Energy Conservation and Demand Management Plan

July 1, 2019 – July 1, 2023

Ottawa Carleton District School Board

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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
        - 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
- Other
    - In particular the OCDSB has been impacted in two areas which have increased the energy demand: the increase in the operating hours/community use of schools and the increase in buildings now serviced with air conditioning systems

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	158	163	+3.2%
Total Number of Portables/Portapaks	304	385	+2.7%
Total Floor Area	11,477,117 ft2	12,120,981 ft2	+5.6%
Average Operating Hours	80	95	+18.8%
Average Daily Enrolment	64,204	64,597	0.6%

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)	72,207,140	71,516,500
Total Natural Gas (ekWh)	104,467,500	128,761,800
Total Heating Fuel (Type 1 and 2) (ekWh)	0	0
Total Heating Fuel (Type 4 and 6) (ekWh)	0	0
Total Propane (ekWh)	511,243	1,815,347
Total Wood (ekWh)	0	0
Total District Heat (ekWh)	0	0

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

Utility	Fiscal Year 2012 to 2013 (Baseline year)	Fiscal Year 2017 to 2018
Total District Cool (ekWh)	0	0

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 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).

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[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.

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)	171,969,200	197,884,200
Energy Intensity (eKWh/ft2)	14.98	16.33
Energy Intensity (eKWh/m2)	161.3	175.7

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	0.178	1.92	1	-0.46	-4.9	-0.64
2014 to 2015	0.193	2.07	1	-1.02	-11.0	-1.21
2015 to 2016	0.203	2.19	1	-0.19	-2.0	-0.39
2016 to 2017	0.208	2.24	1	0.71	7.7	0.50
2017 to 2018	0.213	2.29	1	-0.39	-4.2	-0.61

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	2.90	31.2	Do not write in this cell
Forecasted Cumulative Energy Intensity Conservation Goal as a Percentage	Do not write in this cell	Do not write in this cell	5
Actual Cumulative Energy Intensity Reduced or Increased from Fiscal Year 2013 to 2014 through Fiscal Year 2017 to 2018 – Weather Normalized	-1.34	-14.4	Do not write in this cell
Variance between 2014 Forecast Cumulative Conservation Goal and Actual Cumulative Energy Intensity– Weather Normalized	-4.24	-45.6	Do not write in this cell
% of Cumulative Energy Intensity Conservation Goal Achieved - Weather Normalized	Do not write in this cell	Do not write in this cell	-46.28

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:
    - Preparation of a Multi-Year Energy Management Plan that is submitted annually for Board approval
    - Monitoring all energy use throughout the Board. Analyzing the data to identify energy saving opportunities.
    - Propose/implement energy saving measures such as lighting retrofits, HVAC system upgrades and new/upgrades to the building automation systems.

2. The Board has 6 full time energy management positions within the Energy Management Department.

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 power generation systems

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	0.15	0.15	0.15	0.15	0.15
ekW/m2	1.58	1.58	1.58	1.58	1.58
Percentage Decrease	1	1	1	1	1

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	0.73
ekWh/m2	7.90
Percentage Decrease	4.4

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:
   48 number of schools participate
2. Earth Care Schools:
   0 number of schools participate
3. Enbridge: The School Energy Challenge
   2 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 received $149,464 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
   (For a portion of our portfolio)

   If yes,

   ☐ OECM's Strategic Electricity Management and Advisory Services
   ✓Other:
   Provide Name of Consortia: **Direct Energy (via Aegent)**

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 Ottawa Carleton District School Board senior management has reviewed and approved this Energy Conservation and Demand Management Plan.

Signed: 

Full Name: **Michael Carson**

Job Title: **Chief Financial Officer**

Date: **June 27, 2019**

Investments in Energy Management Strategies

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Design, Construction and Retrofit Strategies

Lighting	2013-2014 Investments in Energy Management Strategies	2014-2015 Investment in Energy Management Strategies	2015-2016 Investment in Energy Management Strategies	2016-2017 Investment in Energy Management Strategies	2017-2018 Investment in Energy Management Strategies
High-efficiency Lighting Systems (T-8, T-5, CFL, LED ...)	$ 343,657	$ 237,378	$ 244,946	$ 90,675	$ 147,038
Daylight Sensors	$ -	$ -	$ -	$ -	$ -
Outdoor Lighting	$ -	$ -	$ -	$ -	$ -
Occupancy Sensors	$ 28,335	$ 271,990	$ 32,225	$ -	$ -
Daylight Harvesting	$ -	$ -	$ -	$ -	$ -
Other (Describe)	$ -	$ -	$ -	$ -	$ -

HVAC	2013-2014 Investment in Energy Management Strategies	2014-2015 Investment in Energy Management Strategies	2015-2016 Investment in Energy Management Strategies	2016-2017 Investment in Energy Management Strategies	2017-2018 Investment in Energy Management Strategies
Efficient Boilers (near condensing)	$ -	$ -	$ -	$ -	$ -
High-efficiency Boilers (condensing)	$ -	$ -	$ -	$ -	$ -
High-efficiency Boiler Burners	$ -	$ -	$ -	$ -	$ -
Geothermal	$ -	$ -	$ -	$ -	$ -
Heat Recovery/Enthalpy Wheels	$ -	$ -	$ -	$ -	$ -
Economizers	$ -	$ -	$ -	$ -	$ -
Energy Efficient HVAC Systems	$ 18,009	$ 35,452	$ 354,530	$ -	$ 6,180
Energy Efficient Rooftop Units	$ -	$ -	$ -	$ -	$ -
High-efficiency Domestic Hot Water	$ -	$ -	$ -	$ -	$ -
Efficient Chillers and Controls	$ -	$ -	$ -	$ -	$ -
High-efficiency Motors	$ -	$ -	$ -	$ -	$ -
VFD	$ -	$ -	$ -	$ -	$ -
Demand Ventilation	$ -	$ -	$ -	$ -	$ -
Entrance Heater Controls	$ -	$ -	$ -	$ -	$ -
Other (Describe)	$ -	$ -	$ -	$ -	$ -

Controls	2013-2014 Investment in Energy Management Strategies	2014-2015 Investment in Energy Management Strategies	2015-2016 Investment in Energy Management Strategies	2016-2017 Investment in Energy Management Strategies	2017-2018 Investment in Energy Management Strategies
Building Automation Systems - New	$ 730,346	$ 510,407	$ 72,000	$ 9,437	$ -
Building Automation Systems - Upgrade	$ 186,206	$ 501,538	$ 831,594	$ 1,138,563	$ 1,172,433
Other (Describe)	$ -	$ -	$ -	$ -	$ -

Building Envelope	2013-2014 Investment in Energy Management Strategies	2014-2015 Investment in Energy Management Strategies	2015-2016 Investment in Energy Management Strategies	2016-2017 Investment in Energy Management Strategies	2017-2018 Investment in Energy Management Strategies
Glazing	$ -	$ -	$ -	$ -	$ -
Increased Wall Insulation	$ -	$ -	$ -	$ -	$ -
New Roof	$ -	$ -	$ -	$ -	$ -
New Windows	$ -	$ -	$ -	$ -	$ -
Treatments	$ -	$ -	$ -	$ -	$ -
Shading Devices	$ -	$ -	$ -	$ -	$ -
Other (Describe)	$ -	$ -	$ -	$ -	$ -
Total Investment in Design, Construction and Retrofit Strategies	**$ 1,306,553**	**$ 1,556,765**	**$ 1,535,295**	**$ 1,238,675**	**$ 1,325,651**

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	$ 110,198	$ -	$ -	$ 16,764	$ -
Nighttime Blackout of Sites - Exterior	$ 110,197	$ -	$ -	$ 16,765	$ 4,593
Procures Only Energy Star Certified Appliances	$ -	$ -	$ -	$ -	$ -
Daylight Harvesting (servicing)	$ -	$ -	$ -	$ -	$ -
Demand Ventilation (servicing)	$ -	$ -	$ -	$ -	$ -
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	**$ 220,395**	**$ -**	**$ -**	**$ 33,529**	**$ 4,593**

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**	**$900**	**Estimated Cost of Implementation**	**Estimated Cost of Implementation**
Building Operator Training	$ 900	$ 900	$ 900	$ 900	$ 900
NRCan Benchmarking Program	$ -	$ -	$ -	$ -	$ -
Building Automation Training (site specific)	$ 800	$ 800	$ 800	$ 800	$ 800
Ongoing Training and Awareness Programs for Energy Conservation	$ 16,958	$ 35,464	$ 793	$ -	$ -
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	**$ 18,658**	**$ 37,164**	**$ 2,493**	**$ 1,700**	**$ 1,700**

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	$ -	$ -	$ -	$ 1,912,093.00	$ 2,037,542.00		
Solar Air	$ -	$ -	$ -	$ -	$ -		
Solar Water	$ -	$ -	$ -	$ -	$ -		
Wind Turbine	$ -	$ -	$ -	$ -	$ -		
Biomass	$ -	$ -	$ -	$ -	$ -		
Other	$ -	$ -	$ -	$ -	$ -		
Total	$ -	$ -	$ -	$ 1,912,093.00	$ 2,037,542.00	8	963

Investments in Energy Management Strategies

Summary of Investment by Type

Total Investments in Energy Management Strategies FY 2012-13 to FY 2017-18	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018	2013/2014-2017/2018
	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	$ 1,306,553	$ 1,556,765	$ 1,535,295	$ 1,238,675	$ 1,325,651	6,962,939
Operations and Maintenance Investments Total	$ 220,395	$ -	$ -	$ 33,529	$ 4,593	258,517
Occupant Behaviour Investments Total	$ 18,658	$ 37,164	$ 2,493	$ 1,700	$ 1,700	61,715
Renewable Energy Investments Total	$ -	$ -	$ -	$ 1,912,093	$ 2,037,542	3,949,635
Total Investment Per Fiscal Year	$ 1,545,606	$ 1,593,929	$ 1,537,788	$ 3,185,997	$ 3,369,486	11,232,806

Calculating Energy Conservation Goals for FY 2019 to FY 2023

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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	MicroFIT	13	13	13	13	13	13	136,500	136,500	136,500	136,500	136,500	130	682,500
Solar photovoltaic	Net-Meterir	8	10	11	12	13	14	1,429,828	1,588,698	1,747,568	1,906,438	2,065,308	1538	8,737,840
Solar air														0
Solar water														0
Wind Turbine														0
Biomass														0
Other														0

End of worksheet.

Calculating Energy Conservation Goals for FY 2019 to FY 2023

Design, Construction and Retrofit Strategies

Lighting	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 Saving (ekWh)	2018/2019-2022/2023 Estimated Total Accumulated Energy Savings (ekWh)	Energy Payback Period	% related to Electricity	% related to Natural Gas
High Efficiency Lighting Systems	15	$ 500,000	408,163	$ 500,000	408,163	$ 500,000	408,163	$ 500,000	408,163	$ 500,000	408,163	6,122,449	7	100	0
Outdoor Lighting	15	$ 50,000	40,816	$ 50,000	40,816	$ 50,000	40,816	$ 50,000	40,816	$ 50,000	40,816	612,245	7	100	0
Occupancy Sensors	10	$ 300,000	342,857	$ 300,000	342,857	$ 300,000	342,857	$ 300,000	342,857	$ 300,000	342,857	5,142,857	5	100	0
Other (Describe)	-	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-	0		100

H.V.A.C.	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
Efficient Boilers (near condensing)	30	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-	15	5	95
High-efficiency Boilers (condensing)	15	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-	10	5	95
High-efficiency Boiler Burners	10	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-	5	5	95
Geothermal	20	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-	35	100	0
Heat Recovery/Enthalpy Wheels	30	$ 50,000	107,907	$ 50,000	107,907	$ 50,000	107,907	$ 50,000	107,907	$ 50,000	107,907	1,618,612	8	20	80
Economizers	15	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-	7.5	50	50
Energy Efficient HVAC systems	30	$ 121,000	15,844	$ 172,500	22,568	$ 224,000	29,331	$ 274,000	35,879	$ 324,000	42,426	371,749	75	50	50
Energy Efficient Rooftop Units	15	$ 100,000	32,736	$ 100,000	32,736	$ 100,000	32,736	$ 100,000	32,736	$ 100,000	32,736	491,039	30	50	50
High Efficiency Domestic Hot Water	15	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-	10	15	85
Efficient Chillers and Controls	25	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-	100	100	0
High-efficiency Motors	20	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-	10	100	0
VFD	15	$ 100,000	144,496	$ 100,000	144,496	$ 100,000	144,496	$ 100,000	144,496	$ 100,000	144,496	2,167,434	5	75	25
Demand Ventilation	10	$ 100,000	196,415	$ 100,000	196,415	$ 100,000	196,415	$ 100,000	196,415	$ 100,000	196,415	2,948,231	5	50	50
Entrance Heater Controls	20	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-	5	50	50
Destratification Fans	10	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-	7	100	0
Other (Describe)		$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-	0		100

Controls	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
Building Automation Systems - New	10	$ 50,000	32,736	$ 50,000	32,736	$ 50,000	32,736	$ 50,000	32,736	$ 50,000	32,736	491,039	15	50	50
Building Automation Systems - Upgrade	10	$ 200,000	130,944	$ 200,000	130,944	$ 200,000	130,944	$ 200,000	130,944	$ 200,000	130,944	1,964,154	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	$ 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
Other (Describe)		$ -	-	$ -	-	$ -	-	$ -	-	-	-	-	0		100

Building Envelope	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
Glazing	30	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-	80	20	80
Increased Wall Insulation	50	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-	40	20	80
New Roof	25	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-	200	20	80
New Windows	30	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-	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 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		$ 1,656,000	1,546,875	$ 1,707,500	1,553,619	$ 1,759,000	1,560,362	$ 1,809,000	1,566,910	$ 1,859,000	1,573,457	23,337,215

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 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

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	$ 4,000	7,857	$ 2,500	4,910	$ 1,000	1,964	$ 1,000	1,964	$ 1,000	1,964	70,710	5	50	50
Day and Night Temperature Guidelines for all Schools	10	$ 500	1,727	$ 500	1,727	$ 500	1,727	$ 500	1,727	$ 500	1,727	25,568	5	20	80
Nighttime Blackout of Sites - Interior	10	$ 50,000	40,816	$ 50,000	40,816	$ 50,000	40,816	$ 50,000	40,816	$ 50,000	40,816	612,245	7	100	-
Nighttime Blackout of Sites - Exterior	10	$ 50,000	40,816	$ 50,000	40,816	$ 50,000	40,816	$ 50,000	40,816	$ 50,000	40,816	612,245	7	100	-
Procures Only Energy Star Certified Appliances	5	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-	5	100	-
Demand Ventilation (servicing)	3	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-	5	50	50
HVAC Optimization (coil cleaning, re-calibration of equipment)	3	$ 2,000	9,821	$ 2,000	9,821	$ 2,000	9,821	$ 2,000	9,821	$ 2,000	9,821	147,312	2	50	50
Commissioning (retro and re)	10	$ 50,000	49,104	$ 50,000	49,104	$ 50,000	49,104	$ 50,000	49,104	$ 50,000	49,104	736,558	10	50	50
Other (Describe)		$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-	0		100

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
Walk Through Audit	5	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-	1000	50	50
Engineering Audit	5	$ 1,500	15	$ 1,500	15	$ 1,500	15	$ 1,500	15	$ 1,500	15	221	1000	50	50
Other (Describe)		$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-	0		100

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		$ [illegible]	[illegible]	$ [illegible]	[illegible]	$ [illegible]	[illegible]	$ 155,000	[illegible]	$ [illegible]	[illegible]	[illegible]

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

Press TAB to move to input area. Press UP or DOWN ARROW in column A to read through the document.

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	$ 2,000	5,724	$ 2,000	5,724	$ 2,000	5,724	$ 2,000	5,724	$ 2,000	5,724	85,860	3	60	40
Energy Benchmarking Program	5	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-	1000	50	50
Building Automation Training (site specific)	3	$ 2,000	17,173	$ 2,000	17,173	$ 2,000	17,173	$ 2,000	17,173	$ 2,000	17,173	257,599	1	60	40
Ongoing Training and Awareness Programs for Energy Conservation	5	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-	10	90	10
Detailed Information on Building Operational Costs	1	$ 500	5	$ 500	5	$ 500	5	$ 500	5	$ 500	5	74	1000	50	50
Detailed Information on Energy Consumption (e.g. via the Utility Consumption Database or other database)	1	$ 500	5	$ 500	5	$ 500	5	$ 500	5	$ 500	5	74	1000	50	50
Participate in Environmental Programs, such as EcoSchools, Earthcare	1	$ 40,000	49,886	$ 40,000	49,886	$ 40,000	49,886	$ 40,000	49,886	$ 40,000	49,886	748,293	5	90	10
Other Tools (Define)		$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-	0		100
Occupant Behaviour Strategies Total		**$ 45,000**	**72,794**	**$ 45,000**	**72,794**	**$ 45,000**	**72,794**	**$ 45,000**	**72,794**	**$ 45,000**	**72,794**	**1,091,906**			

Keys	
$0.175	= cost of 1 ekWh electricity
$0.0287	= cost of 1 ekWh natural gas
0.0955	m³ = 1 ekWh
$0.30	= cost of 1 m³ of natural gas

End of worksheet

Calculating Energy Conservation Goals for FY 2019 to FY 2023

Press TAB to move to input area. Press UP or DOWN ARROW in column A to read through the document.

Conservation Goal

	FY 2018	
Total Building Area (includes portables) (m^3)	1,126,072	Enter from UCD. - use square meters
Total Building Area (includes portables) (ft^2)	12,120,981	Enter from UCD - use square feet
Energy Consumption for the board (ekWh)	202,093,600	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	$ 1,656,000	1,546,875	$ 1,707,500	1,553,619	$ 1,759,000	1,560,362	$ 1,809,000	1,566,910	$ 1,859,000	1,573,457	23,337,215
Appendix C: Operations and Maintenance Strategies Total	$ 158,000	150,155	$ 156,500	147,209	$ 155,000	144,263	$ 155,000	144,263	$ 155,000	144,263	2,205,187
Appendix D: Occupant Behaviour Strategies Total	$ 45,000	72,794	$ 45,000	72,794	$ 45,000	72,794	$ 45,000	72,794	$ 45,000	72,794	1,091,906
TOTAL	$ 1,859,000	1,769,824	$ 1,909,000	1,773,621	$ 1,959,000	1,777,419	$ 2,009,000	1,783,966	$ 2,059,000	1,790,513	26,634,308
Percentage reduction		0.88		0.88		0.88		0.88		0.89	4.40
Conservation Goal (ekWh/m^3)		1.57		1.58		1.58		1.58		1.59	7.90
Conservation Goal (ekWh/ft^2)		0.15		0.15		0.15		0.15		0.15	0.73

End of worksheet.