OTTAWA-CARLETON DISTRICT SCHOOL BOARD

Learning Well-Being Social Responsibility

Energy Conservation and Demand Management Plan

July 2024 - July 2028

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Education Sector Background

The Ottawa Carleton District School Board (OCDSB) is the largest school board in eastern Ontario serving over 73,000 students within a 2,760 square kilometre area known as the city of Ottawa.

The total managed building area for the board exceeds 11 million square feet across 156 facilities that include elementary and high school as well as administrative buildings. The Facilities Department is made up of a multi-disciplinary group of professionals who design, build, manage, operate, and repair these facilities and properties under the jurisdiction of the Ottawa-Carleton District School Board.

Part of the Facilities Department work plan is to develop an awareness of our energy usage and environmental issues and to develop strategies leading to the reduction of the OCDSB's energy consumption and Greenhouse Gas (GHG) emissions.

Funding and Energy Management Planning

Each year school boards receive 100% of their funding from the ministry of education. In addition, school boards may receive time-limited funds over this period.

The Ministry typically announces each Board's funding allocations, for the upcoming school board Fiscal Year (September 1st to August 31st), in March-April. Funding is allocated on an annual basis.

While the board may have a five-year energy management strategy and plans to anticipate changes for the future, the ability to implement this strategy depends on the funding that's received for each of the five years covered by the 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
    - Childcare
    - 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

1.1. 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	156	157	1
Total Number of Portables/Portapaks	372	424	52
Total Floor Area	1,092,043 sqm	1,103,408 sqm	11,365
Average Operating Hours	80	80	0
Average Daily Enrolment	65,632	73,566	7,934
% of Total Floor Area Air Conditioned	59%	63.5%	4.5%
Number of Facilities with Mechanical Ventilation	156	157	1
Other Relevant Changes in the Operation of Assets: **Demand Controlled Ventilation**	45	154	+109

1.2. 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)	72,019,944	71,473,792
Total Natural Gas (ekWh)	128,751,048	120,990,424

[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 2017 to 2018 (Baseline year)	Fiscal Year 2022 to 2023
Total Heating Fuel (Type 1 and 2) (ekWh)	0	0
Total Heating Fuel (Type 4 and 6) (ekWh)	0	0
Total Propane (ekWh)	1,229,138	1,127,769
Total District Heat (ekWh)	0	0
Total District Cool (ekWh)	0	0

1.3. 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.

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

[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.t

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).

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)	202,033,200	208,779,024
Energy Intensity (ekWh/ft2)	17.19	17.58
Energy Intensity (ekWh/m2)	185.01	189.21
Total GHG Emissions ($kgCO_2$)	25,972,294	26,954,756
Emissions Intensity ($kgCO_2/ft^2$)	2.21	2.27
Emissions Intensity ($kgCO_2/m^2$)	23.73	24.43

1.4. 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.

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
2018-2019	0.15	1.58	1	0.90	9.64	5.21%
2019-2020	0.15	1.58	1	0.22	2.39	1.36%

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.

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
2020-2021	0.15	1.58	1	-1.57	-16.85	-9.74%
2021-2022	0.15	1.58	1	0.35	3.77	1.99%
2022-2023	0.15	1.58	1	-0.29	-3.15	-1.69%

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/ft^2 – 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 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 several 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 daily, 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 daily, 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 daily, 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 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 saw 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 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.

1.5. 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)
Forecasted Cumulative Energy Intensity Conservation Goal of Fiscal Year 2018 to 2019 through Fiscal Year 2022 to 2023	0.75	7.90
Forecasted Cumulative Energy Intensity Conservation Goal as a Percentage	5%	
Actual Cumulative Energy Intensity Reduced (+) or Increased from Fiscal Year 2018 to 2019 through Fiscal Year 2022 to 2023 – Weather Normalized	-0.39	-4.21
Variance between 2019 Forecast Cumulative Conservation Goal and Actual Cumulative Energy Intensity– Weather Normalized	-1.14	-12.11
% of Cumulative Energy Intensity Conservation Goal Achieved - Weather Normalized	-52.13%	

1.6. 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:

A. Design, Construction and Retrofit Investments
B. Operations and Maintenance Investments
C. Occupant Behaviour Investments
D. Renewable Energy Investments
E. 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:
   - 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, building envelope improvements and new/upgrades to the building automation systems.

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

Renewable Energy

Definition

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

- Solar power generation

Net-metering solar power generation systems have been adopted as a viable opportunity for new solar initiatives in the district. Net-metering systems provide the district with the ability to consume the electricity generated on site. The electrical generation may offset as much as 50% of the annual electricity usage at a school, depending on the installed system's size and the school's actual usage.

Since 2019, OCDSB has added nine solar net metering sites with total installed capacity **exceeding 1 MW**. The district plans to add more net-metering systems in the next few years, as budgets permit.

Solar Net Metering Installed Capacity ((MW)	*Total Electricity Generation since 2019 (kWh)*	*Total Cost Avoidance since 2019 ($)*
1.1	5,170,627	$930,512

For a list of the Board's renewable energy projects, please refer to the **Appendix F: Renewable Energy Investments (FY 2024-2028)**

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 **Appendix G: Design, Construction, and Retrofit Investments (FY 2024-2028)**

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 **Appendix H: Operations and Maintenance Investments (FY 2024-2028)**

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 **Appendix I: Occupant Behaviour Investments (FY 2024-2028)**

2.1. 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
ekWh/ft^2	0.34	0.34	0.34	0.34	0.34
ekWh/m^2	3.7	3.7	3.7	3.7	3.7
Percentage Decrease	2%	2%	2%	2%	2%

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	**1.7**
ekWh/m^2	**18.5**
Percentage Decrease	**10%**

NOTE TO READERS:

There are many factors that influence the Board's ability to meet energy conservation targets. A list of these factors includes, but are not limited to, in the following areas:

1. *Changes in BAS programming*

- Introduction of Before and After school programs during school year as well as community use hours in summer means that a facility's HVAC system may have to operate on an extended period to match the longer occupancy hours. In addition, ventilation rates to optimize indoor air quality for safe and healthy learning environments also affects the energy use.

2. *Changes to School Board Funding Models*

- Forecasted conservation goals assume that the current funding models remain in place for the next five years.
- All Board's funding is determined on an annual basis and therefore any changes in the funding model is expected to impact forecasted values.

3. *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.

2.2. Environmental Programs

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

The name of the program is **The Sustainability Journal.**
153 schools participate.

The Sustainability Journal is an OCDSB created communication and support platform for OCDSB educators to share environmental initiatives and to find environmental resources that they can bring back to their classrooms. The main ethos of this program intends to deepen and embed environmental education and programming into OCDSB schools.

2.3. 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 2018 to 2019 and Fiscal Year 2022 to 2023, the Board has applied for $ **406,373** 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

   ☒ IESO Service Representative

   ☒ Enbridge Service Representative

   ☐ Other

2.4. Energy Procurement

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

   ☒ Yes ☐ No

(For a portion of the portfolio)

☐ OECM's Strategic Electricity Management and Advisory Services

☒ Other:

Provide Name of Consortia: **Direct Energy**

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

☒ Yes ☐ No

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

☐ Other:

Provide Name of Consortia: **Twin Eagle Resource Management**

2.5. 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:

2.6. Carbon Reduction strategies

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

   ☐ fuel oil to propane

   ☐ fuel oil to natural gas

   ☐ propane to natural gas

   ☒ natural gas to electricity Expected Number of facilities ~ **101**

2. The board plans to introduce ventilation controls:

   ☒ Heat Wheel Recovery Existing Number of facilities ~ **52**

   ☒ CO2 controls / on demand Existing Number of facilities ~ **154**

3. Board is limited by options to move to “cleaner” fuel based on availability, lack of infrastructure, or equipment/mechanical system constrains.

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	6am - 11pm	September 30	21.5 ºC	May 15	24 ºC
Unoccupied	11pm - 6am	September 30	17 ºC	May 15	26 ºC

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

I confirm that the Ottawa-Carleton District School Board senior management has reviewed and approved this Energy Conservation and Demand Management Plan.

X 

Full Name: Dan Bradley

Job Title: General Manager – Facility Operations

Date: 2024-06-25

Appendix A. Design, Construction and Retrofit Investments (2019-2023)

Design, Construction and Retrofit Strategies					
	2018-2019	2019-20	2020-2021	2021-2022	2022-2023
Lighting / Electrical	**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 (D5020, D502001, D502003, D502004)	$ 6,588,726	$ 6,085,658	$ 5,922,419	$ 8,478,041	$ 10,429,050
Outdoor Lighting (D502004)	$ 467,345	$ 364,942		$ 11,256	
Occupancy Sensors (D5021, D5022)	$ -	$ -	$ -	$ -	$ -
Daylight Harvesting	$ -	$ -	$ -	$ -	$ -
Dimming Switches					
Other (Describe)					
	2018-2019	2019-20	2020-2021	2021-2022	2022-2023
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) (D3020, D302001, D302002)					
High-efficiency Boilers (condensing) (D3020, D302001, D302002)	$ 2,668,534	$ 1,367,276	$ 325,445	$ 60,975	$ 852,327
High-efficiency Boiler Burners (D3020)					
Geothermal (D302099)					
Heat Recovery/Enthalpy Wheels (D3090)					
Economizers (D306002)	$ 282,581	$ 70,026	$ 32,724		
Energy Efficient HVAC systems (D3050,D3040)	$ 1,307,839	$ 728,971	$ 600,002	$ 7,363,107	$ 717,250
Energy Efficient Rooftop Units (D302098)	$ 821,211	$ 21,614	$ 632,977	$ 519,687	
High Efficiency Domestic Hot Water (D2020)	$ 260,055	$ 492,818	$ 299,019	$ 626,181	$ 272,338
Efficient Chillers and Controls (D3030, D303011, D303012)	$ 1,276,095	$ 726,513	$ 143,923	$ 143,757	$ 396,275
High-efficiency Motors (D304007, D303011)					
VFD (D302056)	$ -	$ -	$ -	$ -	$ -
Demand Ventilation (D3040)	$ -	$ -	$ -	$ 1,196,559	$ -
Entrance Heater Controls (D302099)	$ 118,660	$ 3,622			
Destratification Fans (D3090)					
Other (Describe)	$ -	$ -	$ -	$ -	$ -
	2018-2019	2019-20	2020-2021	2021-2022	2022-2023
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 (D3060)	$ -	$ -	$ -	$ -	$ -
Building Automation Systems - Upgrade (D3060)	$ 566,676	$ 623,133	$ 536,979	$ 410,924	$ 152,808
Real-time energy data for operators to identify and diagnose building issues					
Voltage Harmonizers (D501001)	$ 1,037,286	$ 618,046		$ 855,249	$ 342,427
Other (Describe)	$ -	$ -	$ -	$ -	$ -
	2018-2019	2019-20	2020-2021	2021-2022	2022-2023
Building Envelope	**Investment in Energy Management Strategies**	**Investment in Energy Management Strategies**	**Investment in Energy Management Strategies**	**Investment in Energy Management Strategies**	**Investment in Energy Management Strategies**
Glazing (B302006, B2020, B3021)		$ 10,474	$ 335,931	$ 115,105	
Increased Wall Insulation (B2010)	$ 198,211	$ 190,904			$ 34,603
New Roof (B3010, B3020)	$ 9,895,469	$ 5,180,925	$ 10,289,077	$ 12,202,144	$ 10,072,957
New Windows (B2020)	$ 3,415,389	$ 1,870,176	$ 2,857,031	$ 3,700,196	$ 3,171,494
Treatments					
Shading Devices	$ -	$ -	$ -	$ -	$ -
Other (Describe)	$ -	$ -	$ -	$ -	$ -
Total Investment in Design, Construction and Retrofit Strategies	**$ 28,904,078**	**$ 18,355,098**	**$ 21,975,527**	**$ 35,683,181**	**$ 26,441,529**

Appendix B. Operations and Maintenance Investments (2019-2023)

Operations and Maintenance Strategies					
	2018-2019	2019-20	2020-2021	2021-2022	2022-2023
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	$ 50,000	$ 50,000	$ 50,000	$ 50,000	$ 50,000
Day and Night Temperature Guidelines for all Schools	$ -	$ -	$ -	$ -	$ -
Nighttime Blackout of Sites - Interior	$ -	$ -	$ -	$ -	$ -
Nighttime Blackout of Sites - Exterior	$ -	$ -	$ -	$ -	$ -
Procures Only Energy Star Certified Appliances	$ -	$ -	$ -	$ -	$ -
Preventative Maintenance (re-commissioning, coil cleaning, filter changes)	$ 794,234	$ 689,617	$ 738,970	$ 732,653	$ 877,634
Daylight Harvesting (servicing)	$ -	$ -	$ -	$ -	$ -
Demand Ventilation (servicing)	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000
Water Leak Detection System				$ 30,284	$ 30,284
Other (Describe)	$ -	$ -	$ -	$ -	$ -
	2018-2019	2019-20	2020-2021	2021-2022	2022-2023
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	**$ 854,234**	**$ 749,617**	**$ 798,970**	**$ 822,937**	**$ 967,918**

Appendix C. Occupant Behaviour Investments (2019-2023)

Occupant Behaviour Strategies					
	2018-2019	2019-20	2020-2021	2021-2022	2022-2023
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	$ 25,000	$ 25,000	$ 25,000	$ 25,000	$ 25,000
Building Automation Training (site specific)	$ 25,000	$ 25,000	$ 25,000	$ 25,000	$ 25,000
Ongoing Training and Awareness Programs for Energy Conservation	$ 1,000	$ 1,000	$ 1,000	$ 1,000	$ 1,000
Provide Detailed Information on Building Operational Costs	$ 1,000	$ 1,000	$ 1,000	$ 1,000	$ 1,000
Board policy to limit appliances brought (space heater, mini fridge, coffee machine) into the workspace	-	-	-	-	-
Provide Detailed Information on Energy Consumption (e.g. via the Utility Consumption Database or other database)	$ 982	$ 982	$ 982	$ 982	$ 982
Participate in Environmental Programs, such as EcoSchools, Earthcare	$ 1,000	$ 20,000	$ 20,000	$ 1,000	$ 1,000
Other tools (Define)	$ -	$ -	$ -	$ -	$ -
Total Investment in Occupant Behaviour Strategies	**$ 53,982**	**$ 72,982**	**$ 72,982**	**$ 53,982**	**$ 53,982**

Appendix D. Renewable Energy Investments (2019-2023)

Renewable Energy Investments							
	Investment in Renewable Energy Technology ($)						
Type of Renewable Energy	Fiscal Year 2018-2019	Fiscal Year 2019-2020	Fiscal Year 2020-2021	Fiscal Year 2021-2022	Fiscal Year 2022-2023	Number of systems added	Capacity Added (kW)
Solar Photovoltaic	$ 1,080,785.00	$ 84,130.36		$ -	$ 50,000.00	4	475
Solar Air	$ -	$ -	$ -	$ -	$ -		
Solar Water	$ -	$ -	$ -	$ -	$ -		
Wind Turbine	$ -	$ -	$ -	$ -	$ -		
Biomass	$ -	$ -	$ -	$ -	$ -		
Other	$ -	$ -	$ -	$ -	$ -		
Total	$ 1,080,785.00	$ 84,130.36	$ -	$ -	$ 50,000.00		

Appendix E. Summary of Investment by Type (2019-2023)

Summary of Investment by Type						
	2018-2019	2019-2020	2020-2021	2021-2022	2022-2023	2018/19-2022/2023
Investment Type	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	$ 28,904,078	$ 18,355,098	$ 21,975,527	$ 35,683,181	$ 26,441,529	131,359,412
Operations and Maintenance Investments Total	$ 854,234	$ 749,617	$ 798,970	$ 822,937	$ 967,918	4,193,676
Occupant Behaviour Investments Total	$ 53,982	$ 72,982	$ 72,982	$ 53,982	$ 53,982	307,910
Renewable Energy Investments Total	$ 1,080,785	$ 84,130	$ -	$ -	$ 50,000	1,214,915
Total Investment Per Fiscal Year	$ 30,893,079	$ 19,261,827	$ 22,847,478	$ 36,560,100	$ 27,513,429	137,075,913

Appendix F. Renewable Energy Investments (FY 2024-2028)

Renewable Energy		Estimated number of systems installed						Estimated total number of ekWh generated annually						
Type of Renewable Energy	Define	Number of existing systems in asset portfolio (owned)	Fiscal Year 2023-2024	Fiscal Year 2024-2025	Fiscal Year 2025-2026	Fiscal Year 2026-2027	Fiscal Year 2027-2028	Fiscal Year 2023 - 2024	Fiscal Year 2024 - 2025	Fiscal Year 2025 - 2026	Fiscal Year 2026 - 2027	Fiscal Year 2027 - 2028	Total Size (kW)	Actual or Estimated Total Generation (ekWh)
Solar photovoltaic	Solar Net Metering Systems	9	2	3	3	3	3	1,000,000	1,250,000	1,625,000	2,000,000	2,375,000	2,200	8,250,000
Solar air														
Solar water														
Wind Turbine														
Biomass														
Other														

Appendix G. Design, Construction, and Retrofit Investments (FY 2024-2028)

Design, Construction and Retrofit Strategies												
		2023-2024		2024-2025		2025-2026		2026-27		2027-2028		2023/24-2027/28
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)
High Efficiency Lighting Systems (D5020, D502001, D502003, D502004)	30	$ 6,225,000	1,986,280	$ 2,500,000	797,703	$ 2,500,000	797,703	$ 2,500,000	797,703	$ 2,500,000	797,703	17,908,424
Outdoor Lighting (D502004)	30	$ -	-	$ -	-	$ -	-	$ -	-		-	-
Occupancy Sensors (D5021, D5022)	10	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-
Other (Describe)		$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-
		2023-2024		2024-2025		2025-2026		2026-27		2027-2028		2023/24-2027/28
H.V.A.C.	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)
Efficient Boilers (near condensing) (D3020, D302001	30	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-
High-efficiency Boilers (condensing) (D3020, D3020	15	$ 2,100,000	619,779	$ 1,400,000	413,186	$ 1,400,000	413,186	$ 1,400,000	413,186	$ 1,400,000	413,186	7,230,752
High-efficiency Boiler Burners (D3020)	10	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-
Geothermal (D302099)	25	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-
Heat Recovery/Enthalpy Wheels (D3090)	20	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-
Economizers (D306002)	15	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-
Energy Efficient HVAC systems (D3050,D3040)	35	$ 3,900,000	530,591	$ 1,500,000	204,074	$ 1,500,000	204,074	$ 1,500,000	204,074	$ 1,500,000	204,074	4,693,691
Energy Efficient Rooftop Units (D302098)	25	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-
High Efficiency Domestic Hot Water (D2020)	10	$ 30,000	52,709	$ 350,000	614,935	$ -	-	$ -	-	$ -	-	2,723,281
Efficient Chillers and Controls (D3030, D303011, D30	25	$ 1,400,000	89,343	$ 2,850,000	181,876	$ 1,400,000	89,343	$ 1,400,000	89,343	$ 1,400,000	89,343	1,710,274
High-efficiency Motors (D304007, D303011)	20	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-
VFD (D302056)	10	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-
Demand Ventilation (D3040)	15	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-
Entrance Heater Controls (D302099)	20	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-
Destratification Fans (D3090)	10	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-
Other (Describe)		$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-
		2023-2024		2024-2025		2025-2026		2026-27		2027-2028		2023/24-2027/28
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)
Building Automation Systems - New (D3060)	15	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-
Building Automation Systems - Upgrade (D3060)	15	$ 800,000	544,196	$ -	-	$ -	-	$ -	-	$ -	-	2,720,980
Real-time energy data for operators to identify and diagnose building issues	10	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-
Voltage Harmonizers (D501001)	15	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-
Other (Describe)		$ -	-	$ -	-	$ -	-	$ -	-		-	-
		2023-2024		2024-2025		2025-2026		2026-27		2027-2028		2023/24-2027/28
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)
Glazing (B302006, B2020, B3021)	30	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-
Increased Wall Insulation (B2010)	50	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-
New Roof (B3010, B3020)	22	$ 13,455,000	428,597	$ 10,000,000	318,541	$ 10,000,000	318,541	$ 10,000,000	318,541	$ 10,000,000	318,541	5,328,397
New Windows (B2020)	32	$ 3,450,000	686,854	$ 4,250,000	846,125	$ 2,550,000	507,675	$ 2,550,000	507,675	$ 2,550,000	507,675	9,864,821
Treatments	10	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-
Shading Devices	30	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-
Other (Describe)		$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-
		2023-2024		2024-2025		2025-2026		2026-27		2027-2028		2023/24-2027/28
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		**$ 31,360,000**	**4,938,348**	**$ 22,850,000**	**3,376,439**	**$ 19,350,000**	**2,330,521**	**$ 19,350,000**	**2,330,521**	**$ 19,350,000**	**2,330,521**	**52,180,620**

Appendix H. Operations and Maintenance Investments (FY 2024-2028)

Operations and Maintenance Strategies

Policy and Planning	Quantity of Time that Measure will be in place (years)	2023-2024 Estimated Cost of Implementation	2023-2024 Estimated Annual Energy Savings from all projects (ekWh)	2024-2025 Estimated Cost of Implementation	2024-2025 Estimated Annual Energy Savings from all projects (ekWh)	2025-2026 Estimated Cost of Implementation	2025-2026 Estimated Annual Energy Savings from all projects (ekWh)	2026-27 Estimated Cost of Implementation	2026-27 Estimated Annual Energy Savings from all projects (ekWh)	2027-2028 Estimated Cost of Implementation	2027-2028 Estimated Annual Energy Savings from all projects (ekWh)	2023/24-2027/28 Estimated Total Accumulated Energy Savings (ekWh)
New School Design/Construction Guidelines and Specifications	5	$ 50,000	102,037	$ 50,000	102,037	$ 50,000	102,037	$ 50,000	102,037	$ 50,000	102,037	1,530,551
Day and Night Temperature Guidelines for all Schools	10	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-
Nighttime Blackout of Sites - Interior	10	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-
Nighttime Blackout of Sites - Exterior	10	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-
Procures Only Energy Star Certified Appliances	5	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-
Demand Ventilation (servicing) (D3020,D3030, D3040)	3	$ 10,000	20,407	$ 10,000	20,407	$ 10,000	20,407	$ 10,000	20,407	$ 10,000	20,407	306,110
HVAC Optimization (coil cleaning, re-calibration of equipment) (D3020)	3	$ 850,000	985,340	$ 900,000	1,043,301	$ 650,000	753,495	$ 650,000	753,495	$ 650,000	753,495	13,620,870
Commissioning (retro and re)	10	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-
Other (Describe)		$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-

Energy Audits	Quantity of Time that Measure will be in place	2023-2024 Estimated Cost of Implementation	2023-2024 Estimated Annual Energy Savings from all projects (ekWh)	2024-2025 Estimated Cost of Implementation	2024-2025 Estimated Annual Energy Savings from all projects (ekWh)	2025-2026 Estimated Cost of Implementation	2025-2026 Estimated Annual Energy Savings from all projects (ekWh)	2026-27 Estimated Cost of Implementation	2026-27 Estimated Annual Energy Savings from all projects (ekWh)	2027-2028 Estimated Cost of Implementation	2027-2028 Estimated Annual Energy Savings from all projects (ekWh)	2023/24-2027/28 Estimated Total Accumulated Energy Savings (ekWh)
Walk Through Audit	5	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-
Engineering Audit	5	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-
Other (Describe)		$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-

Operations and Maintenance Strategies Total	Quantity of Time that Measure will be in place	2023-2024 Estimated Cost of Implementation	2023-2024 Estimated Annual Energy Savings from all projects (ekWh)	2024-2025 Estimated Cost of Implementation	2024-2025 Estimated Annual Energy Savings from all projects (ekWh)	2025-2026 Estimated Cost of Implementation	2025-2026 Estimated Annual Energy Savings from all projects (ekWh)	2026-27 Estimated Cost of Implementation	2026-27 Estimated Annual Energy Savings from all projects (ekWh)	2027-2028 Estimated Cost of Implementation	2027-2028 Estimated Annual Energy Savings from all projects (ekWh	2023/24-2027/28 Estimated Total Accumulated Energy Savings (ekWh)
Total		$ 910,000	1,107,784	$ 960,000	1,165,745	$ 710,000	875,939	$ 710,000	875,939	$ 710,000	875,939	15,457,532

Appendix I. Occupant Behaviour Investments (FY 2024-2028)

Occupant Behaviour Strategies		2023-2024		2024-2025		2025-2026		2026-27		2027-2028		2023/24-2027/28
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)
Building Operator Training	3	$ 25,000	75,935	$ 25,000	75,935	$ 25,000	75,935	$ 25,000	75,935	$ 25,000	75,935	1,139,024
Energy Benchmarking Program	5	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-
Building Automation Training (site specific)	3	$ 25,000	113,902	$ 25,000	113,902	$ 25,000	113,902	$ 25,000	113,902	$ 25,000	113,902	1,708,535
Ongoing Training and Awareness Programs for Energy Conservation	5	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-
Detailed Information on Building Operational Costs	1	$ 1,000	10	$ 1,000	10	$ 1,000	10	$ 1,000	10	$ 1,000	10	153
Detailed Information on Energy Consumption (e.g. via the Utility Consumption Database or other database)	1	$ 982	10	$ 982	10	$ 982	10	$ 982	10	$ 982	10	150
Participate in Environmental Programs, such as EcoSchools, Earthcare	1	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-
Other Tools (Define)		$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-
Occupant Behaviour Strategies Total		**$ 51,982**	**189,857**	**$ 51,982**	**189,857**	**$ 51,982**	**189,857**	**$ 51,982**	**189,857**	**$ 51,982**	**189,857**	**2,847,862**

Appendix J. Conservation Goals (FY 2024-2028)

Conservation Goal

	FY 2018
Total Building Area (includes portables) (m^2)	1,092,043
Total Building Area (includes portables) (ft^2)	11,754,643
Energy Consumption for the board (ekWh)	202,000,128

1 ft^2 = 0.0929 m^2

	2023-2024		2024-2025		2025-2026		2026-27		2027-2028		2023/24-2027/28
	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	$ 31,360,000	4,938,348	$ 22,850,000	3,376,439	$ 19,350,000	2,330,521	$ 19,350,000	2,330,521	$ 19,350,000	2,330,521	52,180,620
Appendix C: Operations and Maintenance Strategies Total	$ 910,000	1,107,784	$ 960,000	1,165,745	$ 710,000	875,939	$ 710,000	875,939	$ 710,000	875,939	15,457,532
Appendix D: Occupant Behaviour Strategies Total	$ 51,982	189,857	$ 51,982	189,857	$ 51,982	189,857	$ 51,982	189,857	$ 51,982	189,857	2,847,862
TOTAL	**$ 32,321,982**	**6,235,989**	**$ 23,861,982**	**4,732,041**	**$ 20,111,982**	**3,396,317**	**$ 20,111,982**	**3,396,317**	**$ 20,111,982**	**3,396,317**	**70,486,014**
Percentage reduction		3.09		2.34		1.68		1.68		1.68	10.47
Conservation Goal ($ekWh/m^2$)		5.71		4.33		3.11		3.11		3.11	19.37
Conservation Goal ($ekWh/ft^2$)		0.53		0.40		0.29		0.29		0.29	1.80