Energy Intensity (eKWh/m2)	184.52	152.60

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

Fiscal Year	Conservation Goal ekWh/ft2	Conservation Goal ekWh/m2	Conservation Goal Percentage	Actual Energy Savings ekWh/ft2	Actual Energy Savings ekWh/m2	Actual Energy Percentage
2013 to 2014	-0.17	-1.84	-1	-1.1	-11.91	-6.4
2014 to 2015	-0.17	-1.84	-1	1.04	11.19	6.4
2015 to 2016	-0.17	-1.84	-1	-1.41	-15.19	-8.3
2016 to 2017	-0.17	-1.84	-1	-0.77	-8.32	-5
2017 to 2018	-0.17	-1.84	-1	-0.71	-7.68	-4.8

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.

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

Cumulative Energy Intensity	(ekWh/ft2)	(ekWh/m2)	Variance
Forecasted. Cumulative Energy Intensity Conservation Goal of Fiscal Year 2013 to 2014 through Fiscal Year 2017 to 2018	0.85	9.2	
Forecasted Cumulative Energy Intensity Conservation Goal as a Percentage			5
Actual Cumulative Energy Intensity Reduced or Increased from Fiscal Year 2013 to 2014 through Fiscal Year 2017 to 2018 – Weather Normalized	2.96	31.91	
Variance between 2014 Forecast Cumulative Conservation Goal and Actual Cumulative Energy Intensity– Weather Normalized	2.11	22.71	
% of Cumulative Energy Intensity Conservation Goal Achieved - Weather Normalized			348.8

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:

   -UCDSB reviews the Utilities Consumption Database to assess individual sites and their energy usage to assist with project decisions based on energy efficiency. When replacing school equipment Energy Star qualified replacements are sought out.
   -Building operators also record meter usage daily and monitor for spikes or inconsistencies which triggers an investigation into the cause so it can be rectified.
   -The Upper Canada District School Board searches and reviews available incentive programs to help fund new energy efficient projects and actively applies for these incentives.
   -For new school construction, green sustainability, high energy efficient mechanical systems, LEED design, and increased natural day lighting are strategies under current consideration.
   -Annual Capital renovation projects that include mechanical equipment, glazing, lighting, and roofing components are designed for increased energy efficiency.
   -The Upper Canada District School Board is aware of the growing day to day operating costs due to rising energy bills and as such has started phasing out T12 lights with higher efficiency T8's, LED's and motion sensors. This benefits the end user IE... in gyms they no longer have to wait for lights to warm up as the LEDs are instant on so then the gym can also be put on a motion sensor where in the past the lights were left on all day. Also, the Board has implemented Building Automation Systems at the vast majority of its sites to control equipment and lighting by schedules and planned events i.e. holiday setbacks etc.
   -UCDSB has also implemented a lights out schedule at majority of facilities.

-Along with these measures staff has also been educated in regards to conserving energy at their schools.
-Demand ventilation is considered in many designs.

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

Annual Energy Intensity Conservation Goal	Fiscal Year 2018 to 2019	Fiscal Year 2019 to 2020	Fiscal Year 2020 to 2021	Fiscal Year 2021 to 2022	Fiscal Year 2022 to 2023
ekW/ft2	0.56	0.54	0.54	0.54	0.55
ekW/m2	5.99	5.80	5.80	5.80	5.89
Percentage Decrease	3.45	3.34	3.34	3.34	3.40

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

Table 8: Cumulative Conservation Goal

Cumulative Conservation Goal	Fiscal Year 2018 to 2019 through Fiscal Year 2022 to 2023
ekWh/ft2	2.73
ekWh/m2	29.28
Percentage Decrease	16.88

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 include, but are 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:
   13 schools participate
2. Earth Care Schools:
   ___ number of schools participate
3. Enbridge: The School Energy Challenge
   ___number of schools participate
4. Other: The School Energy Challenge
   The name of the program is _____
   ___ 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

   Between Fiscal Year 2013 to 2014 and Fiscal Year 2017 to 2018, the Board has applied for $229,302.29 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: _____

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: _____

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 Upper Canada District School Boards senior management has reviewed and approved this Energy Conservation and Demand Management Plan.

Full Name: **Peter Bosch**

Job Title: **Manager Of Design And Construction**

Date: **June 24, 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 ...)	$ 375,229	$ 247,799	$ 21,226	$ 619,648	$ 708,815

	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)	$ -	$ -	$ 848,118	$ -	$ -
High-efficiency Boilers (condensing)	$ -	$ -	$ 702,296	$ 928,384	$ 701,933
Energy Efficient HVAC Systems	$ 257,786	$ -	$ 135,473	$ 1,588,631	$ 1,504,203
Energy Efficient Rooftop Units	$ 40,000		$ 40,000	$ 237,106	$ 680,369
Efficient Chillers and Controls	$ 208,048	$ -	$ 321,000	$ 119,529	$ 32,240
VFD	$ -	$ -	$ 10,000	$ 10,000	$ 10,000

	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	$ -	$ 192,761	$ 414,278	$ 1,885,316	$ 610,492
Building Automation Systems - Upgrade	$ 28,254	$ 6,400	$ 28,600	$ -	$ -

	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**
Increased Wall Insulation	$ 158,000	$ 296,133	$ 168,339	$ 1,253,347	$ 503,285
New Roof	$ 2,769,849	$ 4,263,626	$ 5,047,832	$ 10,487,509	$ 7,746,488
New Windows	$ 3,747,077	$ 24,872	$ 1,801,952	$ 2,205,709	$ 6,535,310
Treatments	$ 374,708	$ 2,487	$ 180,195	$ 220,571	$ 653,531
Total Investment in Design, Construction and Retrofit Strategies	**$ 7,958,951**	**$ 5,034,078**	**$ 9,719,309**	**$ 19,555,750**	**$ 19,686,666**

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	$ 827,569	$ 473,198	$ -	$ -	$ -
Day and Night Temperature Guidelines for all Schools	$ 50,000	$ 50,000	$ 50,000	$ 50,000	$ 50,000
Nighttime Blackout of Sites - Interior	$ -	$ 5,100	$ 5,100	$ 5,100	$ 5,100
Nighttime Blackout of Sites - Exterior	$ -	$ 5,100	$ 5,100	$ 5,100	$ 5,100
Procures Only Energy Star Certified Appliances	$ 2,776		$ 2,796	$ 21,710	$ 23,634
Demand Ventilation (servicing)	$ 15,000	$ 15,000	$ 15,000	$ 15,000	$ 15,000

	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**
Engineering Audit	$ -	$ 73,254	$ -	$ -	$ -
Total Investment in Operations and Maintenance Strategies	**$ 895,345**	**$ 621,652**	**$ 77,996**	**$ 96,910**	**$ 98,834**

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	$ 48,929	$ 48,929	$ 48,929	$ 48,929	$ 48,929
Building Automation Training (site specific)	$ 52,000	$ 52,000	$ 52,000	$ 52,000	$ 52,000
Provide Detailed Information on Building Operational Costs	$ 24,000	$ 24,000	$ 24,000	$ 24,000	$ 24,000
Participate in Environmental Programs, such as EcoSchools, Earthcare	$ 3,200	$ 3,200	$ 3,200	$ 3,200	$ 3,200
Total Investment in Occupant Behaviour Strategies	**$ 128,129**	**$ 128,129**	**$ 128,129**	**$ 128,129**	**$ 128,129**

Investments in Energy Management Strategies

	Investment in Renewable Energy Technology ($)						
Type of Renewable Energy	Fiscal Year 2013-2014	Fiscal Year 2014-2015	Fiscal Year 2015-2016	Fiscal Year 2016-2017	Fiscal Year 2017-2018	Number of systems added	Capacity Added (kW)
Solar Photovoltaic	$ -	$ -	$ 100,856.69	$ -	$ -		20
Total	$ -	$ -	$ 100,856.69	$ -	$ -		

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	$ 7,958,951	$ 5,034,078	$ 9,719,309	$ 19,555,750	$ 19,686,666	61,954,754
Operations and Maintenance Investments Total	$ 895,345	$ 621,652	$ 77,996	$ 96,910	$ 98,834	1,790,737
Occupant Behaviour Investments Total	$ 128,129	$ 128,129	$ 128,129	$ 128,129	$ 128,129	640,645
Total Investment Per Fiscal Year	$ 8,982,425	$ 5,783,859	$ 9,925,434	$ 19,780,789	$ 19,913,629	64,386,136

Calculating Energy Conservation Goals for FY 2019 to FY 2023

Renewable Energy			Estimated number of systems installation					Estimated total number of ekWh generated annually						
Type of Renewable Energy	Define	Number of existing systems in asset portfolio (owned)	Fiscal Year 2018-2019	Fiscal Year 2019-2020	Fiscal Year 2020-2021	Fiscal Year 2021-2022	Fiscal Year 2022-2023	Fiscal Year 2018-2019	Fiscal Year 2019-2020	Fiscal Year 2020-2021	Fiscal Year 2021-2022	Fiscal Year 2022-2023	Total Size (kW)	Actual or Estimated Generation (ekWh)
Solar photovoltaic		4	1	1	1	1	1	50000	62000	74000	86000	98000	50	370,000
Other														0

Calculating Energy Conservation Goals for FY 2019 to FY 2023

Design, Construction and Retrofit Strategies

		2018-2019		2019-2020		2020-2021		2021-2022		2022-2023		2018/2019-2022/2023			
Lighting	**Quantity of Time that Measure will be in place (years)**	**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 Saving (ekWh)**	**Estimated Total Accumulated Energy Savings (ekWh)**	**Energy Payback Period**	**% related to Electricity**	**% related to Natural Gas**
High Efficiency Lighting Systems	15	$ 350,000	285,714	$ 350,000	285,714	$ 350,000	285,714	$ 350,000	285,714	$ 350,000	285,714	4,285,714	7	100	0
Outdoor Lighting	15	$ 75,000	61,224	$ 75,000	61,224	$ 75,000	61,224	$ 75,000	61,224	$ 75,000	61,224	918,367	7	100	0
Occupancy Sensors	10	$ 25,000	28,571	$ 25,000	28,571	$ 25,000	28,571	$ 25,000	28,571	$ 25,000	28,571	428,571	5	100	0

		2018-2019		2019-2020		2020-2021		2021-2022		2022-2023		2018/2019-2022/2023			
H.V.A.C.	**Quantity of Time that Measure will be in place**	**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)**	**Energy Payback Period**	**% related to Electricity**	**% related to Natural Gas**
Efficient Boilers (near condensing)	30	$ 150,000	278,029	$ 150,000	278,029	$ 150,000	278,029	$ 150,000	278,029	$ 150,000	278,029	4,170,432	15	5	95
High-efficiency Boilers (condensing)	15	$ 250,000	695,072	$ 250,000	695,072	$ 250,000	695,072	$ 250,000	695,072	$ 250,000	695,072	10,426,079	10	5	95
Energy Efficient HVAC systems	30	$ 250,000	32,736	$ 250,000	32,736	$ 250,000	32,736	$ 250,000	32,736	$ 250,000	32,736	491,039	75	50	50
Energy Efficient Rooftop Units	15	$ 250,000	81,840	$ 250,000	81,840	$ 250,000	81,840	$ 250,000	81,840	$ 250,000	81,840	1,227,596	30	50	50
High Efficiency Domestic Hot Water	15	$ 25,000	49,405	$ 25,000	49,405	$ 25,000	49,405	$ 25,000	49,405	$ 25,000	49,405	741,070	10	15	85
High-efficiency Motors	20	$ -	-	$ -	-	$ -	-	$ -	-	$ 67,518	38,582	38,582	10	100	0
VFD	15	$ 15,000	21,674	$ 15,000	21,674	$ 15,000	21,674	$ 15,000	21,674	$ 15,000	21,674	325,115	5	75	25
Demand Ventilation	10	$ 15,000	29,462	$ 15,000	29,462	$ 15,000	29,462	$ 15,000	29,462	$ 15,000	29,462	441,935	5	50	50

		2018-2019		2019-2020		2020-2021		2021-2022		2022-2023		2018/2019-2022/2023			
Controls	**Quantity of Time that Measure will be in place**	**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)**	**Energy Payback Period**	**% related to Electricity**	**% related to Natural Gas**
Building Automation Systems - New	10	$ 150,000	98,208	$ 150,000	98,208	$ 150,000	98,208	$ 150,000	98,208	$ 150,000	98,208	1,473,116	15	50	50

		2018-2019		2019-2020		2020-2021		2021-2022		2022-2023		2018/2019-2022/2023			
Building Envelope	**Quantity of Time that Measure will be in place**	**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)**	**Energy Payback Period**	**% related to Electricity**	**% related to Natural Gas**
Glazing	30	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-	80	20	80
Increased Wall Insulation	50	$ 200,000	86,326	$ 200,000	86,326	$ 200,000	86,326	$ 200,000	86,326	$ 200,000	86,326	1,294,890	40	20	80
New Roof	25	$ 1,200,000	103,591	$ 1,200,000	103,591	$ 1,200,000	103,591	$ 1,200,000	103,591	$ 1,200,000	103,591	1,553,867	200	20	80
New Windows	30	$ 500,000	107,907	$ 500,000	107,907	$ 500,000	107,907	$ 500,000	107,907	$ 500,000	107,907	1,618,612	80	20	80
Treatments	10	$ 50,000	86,326	$ 50,000	86,326	$ 50,000	86,326	$ 50,000	86,326	$ 50,000	86,326	1,294,890	10	20	80

		2018-2019		2019-2020		2020-2021		2021-2022		2022-2023		2018/2019-2022/2023			
Design, Construction & Retrofit Strategies Total	**Quantity of Time that Measure will be in place**	**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		**$ 3,505,000**	**2,046,086**	**$ 3,505,000**	**2,046,086**	**$ 3,505,000**	**2,046,086**	**$ 3,505,000**	**2,046,086**	**$ 3,572,518**	**2,084,668**	**30,729,874**			

Keys	
colour: yellow	= Default value
colour: blue	= Calculated Value
$0.175	= cost of 1 ekWh electricity
$ 0.0267	= cost of 1 ekWh natural gas
0.0955	m^3 = 1 ekWh (as per NRCan conversion table)
$0.30	= cost of 1 m^3 of natural gas

Calculating Energy Conservation Goals for FY 2019 to FY 2023

Operations and Maintenance Strategies

Policy and Planning	Quantity of Time that Measure will be in place (years)	2018-2019 Estimated Cost of Implementation	2018-2019 Estimated Annual Energy Savings from all projects (ekWh)	2019-2020 Estimated Cost of Implementation	2019-2020 Estimated Annual Energy Savings from all projects (ekWh)	2020-2021 Estimated Cost of Implementation	2020-2021 Estimated Annual Energy Savings from all projects (ekWh)	2021-2022 Estimated Cost of Implementation	2021-2022 Estimated Annual Energy Savings from all projects (ekWh)	2022-2023 Estimated Cost of Implementation	2022-2023 Estimated Annual Energy Savings from all projects (ekWh)	2018/2019-2022/2023 Estimated Total Accumulated Energy Savings (ekWh)	Energy Payback Period	% related to Electricity	% related to Natural Gas
New School Design/Construction Guidelines and Specifications	5	$ 38,435	75,492	$ -	-	$ -	-	$ -	-	$ -	-	377,461	5	50	50
Procures Only Energy Star Certified Appliances	5	$ 9,500	10,857	$ 9,500	10,857	$ 9,500	10,857	$ 9,500	10,857	$ 9,500	10,857	162,857	5	100	-
Demand Ventilation (servicing)	3	$ 15,000	29,462	$ 15,000	29,462	$ 15,000	29,462	$ 15,000	29,462	$ 15,000	29,462	441,935	5	50	50
HVAC Optimization (coil cleaning, re-calibration of equipment)	3	$ 20,000	98,208	$ 20,000	98,208	$ 20,000	98,208	$ 20,000	98,208	$ 20,000	98,208	1,473,116	2	50	50

Energy Audits	Quantity of Time that Measure will be in place	2018-2019 Estimated Cost of Implementation	2018-2019 Estimated Annual Energy Savings from all projects (ekWh)	2019-2020 Estimated Cost of Implementation	2019-2020 Estimated Annual Energy Savings from all projects (ekWh)	2020-2021 Estimated Cost of Implementation	2020-2021 Estimated Annual Energy Savings from all projects (ekWh)	2021-2022 Estimated Cost of Implementation	2021-2022 Estimated Annual Energy Savings from all projects (ekWh)	2022-2023 Estimated Cost of Implementation	2022-2023 Estimated Annual Energy Savings from all projects (ekWh)	2018/2019-2022/2023 Estimated Total Accumulated Energy Savings (ekWh)	Energy Payback Period	% related to Electricity	% related to Natural Gas
Engineering Audit	5	$ 16,879	168	$ -	-	$ -	-	$ -	-	$ -	-	829	1000	50	50

Operations and Maintenance Strategies Total	Quantity of Time that Measure will be in place	2018-2019 Estimated Cost of Implementation	2018-2019 Estimated Annual Energy Savings from all projects (ekWh)	2019-2020 Estimated Cost of Implementation	2019-2020 Estimated Annual Energy Savings from all projects (ekWh)	2020-2021 Estimated Cost of Implementation	2020-2021 Estimated Annual Energy Savings from all projects (ekWh)	2021-2022 Estimated Cost of Implementation	2021-2022 Estimated Annual Energy Savings from all projects (ekWh)	2022-2023 Estimated Cost of Implementation	2022-2023 Estimated Annual Energy Savings from all projects (ekWh	2018/2019-2022/2023 Estimated Total Accumulated Energy Savings (ekWh)
Total		$ 80,814	214,385	$ 44,500	139,527	$ 44,500	139,527	$ 44,500	139,527	$ 44,500	139,527	2,455,756

Keys	
$0.176	= cost of 1 ekWh electricity
$0.0287	= cost of 1 ekWh natural gas
0.0953	m^3 = 1 ekWh
$0.39	= cost of 1 m^3 of natural gas

Occupant Behaviour Strategies

		2018-2019		2019-2020		2020-2021		2021-2022		2022-2023		2018/2019-2022/2023			
Training and Education	**Quantity of Time that Measure will be in place (years)**	**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)**	**Energy Payback Period**	**% related to Electricity**	**% related to Natural Gas**
Building Operator Training	3	$ 48,929	140,045	$ 48,929	140,045	$ 48,929	140,045	$ 48,929	140,045	$ 48,929	140,045	2,100,678	3	60	40
Participate in Environmental Programs, such as EcoSchools, Earthcare	1	$ 3,200	3,991	$ 3,200	3,991	$ 3,200	3,991	$ 3,200	3,991	$ 3,200	3,991	59,863	5	90	10
Occupant Behaviour Strategies Total		**$ 52,129**	**144,036**	**$ 52,129**	**144,036**	**$ 52,129**	**144,036**	**$ 52,129**	**144,036**	**$ 52,129**	**144,036**	**2,160,542**			

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) (m^2)	401,609	Enter from UCD. - use square meters
Total Building Area (includes portables) (ft^2)	4,322,885	Enter from UCD - use square feet
Energy Consumption for the board (ekWh)	69,661,730	Enter from UCD

1 ft^2 = 0.0929 m^2

	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	$ 3,505,000	2,046,086	$ 3,505,000	2,046,086	$ 3,505,000	2,046,086	$ 3,505,000	2,046,086	$ 3,572,518	2,084,668	30,729,874
Appendix C: Operations and Maintenance Strategies Total	$ 99,814	214,185	$ 44,500	138,527	$ 44,500	138,527	$ 44,500	138,527	$ 44,500	138,527	2,456,198
Appendix D: Occupant Behaviour Strategies Total	$ 52,129	144,036	$ 52,129	144,036	$ 52,129	144,036	$ 52,129	144,036	$ 52,129	144,036	2,160,542
TOTAL	**$ 3,656,943**	**2,404,307**	**$ 3,601,629**	**2,328,649**	**$ 3,601,629**	**2,328,649**	**$ 3,601,629**	**2,328,649**	**$ 3,669,147**	**2,367,231**	**35,346,614**
Percentage reduction		3.45		3.34		3.34		3.34		3.40	16.88
Conservation Goal (ekWh/m^2)		5.99		5.80		5.80		5.80		5.89	29.28
Conservation Goal (ekWh/ft^2)		0.56		0.54		0.54		0.54		0.55	2.72

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