

Energy Conservation and Demand Management Plan

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Education Sector Background

Funding and Energy Management Planning

Each year, school boards receive approximately \$1.4 billion in School Renewal Allocation funding from the province. In addition, school boards may receive other capital-related and time-limited funds over this period.

The Ministry typically announces each Board's funding allocations through Core Education Funding (formerly Grants for Student Needs), for the upcoming Fiscal Year (September 1st to August 31st), typically in March-April on an annual basis.

While a board may have a five-year energy management strategy, the ability to implement their strategy depends on the funding that is 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
- Building Envelope - thermal performance
- Equipment/Systems
- Age
- Operating Efficiency

- Lifecycle/Building Condition
- 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
 - Arenas/outdoor rinks

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 academic 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 2017 to 2018 to the end of the five-year reporting period Fiscal Year 2022 to 2023.

Table 1: Board's Asset Portfolio

Key Metrics	(Baseline Year) Fiscal Year 2017 to 2018	Fiscal Year 2022 to 2023	Variance
Total Number of Buildings	98	89	-9
Total Number of Portables/Portapaks	292	375	83
Total Floor Area	6,046,050	5,924,615	-121,435
Average Operating Hours	75	75	
Average Daily Enrolment	33,436	46,177	12,741
% of Total Floor Area Air Conditioned	64	71	7
Number of Facilities with Mechanical Ventilation	67	70	3
Other Relevant Changes in the Operation of Assets: Beginning in 2022, the Ottawa Catholic School Board began a project to add air conditioning to all portable and portapak classrooms; it is now completed. In addition, the board has prioritized adding mechanical ventilation to any remaining tier 3 schools. Over the next fiscal year, 4-200kw solar Net Metering installations will be brought online for a total of 8 renewable energy systems in the OCSB inventory.			

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 2017 to 2018 (Baseline year)	Fiscal Year 2022 to 2023
Total Electricity (kWh)	40,216,710 kWh	40,867,680 kWh
Total Natural Gas (ekWh)	4,8448,970 ekWh	4,4540,890 ekWh
Total Heating Fuel (Type 1 and 2) (ekWh)		218,469 ekWh
Total Propane (ekWh)		268,887 ekWh

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 2017 to 2018	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
HDD	3989	4196	3837	3696	3799	3,611
CDD	432	334	415	392	340	267

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.

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 buildings have partial air conditioning. The UCD only applies CDD to meters that demonstrate an increase in consumption due to air conditioning.

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. The unit of measurement used is either equivalent kilowatt hours per square foot (ekWh/ft²) or equivalent kilowatt hours per square metre (ekWh/m²). The limitation to this normalization calculation is that some energy usage is independent of weather such as domestic hot water production and base load electrical costs associated with pumps, fans, lighting and plug loads.

Table 4: Weather Normalized Values

Weather Normalized Values	Fiscal Year 2017 to 2018 (Baseline Year)	Fiscal Year 2022 to 2023 (Most Recent Data Available)
Total Energy Consumed (ekWh)	85,214,820 ekWh	85,397,592 ekWh
Energy Intensity (ekWh/ft ²)	14.72	15.45
Energy Intensity (ekWh/m ²)	158.32	166.72
Total GHG Emissions (kgCO ₂)	10,728,703 kgCO ₂	9,351,994 kgCO ₂
Emissions Intensity (kgCO ₂ /m ²)	18.87 kgCO ₂ /m ²	16.79 kgCO ₂ /m ²

D. Review of Previous Energy Conservation Goals and Achievements

In 2019, 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.

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

Fiscal Year	Conservation Goal ekWh/ft ²	Conservation Goal ekWh/m ²	Conservation Goal Percentage	Actual Energy Savings ekWh/ft ²	Actual Energy Savings ekWh/m ²	Actual Energy Percentage
2018 to 2019	.56	6.03	3.82	.86	9.24	5.83
2019 to 2020	.62	6.63	4.20	.79	8.48	5.69
2020 to 2021	.51	5.49	3.48	-.88	-9.52	-6.77
2021 to 2022	.51	5.49	3.48	-.97	-10.43	-6.95
2022 to 2023	.51	5.49	3.48	-.53	-5.75	-3.58

NOTE TO READERS:

When reviewing annual Actual Energy Savings and Actual Energy Percentage across the five (5) years in the chart above, the following should be considered:

1. Conservation goals in the above chart were forecast in Spring 2019 based on the assumption that operational parameters would remain consistent from FY2019 through FY2023. However, the pandemic that arrived in early 2020, significantly changed how schools operated and impacted their energy consumption.
2. As a result of significant operational changes from one year to the next from FY2019 to FY2023, an apple-to-apple comparison of Energy Intensity (ekWh/ft² – the quantity of energy consumed per area) is not possible.
 - Factors that reduced energy consumption include:
 - temporary school closures in FY2020 and FY2021, due to the pandemic
 - boards with centralized Building Automation Systems (BAS) that could be remotely programed to “unoccupied set points”, should show a reduction in consumption

- temporary suspension of community use of schools, before/after school programs, childcare programs, continuing education and summer school programs
 - for schools with these programs, the number of “occupied set point” operating hours would be significantly reduced
- Factors that increased consumption include:
 - Implementation of new health and safety factors in FY2021 through FY2023 to address pandemic issues, such as:
 - increased ventilation (intake of fresh air),
 - increased filtration requirements
 - expanded operating hours (run-time) of HVAC equipment

A board’s ability to achieve their 2019 forecasted Conservation Goals may be limited by some or all the above factors.

In addition to the pandemic-related factors outlined above, there are a number of other factors that regularly impact a board’s ability to achieve their conservation goals, including:

Before and After School Programs

Before-School and After-School Programs need a facility’s Heating, Ventilation, and Air Conditioning (also known as HVAC) system to operate for an extended period of time on a daily basis, which increases the overall energy intensity.

Community Use of Schools

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

Community Hubs

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 on a daily basis, which will increase the overall energy intensity.

Air Conditioning

Historically, schools have not had air conditioning, or there has been minimal air-conditioned space in the facility. However, with changing weather patterns, "shoulder seasons" such as May, June and September are experiencing higher than normal temperatures and there is an increased desire for schools to have air conditioning. Air conditioning significantly increases a facility's energy use, specifically electricity consumption.

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 current 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.

Pandemic

When reviewing year-over-year value, it should be noted that FY2020 values will be lower as schools were closed due to the pandemic (March 2020 until June 2020). During that time, the sector experienced a decrease of 16% in electricity consumption and 3% in natural gas consumption. The difference in the percentage for the two utilities reflects that natural gas is primarily used for heating and April, May and June do not have the same heating demands due to weather.

In FY2021 consumption values were typically higher than FY2020, but due to limited occupancy as a result of the ongoing pandemic, lower than previous consumption levels.

Ventilation and Filtration

In consultation with the Office of the Chief Medical Officer of Health, the Ministry of Labour, Immigration, Training and Skills Development and others, school boards have been expected to continue to build on established practices to optimize air quality to support healthy and safe learning environments for students and staff.

Many of these new recommendations/requirements can impact utility consumption. For instance, the implementation of standalone HEPA filtration units has impacted energy consumption, primarily electricity.

E. Cumulative Energy Conservation Goal

The following table compares the 2019 Forecasted Cumulative Energy Intensity Conservation Goal with the Actual Cumulative Energy Intensity Reduced Savings.

Table 6: Cumulative Energy Intensity Goal from Fiscal Year 2018 to 2019 through Fiscal Year 2022 to 2023

Cumulative Energy Intensity	(ekWh/ft2)	(ekWh/m2)	Variance
Forecasted Cumulative Energy Intensity Conservation Goal of Fiscal Year 2018 to 2019 through Fiscal Year 2022 to 2023	2.71	29.13	
Forecasted Cumulative Energy Intensity Conservation Goal as a Percentage			18.46
Actual Cumulative Energy Intensity Reduced or Increased from Fiscal Year 2018 to 2019 through Fiscal Year 2022 to 2023 – Weather Normalized	-0.74	-8.00	
Variance between 2019 Forecast Cumulative Conservation Goal and Actual Cumulative Energy Intensity– Weather Normalized	-3.45	-37.13.	
% of Cumulative Energy Intensity Conservation Goal Achieved - Weather Normalized			-27.42

F. **Measures Implemented from Fiscal Year 2018 to 2019 to Fiscal Year 2022 to 2023**

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 2019 and Fiscal Year 2023**. 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 measure the related actual energy savings achieved.

PART II – ENERGY CONSERVATION and DEMAND MANAGEMENT PLAN for FISCAL YEAR 2022 to 2023 to FISCAL YEAR 2027 to 2028

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 Ottawa Catholic School Board has had an energy management strategy in place since 2005. The plan has been modified over the years as opportunities for conservation have evolved with new technology and as strategies have been implemented board wide. Currently the focus is on continued operational best practices such as indoor and outdoor lighting blackouts during unoccupied periods as well as holiday, weekend and weeknight setback temperatures.

The OCSB continues to invest school renewal funding into energy efficient lighting, HVAC equipment, roof insulation and building envelope improvements. Our new standard rooftop HVAC equipment is equipped with hybrid heating components. The units can heat with either electric heat pump or natural gas depending on control strategies. The OCSB is also investing in solar Net Metering systems in new school designs. 4 new elementary schools built in 2023-24 will each have a 200kw photovoltaic system located on the roof.

The board continues to navigate through the changing environmental conditions where air conditioning is becoming more of a priority as well as the need for increased outdoor air ventilation to meet Provincial guidelines.

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

In-house including:

- a. Shared job function

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

Renewable Energy

Definition

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

- solar photovoltaic panels

For a list of the Board's renewable energy projects, please refer to the **Calculating Energy Conservation Goals Fiscal Year 2024 to Fiscal Year 2028** explained in [Appendix A: Renewable Energy](#).

Design/Construction/Retrofit

Definition

Design, construction, and retrofit include 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 2023 to 2024 to Fiscal Year 2027 to 2028**, [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 perform at maximum efficiency. For the Board's relevant projects over the next five years, please refer to **Calculating Energy Conservation Goals Fiscal Year 2023 to 2024 to Fiscal Year 2027 to 2028**, [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 2023 to 2024 to Fiscal Year 2027 to 2028**, [Appendix D: Occupant Behaviour](#).

Estimated Annual Energy Savings (ekWh)

$$\frac{\left(\frac{\text{Estimated Cost of Implementation (\$)}}{\text{Simple Payback Period}} \right)}{(\% \text{ related to electricity in fractions} \times \text{Cost of 1 ekWh of electricity}) + (\% \text{ related to Gas in fractions} \times \text{Cost of 1 ekWh of Gas})}$$

- For example, if the total cost to implement LED lighting is \$100,000 and Simple payback is 10 years, @\$0.20/kWh of electricity (and assuming no relation between LED lighting and gas consumption and therefore @ 100% electrical impact, fraction is 1)

- Estimated annual energy savings in kWh would be $\frac{\left(\frac{\$100,000}{10} \right)}{1 \times 0.20} = 50,000 \text{ kWh}$

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 2023 to 2024	Fiscal Year 2024 to 2025	Fiscal Year 2025 to 2026	Fiscal Year 2026 to 2027	Fiscal Year 2027 to 2028
ekW/ft ²	0.64	0.21	0.57	0.55.	0.49
ekW/m ²	6.90	5.46	6.17	5.95	5.24
Percentage Decrease	4.49	3.55	4.01	3.88	3.41

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 2023 to 2024 through Fiscal Year 2027 to 2028
ekWh/ft ²	2.76
ekWh/m ²	29.71
Percentage Decrease	19.34

B. Environmental Programs

In Fiscal Year 2022 to 2023, schools within the Board participated in environmental programs.

1. Eco Schools:
59 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 2018 to 2019 and Fiscal Year 2022 to 2023, the Board has applied for **\$1,389,810** in incentive funding from different agencies to support the implementation of energy efficient projects.

2. The Board uses external resources, such as IESO Service Representatives and / or Enbridge Service Representatives, to apply for incentives.

☒ Yes

☐ No

If yes,

☒ IESO Service Representative

☒ Enbridge Service Representative

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

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

☒ Yes

☐ No

If yes,

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

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:

Monthly meter readings entered into spreadsheet for analysis

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)

F. **Carbon Reduction Strategies**

The board has in place a strategy to switch the fuel currently used to one with a better emissions factor.

- ☒ fuel oil to propane Number of facilities 1
- ☒ propane to natural gas Number of facilities 1

1. The board plans to introduce ventilation controls:
 - ☒ Heat Wheel Recovery Number of facilities 5
2. The Ottawa Catholic School Board is limited by options to move to “cleaner” fuel based on availability, lack of infrastructure, or equipment/mechanical system constraints.

To manage energy consumption, the board has in place the following set point temperatures:

Category	Definition	Winter		Summer	
		Applicable Dates	Set Point	Applicable Dates	Set Point
Occupied	Students in the classrooms	December to March	21	April to November	23
Unoccupied	No students in the classrooms	December to March	18	April to November	28.

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

I confirm that (insert Board's name) senior management has reviewed and approved this Energy Conservation and Demand Management Plan.

Full Name: Miro Vala

Job Title: Superintendent of Planning and Facilities

Date: 28 June 2024