TOWNSHIP OF ESQUIMALT

BUILDING RETROFIT STUDY

PARKS NURSERY, 1100 CRAIGFLOWER RD

JANUARY 2026

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TOWNSHIP OF ESQUIMALT

PROJECT NO.: CA0051294.1761
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TABLE OF CONTENTS

APPENDICES

1 EXECUTIVE SUMMARY

ENERGY AND GHG ANALYSIS

The Parks Nursery consists of a small facilities building along with greenhouses, storage buildings and garages. The reported area of 223 m^2 reflects the main building only. The site used approximately 60,000 ekWh of energy at a cost of $5,000, for an energy intensity of 24.8 ekWh/ft^2.

The current GHG emissions are approximately 5.95 tCO2e, which is similar to the 2010 baseline of 5.1 tCO2e. This is much lower when compared to other municipal buildings such as the Recreation Centre.

ENERGY CONSERVATION AND GHG REDUCTION MEASURES

We identified a number of measures; these have been split up into the following categories:

- Energy Conservation measures
- Capital Measures
- GHG Emissions Reduction Strategies

The following table summarizes the potential energy conservation measures.

MEASURE		POTENTIAL SAVINGS			COST/PAYBACK	
#	ENERGY CONSERVATION MEASURE	Energy (ekWh[1]/Yr)	Utility Cost ($/Yr)	Emissions Reduction (eCO_2 T/Yr)	Opinion Of Cost	Simple Payback (years)
Energy Conservation Measures						
6.1	LED Lighting Retrofit	3,600	$490	0.05	$5,000	10
6.2	Install Programable Thermostats	4,900	$670	0.07	$3,000	4.5
ECM Totals (Rounded)		**8,500**	**$1,160**	**0.12**	**$8,000**	**6.9**
Capital Measures						
7.1	Window Replacement	2,300	$310	0.03	$20,000	NA
7.2	Roof Replacement	700	$100	0.01	$63,500	NA
Capital Measures Totals (Rounded)		**3,000**	**$410**	**0.04**	**$83,500**	**NA**
GHG Reduction Measures						
8.1	2nd Floor Furnace Replacement with Heat Pump	4,000	-$900	2.44	NA	NA
8.2	Replace 1st Floor Furnace with a Heat Pump	2,500	-$530	1.47	$10,380	NA
8.3	Replace Natural Gas DHW Heater with Electric	1,100	-$520	1.12	$5,000	NA
8.4	Replace Natural Gas Unit Heaters with Electric	240	-$80	0.19	$8,000	NA
GHG Reduction Totals (Rounded)		**7,840**	**-$2,030**	**5.22**	**$23,380**	**NA**

[1] ekWh – equivalent kilowatt hour.

The total potential savings will not necessarily equal the simple addition of the individual values. The integrated totals represent an estimate of the combined savings.

Cost savings are based on historic utility rates. Future utility rates are on the rise in many jurisdictions. Higher utility rates result in higher, more attractive cost savings from energy conservation.

To realize the benefits outlined in this report, the measures identified must be implemented. We have recommended a next step for each measure. Depending on the size, complexity, and volume of projects, you may need to prepare engineering designs and/or specifications, develop bid documents for competitive quotes, manage construction review and/or contract administration, commission systems, verify installation as intended, train operators on system changes, measure performance improvement, and analyze/prepare/administer incentive applications and associated reporting. WSP can provide the expertise and services that will lead to successful implementation of energy conservation measures.

2 INTRODUCTION

2.1 AUTHORIZATION

This report was prepared at the request of Steve Knoke, Director, Parks and Recreation Services at the Township of Esquimalt, in accordance with our proposal dated February 28, 2025.

2.2 BACKGROUND

Esquimalt Council has made climate action a strategic priority, declared a climate emergency, and set ambitious targets to reduce corporate greenhouse gas emissions (GHGs) by 45% from 2010 levels by 2030, and to becoming a 100% renewable energy community by 2050. Recently, Council resolved to complete a **GHG Reduction Building Feasibility Study** that would meet Federation of Canadian Municipalities (FCM) goals to identify a sequence of GHG reduction measures to reduce GHG emissions for community buildings by at least 50% within 10 years and by at least 80% (i.e. near net-zero GHG emissions) within 20 years from 2023 (the base year), while managing capital costs and reducing operating costs.

The completion of the Retrofit Feasibility Study would ultimately enable the municipality to integrate reductions in GHG emissions and energy use into longer-term asset management plans for managing the municipal buildings and attain future FCM funding to complete innovative capital projects.

The Township of Esquimalt contracted WSP to conduct Building Retrofit Studies on a portfolio of 5 buildings, with the primary focus on the two largest energy consumers and GHGs emitters.

- **Esquimalt Recreation Centre** (527 Fraser Street): Built in 1973. Gross floor area = 4828. Heated with gas. A community recreation facility with an aquatics centre, weight room, gymnasium, and multi-purpose spaces.
- **Archie Browning Sports Centre** (1151 Esquimalt Road): Built in 1960. Gross floor area = 6050 m^2. Heated with gas. This facility includes an ice arena, a six-sheet curling rink, lounge areas, and Esquimalt Parks and Recreation administrative offices.
- **Municipal Hall** (1229 Esquimalt Road): Built in 2002. Gross floor area = 935 m^2.Heated with gas and electric heat pump. The Hall, a three-storey building includes a council chamber, administrative offices, and satellite police offices.
- **Public Works** building (601 Canteen Road) Built in 1996. Gross floor area = 1150 square metres. Heated with gas. Home to Esquimalt's public works staff and the municipal fleet, including administration offices, mechanics shop, and stores.
- **Parks Nursery** building (1100 Craigflower Road) Built in 1979. Gross floor area = 223 m^2. Heated with gas. Home to Esquimalt's parks staff, including administrative offices, meeting /lunchroom and storage.

This report focuses on the **Parks Nursery building, 1100 Craigflower Road**.

2.3 OPINION OF COSTS

The opinions of probable costs presented in this report should be considered preliminary budgets. They are intended to be sufficient for making educated investment decisions and obtaining preliminary project approval. Significant projects will typically require further investigation and design to accurately determine construction budgets and timing. Unless noted otherwise, we have assumed that all the measures identified in our report will be implemented as a single project. Actual costs may be higher if projects are implemented individually. Costs do not include HST.

For each option where an incentive may be available, we have included an estimate of the potential eligible incentive value, less the anticipated cost of incentive administration. You would need to apply for incentives before proceeding with any work. Incentive programs periodically change. The values presented are based on the program in effect at the time of our investigation. The incentives considered are described below.

2.4 PROJECT SAVINGS

Savings were developed using tabulated data, energy handbooks, the ASHRAE Handbook, weather data, WSP's previous project experience, supplier data sheets, and background information gathered during the site visits, as well as mechanical, electrical, and architectural plans provided by the clients. Equipment operation was based on schedules and control sequences provided by the client during the site visit.

Savings were calculated using the latest rates provided by the energy suppliers.

2.5 UTILITY RATE

The utility rates used throughout this project to assess the savings from implementing energy conservation and decarbonization measures were the current rates published by the supplier. The rates used are summarized in the table below.

Table 2-1 Summary Utility Savings Rates

Electricity	BC Hydro: General Consumption rate = $0.1363 /kWh, No Demand
Natural Gas	FORTIS BC: Small Commercial Rate Total rate (Supply, Delivery, Storage & transport) = $8.80/GJ

2.6 INCENTIVES

The Federation of Canadian Municipalities (FCM) Community Buildings Retrofit (CBR) initiative helps to optimize the energy performance and reduce greenhouse gas (GHG) emissions of community buildings owned by municipalities and not-for-profit organizations. The CBR initiative is administered through FCM's Green Municipal Fund (GMF).

FCM's Community Buildings Retrofit initiative is a $167 million initiative that was made possible through a federal government contribution of $950 million in its 2019 budget. Applicants can stack CBR funding with funding from other programs, including programs available through provincial and territorial governments.

Grants for GHG reduction pathway feasibility studies help to integrate energy and GHG reductions into longer- term plans for managing community buildings. These studies will enable municipalities to identify a sequence of GHG reduction measures—the "GHG reduction pathway"—that will help to reduce GHG emissions for community buildings by at least 50% within 10 years and by at least 80% (i.e. near net-zero GHG emissions) within 20 years while managing capital costs and reducing operating costs. For a full list of eligibility requirements for the CBR initiative and GHG reduction pathway feasibility studies, see the application guide.

2.7 EMISSION ENERGY & CONVERSIONS FACTORS

The emission energy factors and conversion factors used in this report comes from NRCan and are summarized below:

Table 2-2 Emission Energy Factors and Conversions Factors

ENERGY	EMISSION FACTOR (TCO2/EKWH)	EMISSION FACTOR (TCO2E/GWH)	CONVERSION FACTOR
Electricity	0.000014	14.0	
Natural Gas	0.000185995	185.995	0.05167 tCO2/GJ

Updated projections for the future emissions factors for electricity were published in December 2025. The projected factors for British Columbia are listed below.

Table 2-3 Projected Emission Energy Factors for Electricity

YEAR	REGION	EMISSION FACTOR (TCO2E/GWH)*
2025	British Columbia	5.8
2026	British Columbia	7.2
2027	British Columbia	7.7
2028	British Columbia	8.2
2029	British Columbia	8.5
2030	British Columbia	5.7
2031	British Columbia	5.8
2032	British Columbia	5.4
2033	British Columbia	6.5
2034	British Columbia	7.4
2035	British Columbia	2.2

** Excluding Biomass and RNG CO2 emissions*

See ECCC Data Catalogue

3 BUILDING DESCRIPTION

GENERAL DESCRIPTION

Esquimalt Parks Nursery building is a two-storey facility building. There is a workshop on the ground floor, with office spaces on the second floor. The gross floor area is about 223 m², and the property was constructed circa 1979. The site also includes a half-pipe greenhouse which is being used as a storage/workshop, as well as another small greenhouse and garages that are used for storage. The greenhouses are heated but the garages are not.

Table 3-1 General description of the Parks Nursery Building

Name and Address	Parks Nursery Building - 1100 Craigflower Road, Esquimalt, BC V9A 2Y1
Gross Floor Area	223 m^2
Year Constructed	1979
Number of Levels	Two stories
Cladding	The exterior walls are finished with face-sealed stucco cladding, with exterior wood trim.
Parking	Above-ground parking is available surrounding the facility.
Current Occupancy	Normally 1-2 employees, other staff are in and out. An additional 8 auxiliaries in peak season.
Building Usage	Offices, workshops, storage, greenhouse and electric vehicle charging (new in 2025)

Figure 3-1. Aerial view of Parks Nursery

GENERAL SCHEDULES

The schedules considered for the Parks Nursery are below.

Table 3-2 Summary of Schedules

	ON	OFF	DAYS/WK	WK/YR
Occupancy - Week days	7:00	16:00	5	52
Lighting	7:00	16:00	5	52

3.1 BUILDING ENVELOPE

The facilities building above grade structure is wood framed. The ground and second floor structures consist of wood sheathing supported on wood joists and wood-framed walls. The structure has concrete footings and slab-on-grade.

The exterior walls are finished with face-sealed stucco cladding, with exterior wood trim. Windows are generally single glazed in aluminum frames. Some windows have been upgraded to double-glazed windows in vinyl frames. There is one flat roof level, covered with modified bitumen membranes installed over insulation.

3.2 ELECTRICAL INFRASTRUCTURE

The main electrical distribution consists of a simple wall-mounted electrical panel, rated at 100A, 120/208V.

Electricity is supplied to the site via an above ground service attached to a new wood electrical pole located near the entrance gate. The service splits to serve the facilities building and the various outbuildings.

The facility building contains a simple wall-mounted electrical panel, containing a main breaker rated at 100A, 120/208V.

The greenhouse has a small secondary electrical panel that serves simple plug loads, light fixtures and ventilation fans.

Where seen, the distribution wiring in the facility building is copper in BX armored cable.

Four electric vehicle charging stations were installed outside the outbuilding garage in 2025.

3.3 HVAC SYSTEMS

The site audit found that the ground floor and second floor each have a simple gas-fired forced air furnace with exposed ductwork that distributes heat to the occupied spaces. The furnaces are manufactured by Frigidaire (model: FG6RA 096C) and supply a rated heating capacity input of up to 96,000 btu/hr. According to the serial numbers, the furnaces were installed circa 2005.

It was reported that the second-floor furnace was replaced with a heat pump in **September 2025**.

In the clothing storage room on the ground floor there is a ceiling hung electric fan heater.

The building is not equipped with cooling or specific ventilation. A simple wall-mounted electric ventilation fan is located in the ground floor locker room. A passive air vent through the bathroom wall allows fresh air into the bathroom for the gas furnaces.

The storage area (former greenhouse) has two natural gas-fired ceiling-hung unit heaters manufactured by Modine (rated at 75,000 btu/hr each). These unit heaters distribute heat via a duct sock down the middle of the greenhouse that is equipped with a simple fan. There are two additional ventilation fans at one end and two louvers at the other end to help promote ventilation. It is reported that only one is working and that the heat is only turned on when the space is in use.

The small greenhouse has a natural gas-fired unit heater and a small exhaust fan. It is reported that it is not used in winter.

In December 2025, it was discovered that the natural gas piping was leaking. When this occurred and the exactly amount of natural gas that leaked is not known.

Figure 3-2 Office Area Furnace and Storage Room/Greenhouse Unit Heater

Figure 3-3 Greenhouse Exhaust Fan and Unit Heater

3.4 DOMESTIC HOT WATER

Domestic hot water is provided by a gas-fired heater tank located in the women's washroom on the ground floor. According to the data tag, the unit was manufactured by Rheem in 2015, has a heating capacity of 36,000 btu/hr, and a storage capacity of 151 litres (40 gallons).

Figure 3-4 Domestic Hot Water System

3.5 LIGHTING

Exterior Lighting:

A municipal metal lamp post with single fixture is located along the site entrance roadway just outside the entrance gate.

Two wall-mounted LED fixtures are installed on roof overhangs of the facility building to help illuminate the parking area. An LED wall-mounted fixture is also located above the main entrance door.

Interior Lighting:

Ceiling-mounted fluorescent fixtures, each with two-tube 4ft long T8 lamps, illuminate the ground floor and second floor.

Outbuildings are also equipped with simple light fixtures with simple screw-in lamps.

3.6 PLUG LOADS

The main building has typical office equipment as well as small kitchen appliances and a laundry. The workshop and garages have small tools and equipment for servicing.

3.7 RENEWABLE ENERGY

Four electric vehicle charging stations were installed outside the outbuilding garage in 2025.

New PV panels were installed on the roof in late November 2025.

4 EXISTING ENERGY PERFORMANCE

4.1 EXISTING ENERGY PERFORMANCE AND GHG EMISSIONS

4.1.1 ANNUAL UTILITY USAGE AND COSTS

The Parks Nursery is supplied with energy and water from these sources:

- Electricity from BC Hydro
- Natural gas from Fortis BC
- Water from the City of Victoria

Since water is mainly used for watering plants, it is not in scope for this site.

The utility usage and costs are summarized below for 2023 (calendarized data). Unlike other facilities, electricity is invoiced bi-monthly. Also, there have been issues with natural gas. The natural gas meter was not read but estimated for many months. Once the meter was read, there was a large increase in usage. A natural gas leak was discovered in December 2025 which is likely the cause of the increase.

Table 4-1 Baseline Data 2023

Utility	Consumption		Equivalent Consumption		% of total energy	Rate		Cost	Energy Use Intensity (ekWh/ft²)
Electricity	29,868	kWh	29,868	kWh	50%	0.1363	$/kWh	$4,073	12.45
Natural Gas	107	GJ	29,722	ekWh	50%	8.80	$/GJ	$942	12.39
		Total	**59,591**	**ekWh**	**100%**			**$5,014**	**24.83**

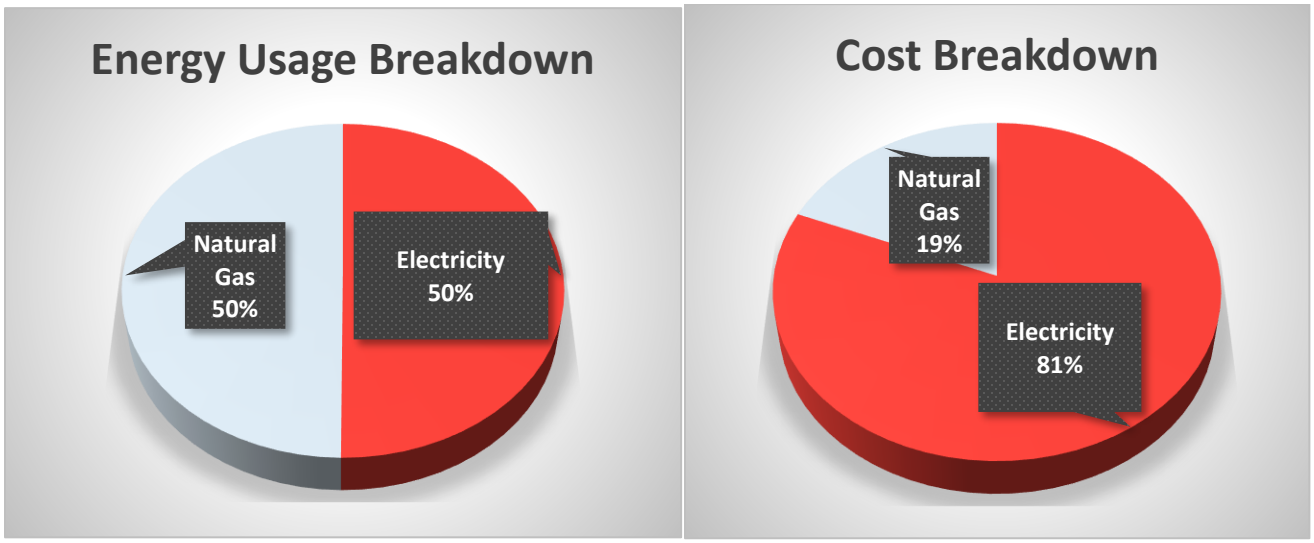

Figure 4-1 Utility Cost and Energy Usage Breakdown

4.1.2 ANNUAL GREENHOUSE GAS EMISSIONS

The annual greenhouse gas (GHG) emissions for the Parks Nursery during the baseline period are summarized below. Most of the emissions come from natural gas consumption. The overall GHG emissions are very low.

Table 4-2 4-3 GHG Emissions Data (May 2024 – April 2025)

Utility	Consumption		GHG emissions (tons eCO2)	% of total GHG emissions	GHG emissions Intensity (kg CO_2e/ft^2)
Electricity	29,868	kWh	0.42	7%	0.17
Natural Gas	107	GJ	5.53	93%	2.30
Total			**5.95**		**2.48**

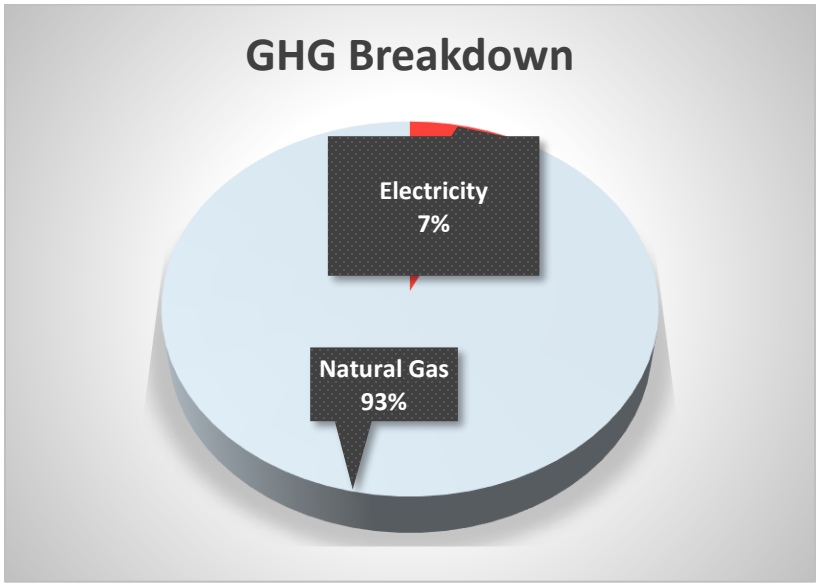

Figure 4-2 GHG Emissions Breakdown

4.1.3 ELECTRICITY

Electricity consumption at the Parks Nursery was assessed starting from December 2022, the baseline is 2023. The usage clearly shows a high baseload but also electric heating. This is expected as the building has some electric heating. No interval data was available for this site. Electricity is invoiced bi-monthly.

The Parks Nursery consumed around 30,000 kWh of electricity in the baseline, at a cost of $4,000. This site is not charged for demand.

The electricity consumption from April 2023 correlates very well with heating degree days with a balance point of 12°C. The electricity consumption does not correlate with cooling degree days, which is expected as there is no cooling on site.

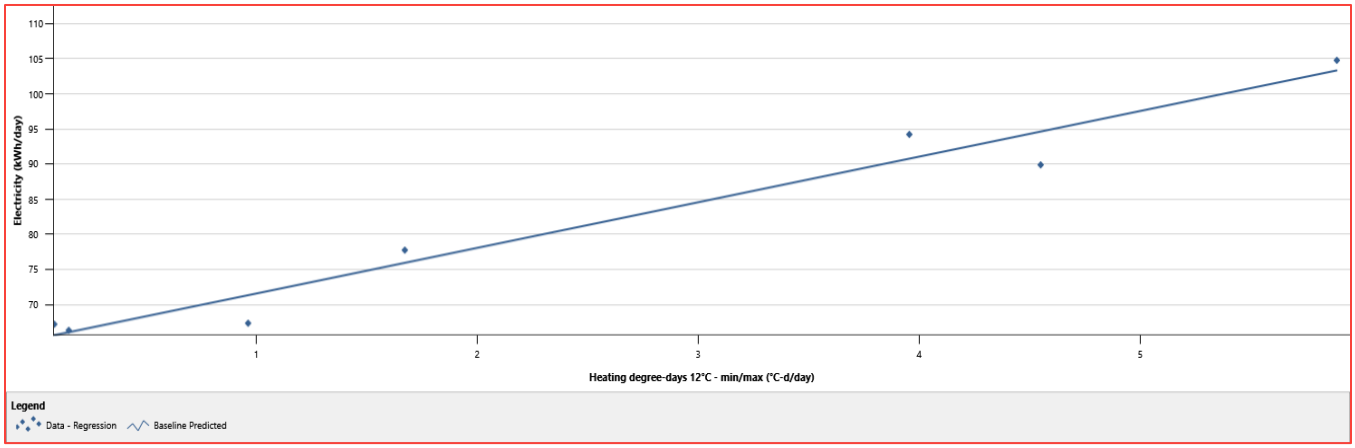

Figure 4-3 Electricity Consumption vs Heating Degree Days

The regression indicates that the majority of the consumption is baseload but with a significant amount of electric heating.

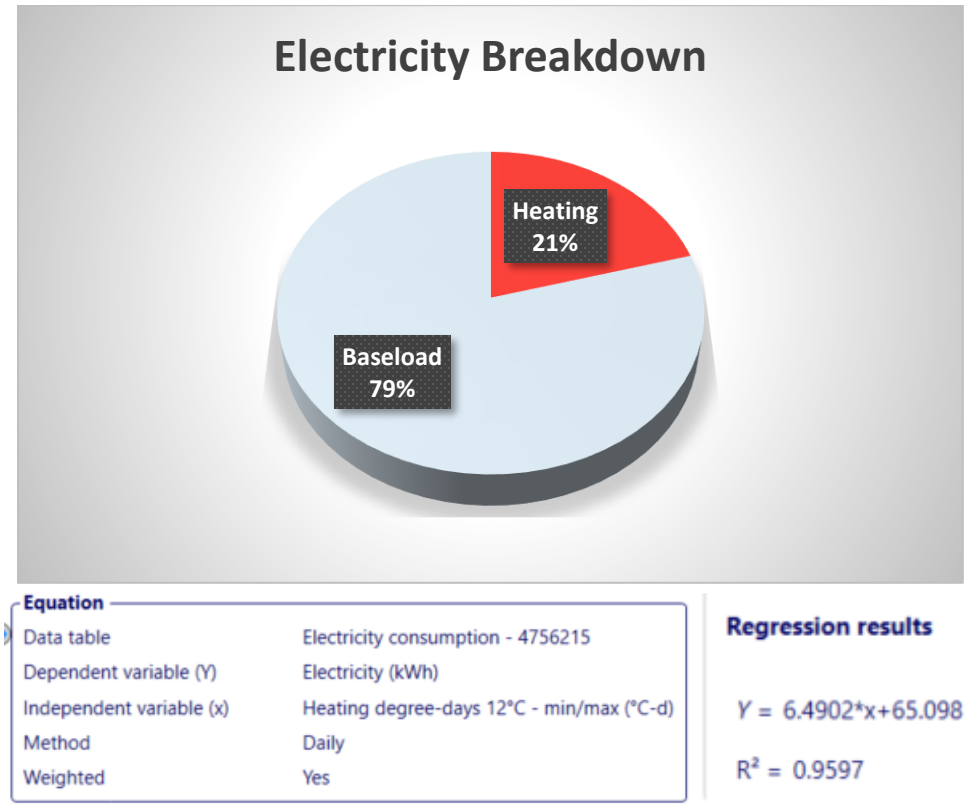

Figure 4-4 Electricity Regression Breakdown

4.1.4 NATURAL GAS

Natural gas consumption at the Parks Nursery was assessed starting from December 2022. A baseline of 2023 was selected as this appears to be prior to the natural gas leak, discovered in December 2025. The Parks Nursery consumed only 107 GJ of natural gas at a cost of $950.

The natural gas usage in 2023 did not correlate with heating degree days, which is surprising since it is used for heating. The invoice data consists of many estimated readings which is likely the issue.

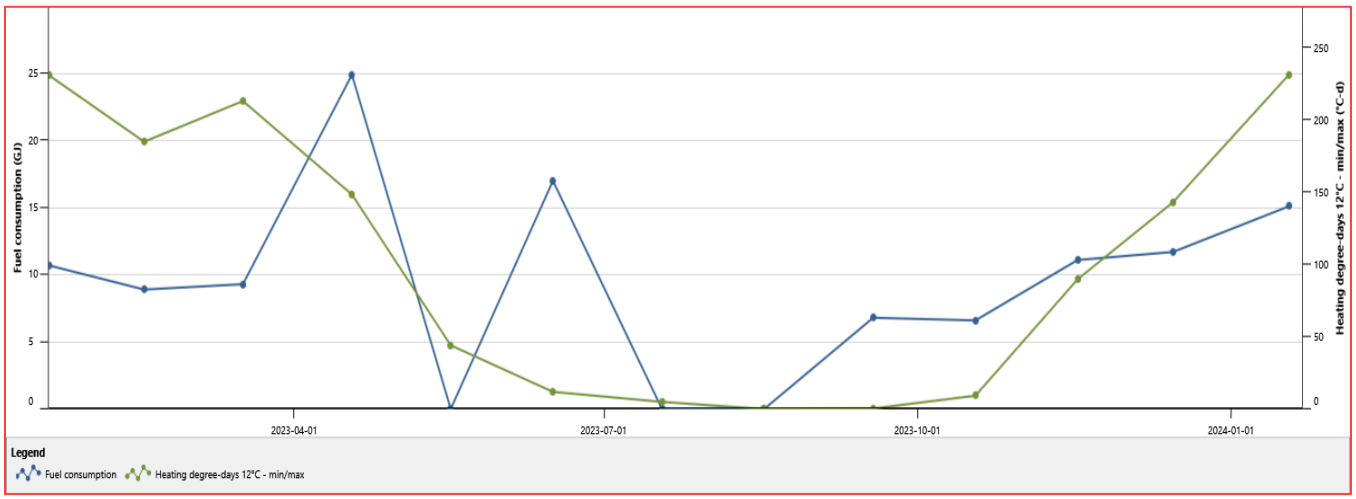

Figure 4-5 Natural Gas Consumption vs HDD

The natural gas meter was not read but estimated for many months. Once the meter was read, there was a significant back charge or true-up. It was also reported in December 2025 that a natural gas line in the greenhouse was leaking. This likely accounts for the increase in natural gas in 2024 and onwards.

4.2 ENERGY PERFORMANCE BENCHMARKING

For context, we have compared the building's energy use intensity (EUI) with the 2019 Survey of Commercial and Institutional Energy Use for office buildings in British Columbia of 24 ekWh/ft^2. The EUI of the Parks Nursery is comparable to this average which indicates that the energy usage of this site is not out of line.

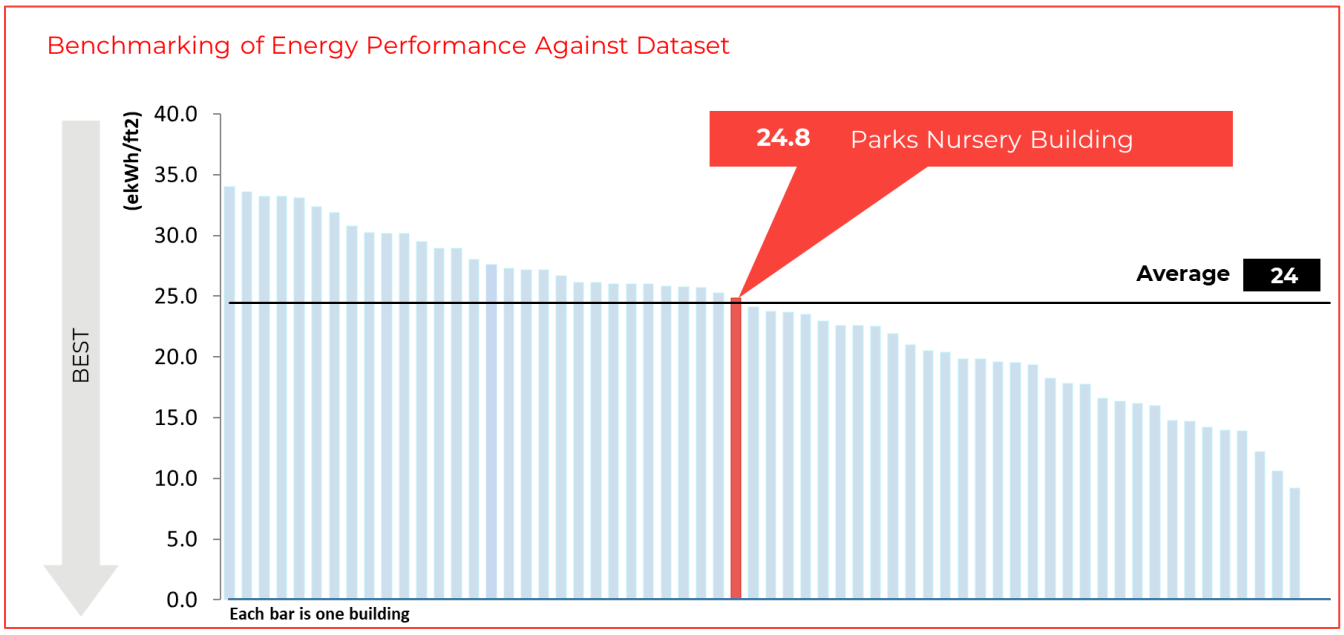

Figure 4-6 Benchmark of Office Buildings

4.3 END-USE-BREAKDOWN

The following graph shows the estimated energy end-use breakdown for the Parks Nursery.

Table 4-4 End-use Breakdown

Section	Energy (GJ)	%
Space heating	85	39.9%
Lights	77	36.2%
Hot water	24	11.3%
Electrical equipment	17	8.0%
Mechanical equipment	10	4.7%
Total	213	

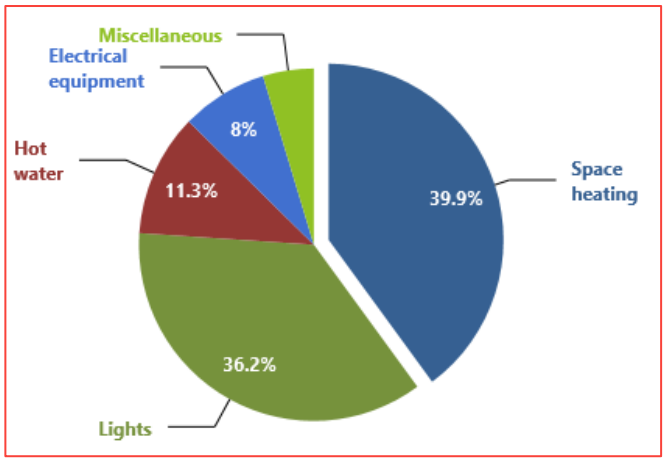

Figure 4-7 End-use Breakdown Graph

5 KEY FINDINGS

The key findings of the Building Retrofit Study are captured below. The findings from our investigation have been divided into the following categories:

1. Energy Conservation Measures (ECMs)
   - Operational energy reduction strategies that do not require extensive equipment replacement but instead optimize existing systems for efficient operation.
2. Capital Measures
   - Retrofit opportunities that require a capital investment.
3. GHG Reduction Strategies
   - Strategies that will reduce carbon or GHG emissions.

6 ENERGY CONSERVATION MEASURES

6.1 LED LIGHTING RETROFIT

6.1.1 OPPORTUNITY

The interior lighting consists of ceiling-mounted fluorescent fixtures, each with two-tube 4 ft long T8 lamps for both the ground floor and second floor of the main building.

Outbuildings are also equipped with simple light fixtures with simple screw-in lamps.

The exterior lighting is all new the LED fixtures and wiring.

6.1.2 SCOPE OF MEASURE

The interior lighting is outdated, inefficient T8 fluorescent lamps. Many of the lamps are dim which commonly occurs as the lamps age, and some of the diffuser covers are missing.

It is recommended that these fixtures be replaced with LEDs. This applies to approximately 20 fixtures in the building.

Table 6-1 LED Lighting Retrofit

ENERGY SAVINGS	% ENERGY SAVINGS	COST SAVINGS	GHG SAVINGS	% GHG SAVINGS	OPINION OF COST	SIMPLE PAYBACK
3,600 ekWh/yr	6%	$490 /yr	0.05 tCO2e	1%	$5,000	10

6.2 INSTALL PROGRAMMABLE THERMOSTATS

6.2.1 OPPORTUNITY

Currently, there is no BAS or remote control for the HVAC equipment in the main building. Since the building is typically only occupied during business hours, it would be efficient to have a night setback of the temperature settings.

6.2.2 SCOPE OF MEASURE

It is recommended to install programable thermostats for the main building heating/cooling systems. This would maintain the usual setpoints during weekdays when the space is occupied but reduce to lower heating/higher cooling setpoints during unoccupied hours.

Table 6-2 Install Programable Thermostats

ENERGY SAVINGS	% ENERGY SAVINGS	COST SAVINGS	GHG SAVINGS	% GHG SAVINGS	OPINION OF COST	SIMPLE PAYBACK
4,900 ekWh/yr	8%	$670 /yr	0.07 tCO2e	1%	$3,000	4.5

7 CAPITAL MEASURES

The following are retrofit opportunities that require major capital investment.

7.1 BUILDING ENVELOPE – WINDOW REPLACEMENT

7.1.1 OPPORTUNITY

Windows generally have fixed single-glazed units and operable horizontal sliders, all in prefinished aluminum frames. Two windows on the north elevation are newer double-glazed units with horizontal sliders, set in vinyl frames, installed in 2022 and 2025 respectively.

The remaining windows are generally original to construction (around 46 years old) with no thermal breaks at frames. They offer poor thermal performance and water penetration resistance.

While the existing original single-glazed windows are functional, upgrading with new assemblies will help improve thermal performance, occupant comfort, and moisture resistance while reducing the risk of further decay and damage. As such, we have budgeted for the general replacement of the remaining single-glazed windows. We have assumed similar double-glazed vinyl framed systems will be installed.

7.1.2 SCOPE OF MEASURE

While the existing original single-glazed windows are functional, upgrading with new assemblies will improve thermal performance, occupant comfort, and moisture resistance while reducing the risk of further decay and damage.

We recommend the general replacement of the remaining single-glazed windows with similar double-glazed vinyl framed systems.

Table 7-1 Window Replacement

ENERGY SAVINGS	% ENERGY SAVINGS	COST SAVINGS	GHG SAVINGS	% GHG SAVINGS	OPINION OF COST	SIMPLE PAYBACK
2,300 ekWh/yr	4%	$310 /yr	0.03 tCO2e	1%	$20,000	NA

7.2 BUILDING ENVELOPE – ROOF REPLACEMENT

7.2.1 OPPORTUNITY

The roof is covered with a conventional two-ply modified bitumen membrane. Upturns at the roof perimeters are covered with prefinished metal flashing. Roof drainage includes internal area drains connected to exterior wall-mounted downspouts. Penetrations in the roof include metal vents for the bathroom fans, exhaust flues, and unfinished sanitary vent stacks.

The flat roofing appears to be in reasonable condition; however, we observed degranulation of the cap sheet, localized blistering, and evidence of previous water ponding. The roof access hatch appears heavily corroded.

The age of the roof membrane could not be confirmed. Given that the building was constructed around 1979, the existing roofing is likely a second-generation system, estimated to be around 15 to 20 years old, which generally agrees with its current visual condition. The assembly is approaching the end of its expected service life. Roof assemblies typically have a service life of approximately 20 to 30 years.

7.2.2 SCOPE OF MEASURE

We recommend roof replacement. This includes removal of the existing roof membrane, localized sheathing repairs, fascia board replacement, installation of a new access hatch, and installation of a new sloped membrane to address existing ponding issues. This project assumes that the new roofing assembly can be applied over the existing sheathing. Depending on the type and condition of the sheathing when exposed, additional repair or replacement costs may be required.

The proposed new roofing assembly includes increased insulation thickness and substitution of insulation material, specifically 5" of polyisocyanurate insulation. It should be noted that adjustments to the parapet heights and cladding may be required to facilitate the increased insulation depth.

Higher-end performance Flat Roofing Assembly:
- 2-Ply modified bitumen membrane
- Fibreboard (7/16")
- Polyisocyanurate Insulation (5")
- Base sheet
- Wood sheathing
- 2x4" wood truss with fibreglass insulation, existing

Table 7-2 Roof Replacement

ENERGY SAVINGS	% ENERGY SAVINGS	COST SAVINGS	GHG SAVINGS	% GHG SAVINGS	OPINION OF COST	SIMPLE PAYBACK
700 ekWh/yr	1%	$100 /yr	0.01 tCO2e	0%	$63,500	NA

8 GHG REDUCTION STRATEGIES

Esquimalt Council has made climate action a strategic priority and set ambitious targets to reduce corporate greenhouse gas emissions (GHGs).

As part of this report, it is required to develop and evaluate the following six GHG reduction pathway scenarios:

1) Short-term retrofit (5 years) – Achieving a 45% GHG reduction from **2010** levels.
2) Medium-term retrofit (10 years) – Achieving a 50% GHG reduction from **2023** levels.
3) Long-term retrofit (20 years) – Achieving an 80% GHG reduction from **2023** levels (near net-zero).
4) Short-term deep retrofit (5 years) – Achieving a 50% GHG reduction from **2023** levels.
5) Maximum site potential – Identifying the greatest possible GHG reductions, regardless of cost.
6) Optimized outcome – Balanced approach of aggressive GHG reduction with asset management objectives.

From the **2010** Energy Audit report, the GHG emissions were **5.1 tCO2e**. From the utility data, the **2023** GHG emissions were **5.95 tCO2e**.

Given the very low emissions in those baseline years and the fact that the vast majority of the GHG emissions (93%) come from natural gas consuming equipment, substantial reductions can only be achieved by measures that reduce or eliminate this equipment.

Table 8-1 List of Natural Gas Consuming Assets

SYSTEM ID	DESCRIPTION
Furnace	Natural gas fired furnace serving the 1st floor, Frigidaire (model: FG6RA 096C), 96,000 btu/hr
Unit Heaters	Two Modine natural gas unit heaters, rated at 75,000 btu/hr each One natural gas unit heater, rating unknown
DHW	Natural gas fired DHW tank heater, from 2015, 36,000 btu/hr

The following are potential opportunities to reduce GHG or carbon emissions while improving energy efficiency.

8.1 REPLACE 2ND FLOOR FURNACE WITH A HEAT PUMP

It should be noted that the furnace for the second floor was replaced with a heat pump in **September 2025**. The new unit is capable of providing cooling as well as heating. This is expected to achieve the following energy and GHG emissions reductions from current levels.

Table 8-2 2nd Floor Furnace Replacement with a Heat Pump

ELECTRICITY SAVINGS	NATURAL GAS SAVINGS	ENERGY SAVINGS	% ENERGY SAVINGS	COST SAVINGS	GHG REDUCTION	% GHG SAVINGS
-9,800 kWh	49.7 GJ	4,000 ekWh/yr	7%	-$900 /yr	2.44 tCO2e	40%

8.2 REPLACE 1ST FLOOR FURNACE WITH A HEAT PUMP

8.2.1 OPPORTUNITY

The first floor is heated by a simple gas-fired forced air furnace, make: Frigidaire, model: FG6RA 096C, input 96,000 btu/hr.

8.2.2 SCOPE OF MEASURE

As this unit is at the end of its useful life, it is recommended to replace the furnace with a heat pump, as was done for the second floor. It is also recommended that the new unit include a programable thermostat. This will save energy and reduce GHG emissions. It is reported that this replacement is scheduled to occur **in 2026**.

Table 8-3 Replace 1st Floor Furnace with a Heat Pump

ENERGY SAVINGS	% ENERGY SAVINGS	COST SAVINGS	GHG SAVINGS	% GHG SAVINGS	OPINION OF COST	SIMPLE PAYBACK
2,500 ekWh/yr	4%	-$530 /yr	1.47 tCO2e	24%	$10,380	NA

8.3 REPLACE NATURAL GAS DHW HEATER WITH ELECTRIC

8.3.1 OPPORTUNITY

Currently, DHW is supplied from a natural gas fired tank heater.

8.3.2 SCOPE OF MEASURE

Replacing this DHW heater with a heat pump or an electric DHW tank heater will reduce GHG emission.

Table 8-4 Replace Natural Gas DHW Heater with Electric

ENERGY SAVINGS	% ENERGY SAVINGS	COST SAVINGS	GHG SAVINGS	% GHG SAVINGS	OPINION OF COST	SIMPLE PAYBACK
1,100 ekWh/yr	2%	-$520 /yr	1.12 tCO2e	18%	$5,000	NA

8.4 REPLACE NATURAL GAS UNIT HEATERS WITH ELECTRIC

8.4.1 OPPORTUNITY

The greenhouses are heated by natural gas fired unit heaters. These are controlled by local thermostats. It is reported that these are rarely used.

8.4.2 SCOPE OF MEASURE

The remaining GHG emission reductions are possible if these unit heaters are replaced with electric heaters. New unit heaters should include programmable thermostats.

Table 8-5 Replace Natural Gas Unit Heaters with Electric

ENERGY SAVINGS	% ENERGY SAVINGS	COST SAVINGS	GHG SAVINGS	% GHG SAVINGS	OPINION OF COST	SIMPLE PAYBACK
240 ekWh/yr	0.4%	-$80 /yr	0.19 tCO2e	3%	$8,000	NA

8.5 SUMMARY OF GHG REDUCTION MEASURES

In 2025, the following measures were implemented and will affect or reduce GHG emissions from the 2010 or 2023 levels
- installing EV chargers,
- replacing the second-floor furnace with a heat pump
- fitting new PV panels on the roof

The EV chargers are related to vehicles rather than the building, so these are not included in the GHG reduction measures. The PV panels are expected to feed the EV chargers, so these are also not included in the GHG reduction measures.

The 2nd floor furnace replacement with a heat pump is expected to reduce GHGs substantially, **approximately 41%.**

In 2026, the first-floor furnace is scheduled to be replaced with a heat pump. This is expected to continue to reduce GHG emissions for a **total reduction of 66%.**

Implementing the suggested ECMs - LED Lighting and Programmable Thermostats - will also reduce emissions, projected for 2026. Further to the building condition assessment, more measures are expected to be taken in the next few years including window replacements in 2026, and a roof replacement in 2030, listed as Capital measures. These are only expected to reduce emissions by minor amounts, to a net **reduction of 68%.**

Implementation of all these measures will achieve substantial reductions, over 68%, in 5 years. Achieving 80% reduction in emissions will require further replacement of natural gas equipment. Replacement of the DHW heater with a heat pump water heater is expected to continue to reduce GHG emissions for a **total reduction of 87%.** The replacement of the greenhouse unit heaters would also contribute to GHG emissions reductions, but the effect is smaller, for a **total reduction of 91%.**

The GHG Reductions are illustrated below. Note that the GHG reductions in Figure below are calculated based on GHG emissions factors of the current year.

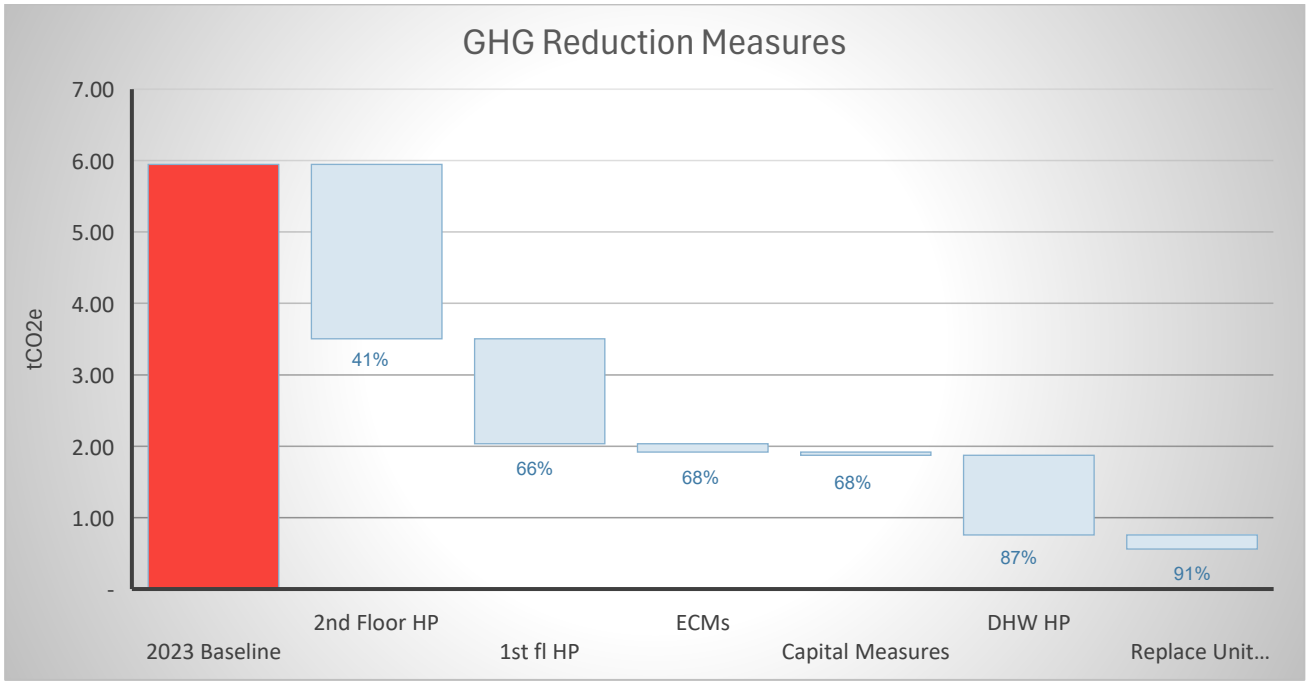

Figure 8-1 GHG Reduction Waterfall

Implementation timelines are listed in Section 9.

8.6 DECARBONIZATION PATHWAYS

Pathways

Since the GHG emissions baselines (2010 and 2023) are very low, there is little benefit in reviewing the 6 individual scenarios. The following pathway to low GHG emissions is outlined below

- ***Business-as-Usual Pathway.*** This is a reference case reflecting the planned (or already completed) energy-related capital renewal projects planned for this building.
- ***GHG Reduction Pathway.*** This Pathway features a combination of the BAU as well as GHG reduction measures. The GHG emissions reductions in this pathway are achieved over the life-cycle performance of 20 years.

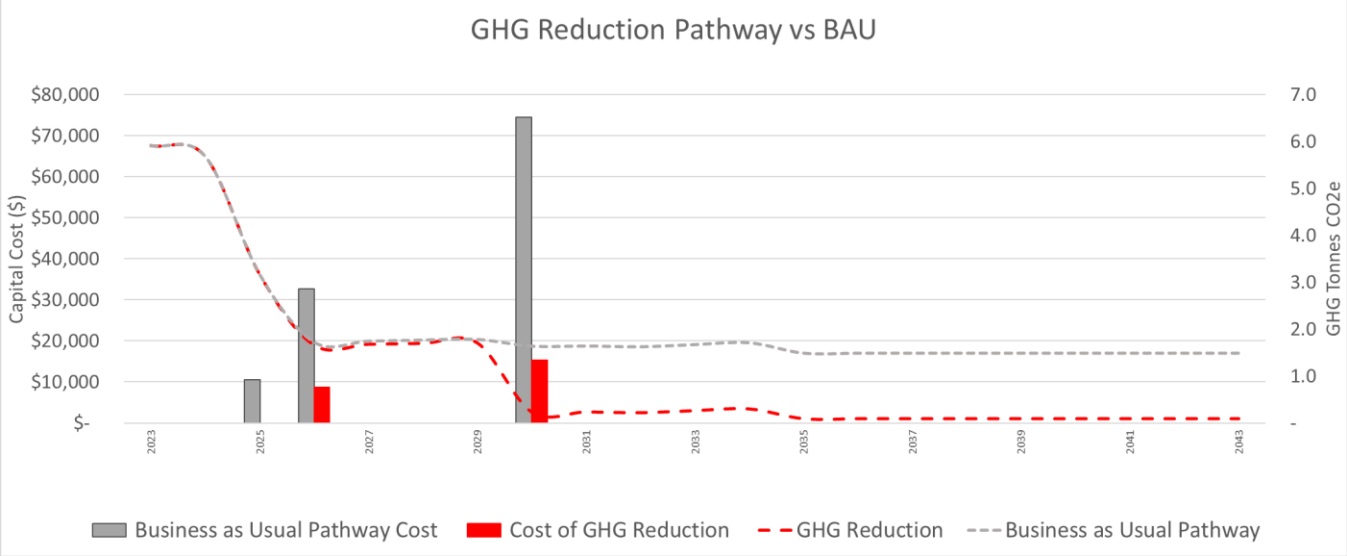

Figure 8-2 GHG Reduction Pathway vs BAU

It is important to highlight that the Township of Esquimalt has already replaced the second-floor furnace with a heat pump and is furthermore planning to replace the first-floor furnace in 2026. As such, the Township has recommended that the replacement of the first-floor furnace be incorporated into the Business-as-Usual (BAU) pathway, rather than treated as a separate GHG reduction initiative.

As a result, the bulk of GHG emission reductions attributed to these recommended measures are now considered part of the BAU scenario. By including these significant upgrades within the BAU pathway, the anticipated emission reductions are effectively realized as part of standard operational improvements, rather than as extraordinary interventions. This approach leads to a notable enhancement in the financial outlook and Life-Cycle Cost Analysis (LCCA) results for the BAU pathway when compared to the dedicated GHG reduction pathway. The BAU scenario, therefore, reflects both the proactive capital renewal projects and the associated emission reductions, demonstrating the Town's commitment to sustainability through its ongoing infrastructure investments.

This integration not only streamlines the assessment process by consolidating key emission-reducing measures under the BAU umbrella but also provides a more accurate and favourable representation of the Township's progress towards its environmental targets. Ultimately, it underscores the efficiency of capital renewal planning in achieving substantial GHG reductions and improved financial performance over the projected study period.

Incremental Life-Cycle Cost (ILCC) is used as the financial metric in this analysis because it captures the greater financial impact over the design option's lifespan as opposed to capital cost or simple payback analysis alone.

Key ILCC parameters include:

- First/capital costs of measures
- 20-year study period, with construction starting in 2026;
- Utility costs, with appropriate escalation rates;
- System service life estimates and associated replacement over the study period
- Standard inflation rates and discount rates

Key assumptions for the LCC analysis include:

- Residual costs of equipment (i.e., equipment service lives longer and shorter than 20 years will result in a linearly-depreciated residual value at the end of the study period);
- The 20-year study starts in 2025 and lasts until 2044 (inclusive). All values in 2025 dollars will be escalated using the rates summarized in the table below.

Table 8-6 LCC Assumptions

Rate Name	Value (%)
Energy Inflation (ENER)	2.00%
Long Term Construction Costs (Capital Costs) Escalation (LTCC)	2.00%
Operations and Maintenance Escalation (O&M)	2.00%
Discount Rate (DISC)	2.00%

- An ***incremental*** LCC analysis as opposed to a ***comparative*** LCC analysis is provided. The difference is that the absolute LCC of the options is not calculated, just the differences in LCC between them; the result will be similar and just as useful for decision-making.
- As discussed above, the Pathway is compared to the life-cycle cost of taking all energy-related capital renewal items identified and executing them as a single construction project. Though this approach is not reflective of how the capital plan proposes execution of the work, it offers a fair comparison of the various programs of work compared to the baseline.

9 TIMELINE

Based on the building condition assessment and discussions with staff, the following timeline is expected for business-as-usual measures.

Table 9-1 Time for Business-as-Usual Measures

MEASURE	YEAR OF IMPLEMENTATION
2nd Floor Furnace Replacement with Heat Pump	2025
Replace 1st Floor Furnace with a Heat Pump	2026
Building Envelope – Window Replacement	2030
Building Envelope – Roof Replacement	2030

The following timeline for measures is proposed for decarbonization measures.

Table 9-2 Time for GHG Reduction Measures

MEASURE	YEAR OF IMPLEMENTATION
LED Lighting Retrofit	2026
Install Programmable Thermostat	2026
Domestic water heater replacement	2030
Unit Heater Replacement	2030

10 REJECTED MEASURES

10.1 BUILDING ENVELOPE

10.1.1 ADDING INSULATION TO WALLS

The current stucco walls are insulated with fibreglass insulation. Consideration could be given to over cladding the existing wall assembly with an exterior insulated metal panel assembly. This would require relocation of the existing windows to align with the new cladding. Completing this work would provide minimal cost savings

11 RECOMMENDATIONS

11.1 SUMMARY OF SAVINGS

Due to the interactive nature of building systems, it is difficult to determine the total savings with precision. However, we estimate that implementing the energy conservation measures (ECMs) outlined in this report would be as follows.

- You will save about 8,500 ekWh of annual energy consumption (14%);
- You will save about $1,160 in annual energy cost (23%);
- It will cost you about $8,000 (HST/GST not included) to implement the measures;
- The simple payback will be over 7 years overall;
- The building's EUI will drop to about 20.9 ekWh/ft2/year;

11.2 NEXT STEPS

This report presents measures that can reduce energy use and GHG emissions at your facility. To realize the benefits outlined in this report, the measures identified must be implemented. Our description of each measure includes our recommendation on how to proceed.

We recommend the following next steps:

1. **Review the proposed measures** listed in section 6;
2. **Decide which measures to implement** and your implementation timeline;
3. **Select your incentive program enrolment strategy**. The preferred incentive program for this property will depend on the measures you choose to implement, and the timeline for implementation.
4. **Decide how implementation will be managed** (and engage support, if desired);
5. **Implement operational measures** that are quick or low-cost. Many operational measures can be implemented soon, to quickly improve building energy performance. Plan to verify that measures are completed and that the expected benefit is achieved;
6. **Implement retrofit measures, or add them to your capital plan** if they cannot be completed in the current capital year. Develop a formal scope of work and request quotes for more detailed or costly measures. You may need to prepare engineering designs and/or specifications, develop bid documents for competitive quotes, manage construction review and/or contract administration, commission systems, verify installation as intended, train operators on system changes, and measure performance improvement;
7. **Train operators** on system changes and update building documentation; and
8. **Measure performance improvement** and verify measures are completed as planned.

WSP can provide the expertise and services that will lead to successful completion of any or all of these operational and retrofit measures.

We trust this report meets your needs and would be pleased to discuss our findings further with you at your convenience. We would also very much like to help you implement these measures and look forward to taking these next steps with you.

APPENDIX

A METHODOLOGY

APPENDIX A

METHODOLOGY

Work completed for this assessment included:

1. Preliminary System Review: We performed this review prior to visiting the site using existing mechanical, electrical, and structural drawings and report. We review past equipment maintenance, repair, and replacement details;
2. Facility Walkthrough: Our team was on site to assess the current condition of equipment and associated components;
3. Fossil-fuelled asset : We developmented an asset inventory profile including model and serial numbers, age, installation date, capacities, dimensions, photographs, etc;
4. Identification : We Identified key issues relevant to project scope related to the state of current fossil-fuelled assets;
5. Analysis: We performed various calculations to estimate both the potential of electrification and implementation costs associated with potential fuel switching measures; and
6. Reporting: We summarized our findings and the recommended next steps in this report.

APPENDIX

B MEASUREMENT AND VERIFICATION OPTIONS

APPENDIX C

MEASUREMENT AND VERIFICATION OPTIONS

For each measure presented in this report, we recommend a measurement and verification approach based on the International Performance Measurement and Verification Protocol (IPMVP): Concepts and Options for Determining Energy and Water Savings. The Protocol defines techniques for reviewing and confirming savings in various situations. The following is an excerpt from the Protocol which outlines the four primary M&V options available:

OPTION A. PARTIALLY MEASURED RETROFIT ISOLATION: Savings are determined by partial field measurement of the energy use of the system(s) to which an ECM was applied; separate from the energy use of the rest of the facility. Measurements may be either short-term or continuous. Partial measurement means that some but not all parameter(s) may be stipulated, if the total impact of possible stipulation error(s) is not significant to the resultant savings. Careful review of ECM design and installation will ensure that stipulated values fairly represent the probable actual value. Stipulations should be shown in the M&V Plan along with analysis of the significance of the error they may introduce.

OPTION B. RETROFIT ISOLATION: Savings are determined by field measurement of the energy use of the systems to which the ECM was applied; separate from the energy use of the rest of the facility. Short-term or continuous measurements are taken throughout the post-retrofit period.

OPTION C. WHOLE FACILITY: Savings are determined by measuring energy use at the whole facility level. Short-term or continuous measurements are taken throughout the post-retrofit period.

OPTION D. CALIBRATED SIMULATION: Savings are determined through simulation of the energy use of components or the whole facility. Simulation routines must be demonstrated to adequately model actual energy performance measured in the facility. This option usually requires considerable skill in calibrated simulation.

APPENDIX

C LIMITATIONS

APPENDIX

LIMITATIONS

WSP Canada Inc. is the “Consultant” referenced throughout this document.

- The scope of our work and related responsibilities related to our work are defined in our project authorization (“Conditions of Assignment”).
- Any user accepts that decisions made, or actions taken based upon interpretation of our work are the responsibility of only the parties directly involved in the decisions or actions.
- No party other than the Client shall rely on the Consultant’s work without the express written consent of the Consultant, and then only to the extent of the specific terms in that consent. Any use which a third party makes of this work, or any reliance on or decisions made based on it, are the responsibility of such third parties. Any third party user of this report specifically denies any right to any claims, whether in contract, tort and/or any other cause of action in law, against the Consultant (including Sub-Consultants, their officers, agents and employees).The work reflects the Consultant’s best judgement in light of the information reviewed by them at the time of preparation. It is not a certification of compliance with past or present regulations. Unless otherwise agreed in writing by the Consultant, it shall not be used to express or imply warranty as to the fitness of the property for a particular purpose. No portion of this report may be used as a separate entity; it is written to be read in its entirety.
- Only the specific information identified has been reviewed. No physical or destructive testing and no design calculations have been performed unless specifically recorded. Conditions existing but not recorded were not apparent given the level of study undertaken. Only conditions actually seen during examination of representative samples can be said to have been appraised and comments on the balance of the conditions are assumptions based upon extrapolation. Therefore, this work does not eliminate uncertainty regarding the potential for existing or future costs, hazards or losses in connection with a property. We can perform further investigation on items of concern if so required.
- The Consultant is not responsible for, or obligated to identify, mistakes or insufficiencies in the information obtained from the various sources, or to verify the accuracy of the information.
- No statements by the Consultant are given as or shall be interpreted as opinions for legal, environmental or health findings. The Consultant is not investigating or providing advice about pollutants, contaminants or hazardous materials.
- The Client and other users of this report expressly deny any right to any claim against the Consultant, including claims arising from personal injury related to pollutants, contaminants or hazardous materials, including but not limited to asbestos, mould, mildew or other fungus.
- Budget figures are our opinion of a probable current dollar value of the work and are provided for approximate budget purposes only. Accurate figures can only be obtained by establishing a scope of work and receiving quotes from suitable contractors.
- Time frames given for undertaking work represent our opinion of when to budget for the work. Failure of the item, or the optimum repair/replacement process, may vary from our estimate.