Energy Conservation and Demand Management Plan

June 24th, 2024

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Education Sector Background

Funding and Energy Management Planning

Each year school boards receive approximately $1.4 billion school renewal funding from the province. 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.

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.

<u>Facility Variables:</u>

- Construction
  - Year built
  - Number of floors
  - Orientation of the building
- Building Area
  a. Major additions
  b. Sites sold/closed/demolished/leased
  c. Portables
    i. Installed
    ii. Removed
    iii. Areas under cons
- Type of technology
- Lifecycle
- Percentage of air-conditioned space

Site Use

d. Elementary school
e. Secondary school
f. Administrative building
g. Maintenance/warehouse facility
h. Community Hubs

Shared Site Use (For example: two or more boards share common areas and/or partnered with a municipality)

i. Swimming pools
j. Libraries
k. Lighted sports fields
l. Sports domes

<u>Other Variables:</u>

- 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

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	**39**	**39**	**0**
Total Number of Portables/Portapaks	**105**	**106**	**6**
Total Floor Area (ft2)	**1,478,435.13**	**1,454,881.13**	**23,554**
Average Operating Hours	**58**	**60**	**2**
Average Daily Enrolment	**9700**	**11142**	**1442**
% of Total Floor Area Air Conditioned	**92**	**92**	**0**
Number of Facilities with Mechanical Ventilation	**39**	**39**	**0**

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)	11,545,459	10,369,859

[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 Natural Gas (ekWh)	12,947,403	10,026,890
Total Heating Fuel (Type 1 and 2) (ekWh)	0	0
Total Heating Fuel (Type 4 and 6) (ekWh)	0	0
Total Propane (ekWh)	0	0
Total District Heat (ekWh)	0	0
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 *c*ommon 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.

[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

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).

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)	23,555,804	20,100,756
Energy Intensity (eKWh/ft2)	15.93	13.82

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/ft2	Conservation Goal Percentage	Actual Energy Savings ekWh/ft2	Actual Energy Percentage
2018 to 2019	16.26	0	2.58	16.19
2019 to 2020	14.54	0	-0.99	-7.44
2020 to 2021	14.92	0	-0.04	-0.31
2021-2022	15.45	0	-0.27	-1.9
2022 to 2023	14.02	0	0.85	5.78

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:

- 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.
- 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 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 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.

BHNCDSB aims to abide by the High Temperature Guidelines, outlined by the Ministry of Education, under the Education Act of Ontario. All heating and cooling set points controlled throughout the board meet the “Comfortable Criteria” outlined in the figure 1.1 below.

AWARENESS INITIATIVES		PREVENTION MEASURES		REACTIVE MEASURES	
Employer Representatives (Designated School Board Staff)	Provide information to supervisors and workers to recognize factors which may increase the risk of developing a heat related illness and the signs and symptoms of heat stress	**Employer Representatives** (Designated School Board Staff)	Encourage the use of mechanical or other specialized equipment to reduce physical demands of work related tasks	**Supervisor Representatives** (Principals, Vice-Principals, Designates, Supervisors)	Provide scheduled daily access to cooler areas in the building when possible
Supervisor Representatives (Principals, Vice-Principals, Designates, Supervisors)	Monitor of environmental conditions (including humidex) and the possibility of heat stress related illness, especially during the first week of elevated temperatures while individuals are acclimatizing		Maintain insulating and reflective barriers which are designed to control the heat at its source (e.g. insulated furnace walls)		Review schedules for individuals exposed to high temperature conditions and increase the frequency and or length of rest breaks when possible
	Ensure that trained First Aid providers are available to respond to heat related illnesses throughout periods during which heat stress related illness is likely to occur		Maintain and maximize the use of existing equipment which is designed to exhaust hot air and humidity from occupied areas		Schedule strenuous jobs to be done during cooler times of the day
	Develop a clear and concise hot weather action plan which includes outdoor activities		Maintain and monitor the effectiveness of equipment designed to reduce the temperature and humidity through air cooling		Ensure that education workers have access to cooler areas of the building to take their scheduled breaks where possible
	Communicate heat stress related information and recommendations to all workers		Maximize the efficiency of building automation systems (BAS) to regulate indoor air temperatures during periods of extreme heat		Investigate and follow-up on any high temperature related incidents which are reported or observed
Worker Members (Education workers)	Acknowledge and promote information in regards to key factors which may increase the risk of developing a heat related illness and the signs and symptoms of heat stress		Consider American Society of Heating, Refrigerating and Air-Conditioning (ASHRAE) standards as it pertains to ventilation based on occupancy levels and air exchange requirements		Consult with employer representatives and Public Health Unit representatives for additional advice as required
Joint Health and Safety Comittee Members	Review information provided in regards to high temperature guidelines and make recommendations	**Supervisor Representatives** (Principals, Vice-Principals, Designates, Supervisors)	Provide access to cool, shaded work areas in the building if practical and safe to do so	**Worker Members** (Education workers)	Use available ventilation equipment to increase air movement if the indoor temperature is below 35°C
			Assess the physical demands of work related tasks and confirm reasonable monitoring and control strategies to implement during high temperature periods		Turn off or limit the use of heat generating equipment and appliances if safe and practical to do so
			Consider additional controls to prevent exposure to high temperatures which may be required for vulnerable individuals such as education workers and students with special needs or medical conditions		Where mechanical cooling is not possible, open interior doors and perimeter windows to increase the exchange of fresh air (when exterior temperatures are cooler)
		Joint Health and Safety Committee Members	Promote discussions, recomendations and relevant information to all education workers		Consume enough potable water to stay hydrated
					Be conscious of medications side effects and avoid beverages which contain sugars and caffeine as this may contribute to dehydration
TEMPERATURE RANGE INCLUDING HUMIDEX	DEGREES OF COMFORT				Avoid exposure to direct sunlight, especially during high heat periods of the day
19-24	Comfortable		A temperature range in which most individuals are comfortable		Consider wearing light and breathable clothing and avoiding clothing fabricated with synthetic fabric which may limit the cooling of the body
26-34	Some discomfort		Some individuals may experience discomfort		Wear light-coloured clothing (preferably a long-sleeve shirt and pants) and cover the head to prevent exposure to direct sunlight when outdoors
					For very hot environments, consider air, water or ice-cooled insulated clothing
35-44	Great discomfort		Most individuals will experience high levels of discomfort (initiate hot weather action plan and avoid exertion)		Consider wearing reflective clothing when working in areas with high radiant heat sources
					Be aware of risks related to the use of vapour-barrier clothing (i.e. chemical protective clothing) as this may limit cooling of the body
45 and above	HEALTH RELATED ILLNESS LIKELY TO OCCUR			**Joint Health and Safety Committee Members**	Review incident details (if any) and compare to policies, procedures and awareness initiatives in place. Make recommendations in order to prevent reoccurrence where possible

Where the capacity exists, the board will manage, monitor and control to standard heating, cooling and ventilation setpoints. The setpoints are outlined in the table below.

Table 6: Thermal Comfort & Ventilation Guidelines

Set Point Type	Heating (ºC)	Cooling (ºC)
Occupied Temp	21	23
Unoccupied Temp	18	28
$C0^2$ PPM	1000	1000
Ventilation (CFM)	ASHRAE 62.1 STDS	

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.

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/ft 2
Forecasted Cumulative Energy Intensity Conservation Goal of Fiscal Year 2018 to 2019 through Fiscal Year 2022 to 2023 https://www1.bhncdsb.ca/wp-content/uploads/BHNCDSB_Files/Reports/Facility%20Reports/2019-24%20Energy%20Conservation%20and%20Demand%20Management%20Plan.pdf	0
Forecasted Cumulative Energy Intensity Conservation Goal as a Percentage https://www1.bhncdsb.ca/wp-content/uploads/BHNCDSB_Files/Reports/Facility%20Reports/2019-24%20Energy%20Conservation%20and%20Demand%20Management%20Plan.pdf	0%
Actual Cumulative Energy Intensity Reduced or Increased from Fiscal Year 2018 to 2019 through Fiscal Year 2022 to 2023 – Weather Normalized	2.12
Variance between 2019 Forecast Cumulative Conservation Goal and Actual Cumulative Energy Intensity– Weather Normalized	2.12
% of Cumulative Energy Intensity Conservation Goal Achieved - Weather Normalized	2.77%

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) 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:

(Prose box: Board to insert text – regarding philosophy)

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. Design/Construction/Retrofit
2. Operations and Maintenance
3. Occupant Behaviour

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 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 performs 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.**

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	13.28	14.05	13.73	14.08	10.35
Percentage Decrease	-1.5%	-1.5%	-1.5%	-1.5%	-1.5%

Table 8: Cumulative Conservation Goal

Cumulative Conservation Goal	Fiscal Year 2023 to 2024 through Fiscal Year 2027 to 2028
ekWh/ft^2	10.35
Percentage Decrease	-7.5%

B. Environmental Programs

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

1. Eco Schools:
   5 number of schools participate
2. Earth Care Schools:
   0 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 2018 to 2019 and Fiscal Year 2022 to 2023, the Board has applied for approximately $50,000 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

D. <u>Energy Procurement</u>

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'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

E. <u>Demand Management</u>

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

☐ Invoices

☒ Real-time data

☒ Online data from the Local Distribution Company (LDC)

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. 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: Lou Citino

Job Title: Manger Of Facilities and Construction

Date: 2024-06-24

Appendix B: Calculating Energy Conservation Goals FY2024-FY2028

Design, Construction and Retrofit

Calculating Energy Conservation Goals for FY 2024 to FY 2028

Design, Construction and Retrofit Strategies

	2023-2024		2024-2025		2025-2026		2026-2027		2027-2028		2023/2024-2027/2028	
Lighting	**Estimated Cost of Implementation**	**Estimated Annual Energy Savings from all projects (ekWh)**	**Estimated Cost of Implementation**	**Estimated Annual Energy Savings from all projects (ekWh)**	**Estimated Cost of Implementation**	**Estimated Annual Energy Savings from all projects (ekWh)**	**Estimated Cost of Implementation**	**Estimated Annual Energy Savings from all projects (ekWh)**	**Estimated Cost of Implementation**	**Estimated Annual Energy Saving (ekWh)**	**Estimated Total Accumulated Energy Savings (ekWh)**	**Energy Payback Period**
High Efficiency Lighting Systems	$ -	-	$ -	-	$ 500,000	784,929	$ 500,000	784,929	$ 500,000	784,929	4,709,576	3.5
Outdoor Lighting	$ -	-	$ -	-	$ 50,000	85,852	$ 100,000	171,703	$ 25,000	42,926	643,887	3.2
Occupancy Sensors	$ -	-	$ -	-	$ 15,000	20,604	$ 15,000	20,604	$ 15,000	20,604	123,626	4
Other (Describe)	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-	0

	2023-2024		2024-2025		2025-2026		2026-2027		2027-2028		2023/2024-2027/2028	
H.V.A.C.	**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**
Efficient Boilers (near condensing)	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-	15
High-efficiency Boilers (condensing)	$ -	-	$ -	-	$ -	-	$ -	-	$ 1,500,000	4,130,240	4,130,240	10
High-efficiency Boiler Burners	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-	5
Geothermal	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-	35
Heat Recovery/Enthalpy Wheels	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-	8
Economizers	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-	7.5
Energy Efficient HVAC systems	$ 200,000	25,318		-		-	$ -	-	$ 750,000	94,944	221,537	75
Energy Efficient Rooftop Units	$ -	-	$ 1,200,000	379,777	$ 600,000	189,888	$ -	-	$ -	-	2,088,773	30
High Efficiency Domestic Hot Water	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-	10
Efficient Chillers and Controls	$ -	-	$ 650,000	35,714	$ -	-	$ -	-	$ -	-	142,857	100
High-efficiency Motors	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-	10
VFD	$ -	-	$ -	-	$ 40,000	55,686	$ 40,000	55,686	$ 40,000	55,686	334,116	5
Demand Ventilation	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-	5
Entrance Heater Controls	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-	5
Destratification Fans	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-	7
Other (Describe)	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-	0

	2023-2024		2024-2025		2025-2026		2026-2027		2027-2028		2023/2024-2027/2028	
Controls	**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**
Building Automation Systems - New	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-	15
Building Automation Systems - Upgrade	$ -	-	$ 10,000	6,330	$ 30,000	18,989	$ 120,000	75,955	$ 50,000	31,648	265,844	15
Real-time energy data for operators to identify and diagnose building issues	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-	3
Voltage Harmonizers	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-	7
Other (Describe)	$ -	-	$ -	-	$ -	-	$ -	-		-	-	0

	2023-2024		2024-2025		2025-2026		2026-2027		2027-2028		2023/2024-2027/2028	
Building Envelope	**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**
Glazing		-	$ -	-	$ -	-	$ -	-	$ -	-	-	80
Increased Wall Insulation	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-	40
New Roof	$ 800,000	67,431	$ -	-	$ -	-	$ -	-	$ 1,000,000	84,289	421,443	200
New Windows	$ -	-	$ -	-	$ 500,000	105,361	$ 500,000	105,361	$ 500,000	105,361	632,165	80
Treatments	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-	10
Shading Devices	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-	20
Other (Describe)	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-	0

	2023-2024		2024-2025		2025-2026		2026-2027		2027-2028		2023/2024-2027/2028
Design, Construction & Retrofit Strategies Total	**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	**$ 1,000,000**	**92,749**	**$ 1,860,000**	**421,821**	**$ 1,735,000**	**1,261,310**	**$ 1,275,000**	**1,214,239**	**$ 4,380,000**	**5,350,628**	**13,714,064**

Appendix C: Calculating Energy Conservation Goals FY2024 to FY2028 Operations and Maintenance

Calculating Energy Conservation Goals for FY 2024 to FY 2028

Operations and Maintenance Strategies		2023-2024		2024-2025		2025-2026		2026-2027		2027-2028		2023/2024-2027/2028
Policy and Planning	**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)**
New School Design/Construction Guidelines and Specifications	5	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-
Day and Night Temperature Guidelines for all Schools	10		-	$ 500	1,686	$ -	-	$ 1,000	3,372	$ -	-	13,486
Nighttime Blackout of Sites - Interior	10	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-
Nighttime Blackout of Sites - Exterior	10		-	$ 5,000	5,405	$ 35,000	38,462	$ -	-	$ -	-	137,363
Procures Only Energy Star Certified Appliances	5	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-
Demand Ventilation (servicing)	3	$ -	-	$ -	-	$ 7,000	13,292	$ 10,000	18,989	$ 10,000	18,989	96,843
HVAC Optimization (coil cleaning, re-calibration of equipment)	3	$ -	-	$ -	-	$ 10,000	18,989	$ 15,000	28,483	$ 15,000	28,483	142,416
Commissioning (retro and re)	10	$ -	-	$ -	-	$ 30,000	56,967	$ 30,000	56,967	$ 30,000	56,967	341,799
Other (Describe)		$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-

		2023-2024		2024-2025		2025-2026		2026-2027		2027-2028		2023/2024-2027/2028
Energy Audits	**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)**
Walk Through Audit	5	$ -	-	$ -	-		-		-		-	-
Engineering Audit	5	$ -	-	$ -	-	$ 15,000	142	$ 15,000	142	$ 15,000	142	854
Other (Describe)		$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-

		2023-2024		2024-2025		2025-2026		2026-2027		2027-2028		2023/2024-2027/2028
Operations and Maintenance Strategies Total	**Quantity of Time that Measure will be in place**	**Estimated Cost of Implementation**	**Estimated Annual Energy Savings from all projects (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		**$ -**	**-**	**$ 5,500**	**7,188**	**$ 97,000**	**127,812**	**$ 71,000**	**107,953**	**$ 70,000**	**104,581**	**732,763**

Appendix D: Calculating Energy Conservation Goals FY2024 to FY2028 Occupant Behavior

Calculating Energy Conservation Goals for FY 2024 to FY 2028

Occupant Behaviour Strategies

		2023-2024		2024-2025		2025-2026		2026-2027		2027-2028		2023/2024-2027/2028
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	$ 500	1,381	$ 500	1,381	$ 500	1,381	$ 500	1,381	$ 100	276	19,614
Energy Benchmarking Program	5	$ 500	5	$ 1,000	9	$ 900	9	$ 900	9	$ 900	9	113
Building Automation Training (site specific)	3	$ 1,000	8,288	$ 1,000	8,288	$ 1,000	8,288	$ 1,000	8,288	$ 1,000	8,288	124,316
Ongoing Training and Awareness Programs for Energy Conservation	5	$ 1,000	600	$ 1,000	600	$ 1,000	600		-	$ -	-	7,200
Detailed Information on Building Operational Costs	1	$ 5,000	47	$ 10,000	95	$ 10,000	95	$ -	-	$ -	-	902
Detailed Information on Energy Consumption (e.g. via the Utility Consumption Database or other database)	1	$ 5,000	47	$ 1,000	9	$ 1,000	9	$ 1,000	9	$ 1,000	9	332
Participate in Environmental Programs, such as EcoSchools, Earthcare	1	$ 500	600	$ 500	600	$ 500	600	$ 500	600	$ 500	600	9,000
Other Tools (Define)		$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-
Occupant Behaviour Strategies Total		**$ 13,500**	**10,969**	**$ 15,000**	**10,983**	**$ 14,900**	**10,982**	**$ 3,900**	**10,287**	**$ 3,500**	**9,182**	**161,478**

Appendix E: Calculating Energy Conservation Goals

FY2024 to FY2028 Conservation Goals

Calculating Energy Conservation Goals for FY 2024 to FY 2028

Conservation Goal

	FY 2024	
Total Building Area (includes portables) (m^2)	137,351	**Enter from UCD. - use square meters**
Total Building Area (includes portables) (ft^2)	1,454,881	**Enter from UCD - use square feet**
Energy Consumption for the board (ekWh)	24,492,862	**Enter from UCD**

1 ft^2 = 0.0929 m^2

	2023-2024		2024-2025		2025-2026		2026-2027		2027-2028		2023/2024-2027/2028
	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	$ 1,000,000	92,749	$ 1,860,000	421,821	$ 1,735,000	1,261,310	$ 1,275,000	1,214,239	$ 4,380,000	5,350,628	13,714,064
Appendix C: Operations and Maintenance Strategies Total	$ -	0	$ 5,500	7,180	$ 97,000	127,852	$ 71,000	107,953	$ 70,000	104,581	732,762
Appendix D: Occupant Behaviour Strategies Total	$ 13,500	10,969	$ 15,000	10,983	$ 14,900	10,982	$ 3,900	10,287	$ 3,500	9,182	161,478
TOTAL	**$ 1,013,500**	**103,718**	**$ 1,880,500**	**439,984**	**$ 1,846,900**	**1,400,143**	**$ 1,349,900**	**1,332,479**	**$ 4,453,500**	**5,464,391**	**14,608,304**