DISTRICT OF CENTRAL SAANICH – MUNICIPAL HALL

Project No.: 000b-1476-24
1903 Mt Newton Cross Rd, Saanichton, BC   V8M 1T2

Integrated Energy Audit Report

November 15, 2024

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1. EXECUTIVE SUMMARY

The AME group was retained by the District of Central Saanich to investigate opportunities for energy conservation, electrification, installing demand response capacity, and installing behind-the-meter power generation at four of their facilities. This report describes the AME Group's findings for their Municipal Hall; these reports have been developed under CleanBC's Integrated Energy Audit program. This report investigated nine different opportunities for energy conservation including energy efficiency measures, electrification measures, on site generation measures, and one demand response measure. The impact of these measures is summarized in the following table.

Table 1: ECM Savings Summary

No.	Description	Natural Gas Savings (GJ)	Electricity Savings (kWh)	Utility Cost Savings ($)	Emissions Savings (tCO2e)	Capital Cost ($)	Payback Period (year)
ECM-1	Convert Basement to Forced Air Heating	-	58,543	$5,725	0.7	$127,400	22.3
ECM-2	PV Array	-	52,000	$3,800	-	$215,000	25+
ECM-3	Ultra-Low Flow Hot Water Fixtures	-	5,427	$531	0.1	$37,700	25+
ECM-4	DHW CO2 Heat Pumps	-	7,753	$758	0.1	$81,900	25+
ECM-5	Wallpack Battery for Demand Response	-	-	$500	-	$150,000	25+
ECM-6	ASHP Connected to Fire Hall Garage	-	40,511	$3,962	0.5	$35,100	8.9
ECM-7	Solar Thermal Collector (DHW)	-	3,848	$376	0.0	$26,650	25+
ECM-8	FL Lighting Conversion to LED	-	8,000	575	-	$135,000	25+
ECM-9	Conversion to Distributed VRF	-	205,936	$20,139	2.3	$3,217,500	25+

It is recommended that ECM-1 is carried out to improve occupant comfort through improved ventilation. It's also recommended that ECM-6 and ECM-8 are considered for implementation to significantly reduce the amount of electricity needed to meet heating demand. If a more comprehensive retrofitting of the building is being considered, then ECM-9 would be considered as a suitable design alternative to like-for-like replacements of major mechanical equipment.

2. INTRODUCTION

The AME group was retained by the District of Central Saanich to investigate opportunities for energy conservation, electrification, installing demand response capacity, and installing behind-the-meter power generation at four of their facilities. This report describes the AME Group's findings for their Municipal Hall; these reports have been developed under CleanBC's Integrated Energy Audit program.

3. BUILDING DESCRIPTION

This section provides a description of the building as a whole, its mechanical systems and primary energy consumers, and its current on-site power generation.

3.1 General Description

The District of Central Saanich's Municipal Hall is located along Mt Newton Cross Road, and consists of three primary service zones including the Municipal Hall, Police Station, and Fire Hall. The building has approximately 22,700 square feet of conditioned service area.

3.2 Heating & Cooling System

The Municipal Hall consists of three primary zones, with one multizone rooftop unit providing ventilation air and heating to the main floor's administrative zone, one rooftop unit providing ventilation to the council chambers, and the administrative area in the basement. These spaces use perimeter electric resistance baseboard heaters as auxiliary heating. The basement does not have a dedicated mechanical ventilation system. The rooftop units serving the administrative space and council chamber have packaged air conditioning capacity and air-source heat pump. There are several small DX split condensing units that serve as cooling to IT rooms in the basement.

Figure 1: Typical Rooftop Unit (Roof)

The police station is served by rooftop units and several distributed condensing units for cooling. This space is also fitted with baseboard electric heaters.

Figure 2: Typical Condensing Unit Arrangement (Police Station)

The Fire Hall is heated through an electric resistance radiant floor system.

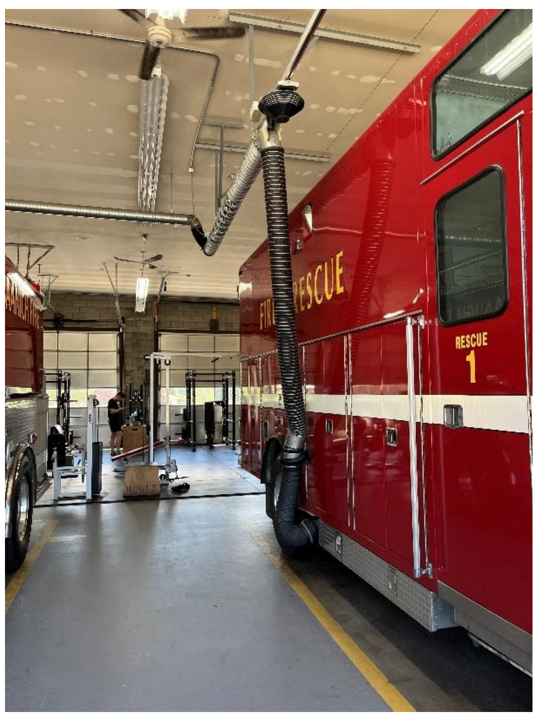

Figure 3: Fire Hall Garage

3.3 Domestic Hot Water System

The building's domestic hot water is distributed through separate electric resistance hot water tanks. Hot water is mainly used by handwash sinks in washrooms.

Figure 4: Typical Domestic Hot Water Tank

A summary of domestic hot water tanks is shown in the following table.

Table 2: DHW System Summary

Location	Heating Capacity	Storage Volume (Gal)
Basement	5,250 W (17,900 BTU/h) (0.36GPH at 100F Temp Rise)	48
Police Station	7,880 W (26,900 BTU/h) (0.54GPH at 100F Temp Rise)	76

4. UTILITY ANALYSIS

This section provides insight to the energy use in this building, with a focus on the proportion of energy use between electricity and natural gas. This is used to provide context for energy savings associated with energy conservation measures (ECMs) explored in later sections of this report.

4.1 Energy Proportion Breakdown

The building uses only electricity, making electricity the sole source of energy-related utility costs and emissions.

4.2 Load Distribution Curve

A load distribution curve of the property's electricity consumption is shown in the following graph.

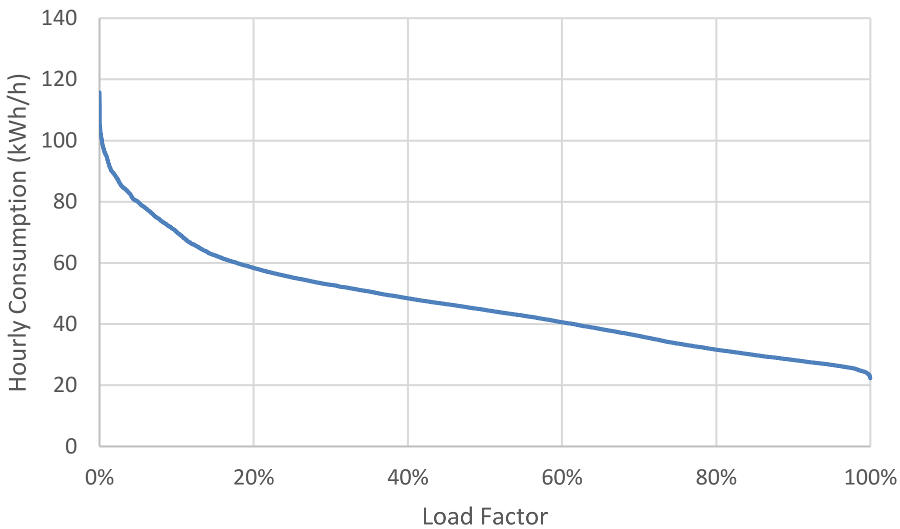

Figure 5: Electricity Load Distribution Curve (Utility Side)

This load distribution curve helps to highlight how often the property draws electrical energy per hour; key takeaways from the load distribution curve are that the building's consumption never dropped below 22kW, and that although the highest hourly power consumption from the grid was 116kW it spent less than 1% of hours drawing more than 95kW.

4.3 Energy Use Regression Curve

Using utility data from the 2023 calendar year, the AME Group was able to develop a linear regression reflecting the building's electricity use using heating-degree days as an independent variable.

The linear regression developed for the building's electricity use is shown in the following figure.

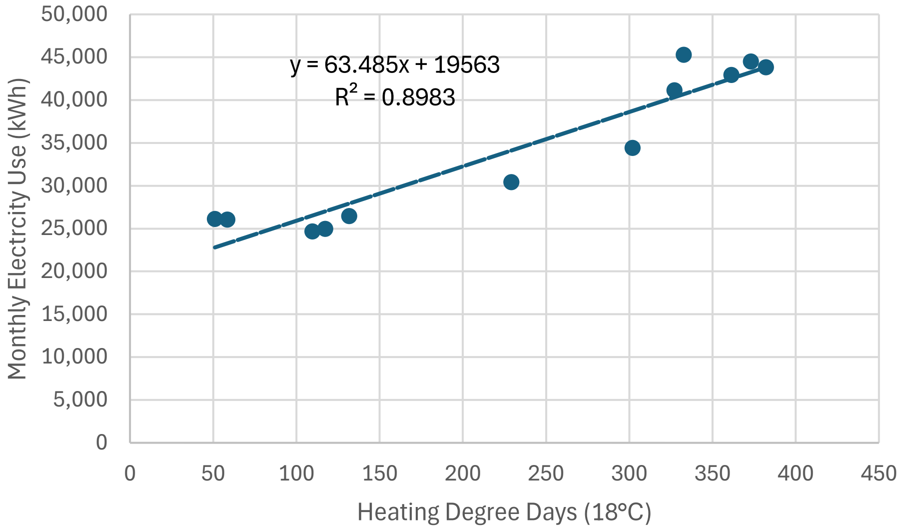

Figure 6: Electricity Linear Regression VS HDD (2023)

The linear correlation between electricity and heating degree days is considered relatively strong, as the threshold for being considered a reliably correlated regression requires an R^2 correlation factor of 0.75 or higher; as shown in the previous graph, the model's correlation factor results in 0.8983. This may be considered a relatively reliable way to predict electricity use using outdoor air temperatures and shows that electricity consumption generally increases when outdoor air temperatures decrease. This reflects the fact that the building mostly uses electric resistance baseboard heaters in the municipal hall and police station, and the fire hall uses an electric resistance radiant floor.

The building's electricity usage and utility costs are summarized in the following table.

Table 3: Electricity Consumption Summary

Description	Quantity
Consumption (2023)	410,959 kWh
Utility Costs	$40,190

5. KEY INPUTS AND ASSUMPTIONS

Several common key inputs applied to the building's ECMs are summarized in the following table.

Table 4: Summary of Key Inputs and Assumptions

Description	Quantity	Unit
Blended Cost of Electricity	0.10 (27.7)	$/kWh ($/eGJ)
Electricity Emission Factor	11.3	tCO_2e/GWh

6. ENERGY CONSERVATION MEASURES

This section describes the energy conservation measures (ECMs) investigated as part of this report. These measures are intended to help provide insight to the building's largest energy consumers and to describe opportunities for energy conservation in the building at a high level.

6.1 Base Case

Before exploring the ECMs investigated in this report, the base case considered should be made clear; the base case for these measures is considered to be the continued operation of the building in a business-as-usual fashion, with no major mechanical equipment retrofits considered in the short-term future. Energy consumption from the 2023 calendar year was used as a reference when developing these energy savings, utility cost savings, and emissions savings amounts.

6.2 ECM-1: Convert Basement to Forced Air Heating

The first measure explores the implementation of a ventilated heating system to serve the basement.

.1 Measure Description

This measure would involve the installation of an additional air handling unit to serve the basement, complete with a heat pump heating coil and backup electric resistance coil. This would allow for the basement to receive fresh air turnover, helping to maintain air quality and to mitigate the risk of long-term contaminants. This would also have the benefit of installing heat pump heating capacity to the basement at the same time; a air-source heat pump would be expected to operate at a high coefficient of performance between 2.0 and 4.0, preventing demand on the current electric resistance baseboard heaters. As such, this measure would be expected to save a significant amount of electrical energy consumption, especially in winter seasons.

.2 Design Considerations

While this measure offers significant benefits to the basement's air quality control and to the building's energy efficiency, this measure would also require a substantial amount of shutdown time in the basement administrative spaces to install ductwork, drywall, add in wall penetrations, and test the new system before being used. This measure would require a new air handler or roof top unit to be installed either on the roof or outdoors at grade, with supply and return air ducts routed to occupied spaces. Because of this extensive scope of work, this measure would not be recommended unless a major renovation of the basement space were to take place and the space would not be occupied during the installation.

.3 Savings Summary

Savings associated with this measure are shown in the following table.

Table 5: ECM-1 Annual Savings Summary

No.	Description	Natural Gas Savings (GJ)	Electricity Savings (kWh)	Utility Cost Savings ($)	Emissions Savings (tCO2e)	Capital Cost ($)	Payback Period (years)
ECM-1	Convert Basement to Forced Air Heating	-	58,543	$5,725	0.7	$127,400	22.3

6.3 ECM-2: PV Array

The opportunity exists to install a photovoltaic (PV) panel array on the roof of this building.

.1 Measure Description

This measure would involve the installation of a PV panel array on the roof with the intention of subscribing to BC Hydro's net-metering program.

.2 Design Considerations

For more design considerations for this measure, refer to report under separate cover.

.3 Savings Summary

Savings associated with this measure are shown in the following table.

Table 6: ECM-2 Annual Savings Summary

No.	Description	Natural Gas Savings (GJ)	Electricity Savings (kWh)	Utility Cost Savings ($)	Emissions Savings (tCO2e)	Capital Cost ($)	Payback Period (years)
ECM-2	PV Array	-	52,000	$3,800	-	$215,000	25+

6.4 ECM-3: Ultra-Low Flow Hot Water Fixtures

The opportunity exists to retrofit the building's hand-washing sinks to lower flow. The flow rate of the current fixtures is approximately 1GPM, and may be lowered to 0.5GPM while still offering effective flow for hand washing.

.1 Measure Description

The opportunity exists to replace some of the building's hand wash sinks with lower flow fixtures that still provide adequate flow. Reducing flow in these fixtures would both reduce the amount of water consumed by the building and reduce the amount of electricity required by the DHW systems per minute of fixture use.

.2 Design Considerations

Although there may be an opportunity to lower the flow rate of the water fixtures in the washrooms to 0.5GPM, it should be noted that lower flow fixtures are sometimes not preferred by building tenants and may cause tenants to wash their hands for longer periods of time if fixtures at too low of a flow rate are selected. In addition, savings associated with reducing flow are high when reducing from high flow to low flow, and the hand wash sinks in this building, which are estimated to have 1GPM of flow, are not necessarily considered to be high flow (2.0 GPM+).

.3 Savings Summary

Savings associated with this measure are shown in the following table.

Table 7: ECM-3 Annual Savings Summary

No.	Description	Natural Gas Savings (GJ)	Electricity Savings (kWh)	Utility Cost Savings ($)	Emissions Savings (tCO2e)	Capital Cost ($)	Payback Period (years)
ECM-3	Ultra-Low Flow Hot Water Fixtures	-	5,427	$531	0.1	$37,700	25+

6.5 ECM-4: DHW CO_2 Heat Pumps

This measure explores the use of CO_2 heat pump technology in the building's DHW systems.

.1 Measure Description

The opportunity exists to install an additional heat source to the domestic hot water tanks in the form of CO_2 heat pumps; this would consist of 1-2 small condensing units located on the building's outer roof or at grade with a piped connection to the DHW supply line and DCW makeup water line. This would be intended to operate as the primary heat source for DHW production and would be expected to run at a low but constant heating output.

CO_2 heat pumps excel at providing a low flow of hot water at a high temperature difference, making them well suited to DHW production. They are relatively expensive, and as such they benefit from being used with a high amount of hot water storage.

.2 Design Considerations

For this measure to be implemented, new condensing units would need to be installed on the outer roof or at grade, and pipework would need to be run from the DHW tanks to the new condensing units. Although it would be possible to install these heat pumps to each domestic hot water tank, this measure may also be considered for a smaller subset of the building's DHW tanks, focusing on those service areas with higher occupancy. Choosing to install heat pumps to a smaller portion of the building's DHW services would reduce energy savings, but would lower this measure's up-front capital cost.

.3 Savings Summary

Savings associated with this measure are shown in the following table.

Table 8: ECM-4 Annual Savings Summary

No.	Description	Natural Gas Savings (GJ)	Electricity Savings (kWh)	Utility Cost Savings ($)	Emissions Savings (tCO2e)	Capital Cost ($)	Payback Period (years)
ECM-4	DHW CO2 Heat Pumps	-	7,753	$758	0.1	$81,900	25+

6.6 ECM-5: Wallpack Battery for Demand Response

With new programs from CleanBC refocusing from full electrification to a more holistic review of grid integrity, opportunities for onsite power reserves may be explored for the purposes of peak demand period response.

.1 Measure Description

This measure would involve the installation of DC batteries, which would be used to help trim the building's electrical demand during BC's typical peak demand period of 4PM-8PM. These batteries would be activated to help supplement the building's power demand during this period, reducing the building's electrical consumption during this time. The battery array would then be charged overnight before being called upon again during the next peak demand period.

.2 Design Considerations

This measure is a relatively new consideration from CleanBC, but may be considered by building owners as a way of integrating on-site storage for other purposes as well, including power supply during power outages. This may couple well with the implementation of a PV array. For more information regarding this measure, refer to report under separate cover.

.3 Savings Summary

Savings associated with this measure are shown in the following table.

Table 9: ECM-5 Annual Savings Summary

No.	Description	Natural Gas Savings (GJ)	Electricity Savings (kWh)	Utility Cost Savings ($)	Emissions Savings (tCO2e)	Capital Cost ($)	Payback Period (years)
ECM-5	Wallpack Battery for Demand Response	-	-	$500	-	$150,000	25+

6.7 ECM-6: ASHP Connected to Fire Hall Garage

This measure would include installing a wall-cassette DX Split with heating and cooling capacity to the Fire Hall.

.1 Measure Description

Although heat for the Fire Hall is provided through an electric resistance radiant floor and this system is expected to evenly heat the garage, the overall efficiency of the radiant floor is similar to an electric baseboard heater. This measure would involve the installation of a wall-mounted cassette connected to a DX Split with heat pump capacity in the fire hall, which would be capable of heating the garage as a first priority before the radiant floor is called upon. This would prioritize the use of the air-source heat pump before activating the radiant floor system. The new heat pump system would be expected to operate at a higher coefficient of performance, thus mitigating a significant proportion of the cost of heating the fire hall garage.

.2 Design Considerations

Savings for this measure are dependent on the size of air-source heat pump installed; since the cost per-unit of heating capacity in an air-source heat pump is relatively high and the rest of the fire hall garage's heating capacity is already electrified, the new ASHP would not need to be fully sized for peak heating demand; savings for this measure are based on having a maximum of 24,000 BTU/h of heating capacity available from the new ASHP. The wall cassette should be located where the garage is the most occupied, and the condensing unit would be mounted on the garage roof.

.3 Savings Summary

Savings associated with this measure are shown in the following table.

Table 10: ECM-6 Annual Savings Summary

No.	Description	Natural Gas Savings (GJ)	Electricity Savings (kWh)	Utility Cost Savings ($)	Emissions Savings (tCO2e)	Capital Cost ($)	Payback Period (years)
ECM-6	ASHP Connected to Fire Hall Garage	-	40,511	$3,962	0.5	$35,100	8.9

6.8 ECM-7: Solar Thermal Collector

The opportunity exists to install a partial solar thermal collector for heating domestic hot water.

.1 Measure Description

This measure would include the installation of a vacuum-tube solar thermal collector on the roof of the municipal hall, with the intention of using it for pre-heating domestic hot water serving the domestic hot water tank in the basement. This system would allow for electric resistance heating demand on this domestic hot water tank to be mitigated directly. This system may be expanded to other domestic hot water plants, or to other hydronic heating applications.

.2 Design Considerations

This solar thermal collector should be selected as a vacuum tube as opposed to a flat plate configuration; a vacuum tube solar collector is expected to be able to heat to a higher temperature and with lower outdoor air temperatures than a flat plate solar collector, making it more applicable for domestic hot water heating. Solar thermal collectors should also always be installed with heat rejection capacity to prepare for any condition where the solar collector has heated the water in the domestic hot water system to it's maximum and the temperature of the water in the solar collector is still rising. This new system would be installed on the roof of the municipal building with piping routed from the roof to the basement mechanical room, and would use a heat exchanger and circulation pump to share heat with potable water. The water loop connected directly to the solar collector would require glycol as freeze protection, preventing circulated water from freezing during winter conditions.

.3 Savings Summary

Savings associated with this measure are shown in the following table.

Table 11: ECM-7 Annual Savings Summary

No.	Description	Natural Gas Savings (GJ)	Electricity Savings (kWh)	Utility Cost Savings ($)	Emissions Savings (tCO2e)	Capital Cost ($)	Payback Period (years)
ECM-7	Solar Thermal Collector (DHW)	-	3,848	$376	0.0	$26,650	25+

6.9 ECM-8: FL Lighting Conversion to LED

This measure reflects a high level of conversion from fluorescent lighting to LED fixtures, maintaining a consistent lighting intensity. More information will be available under separate cover.

.1 Measure Description

The opportunity exists to retrofit the lighting fixtures in the building to LED from their original fluorescent selections. This would be expected to lower electricity use and building peak demand.

.2 Design Considerations

For more design considerations for this measure, refer to report under separate cover.

.3 Savings Summary

Savings associated with this measure are shown in the following table.

Table 12: ECM-8 Annual Savings Summary

No.	Description	Natural Gas Savings (GJ)	Electricity Savings (kWh)	Utility Cost Savings ($)	Emissions Savings (tCO2e)	Capital Cost ($)	Payback Period (years)
ECM-8	FL Lighting Conversion to LED	-	8,000	575	-	$135,000	25+

6.10 ECM-9: Conversion to Distributed VRF

The opportunity may exist to retrofit the mechanical systems of the Municipal Hall more comprehensively, converting the building to a full variable refrigerant flow (VRF) system.

.1 Measure Description

This measure would include retrofitting the mechanical systems serving the municipal hall, police station, and fire hall with a new VRF heat recovery system; in discussions with the District of Central Saanich, a more thorough and comprehensive conversion for the building's mechanical systems could be of interest; where different mechanical systems have been installed to the building throughout its service life, these mechanical systems do not communicate with one another, and do not recover heat from those spaces with cooling demand to other spaces that require heating. If a major renovation of the property is under consideration, a VRF system would include the installation of new condensing units on the roof, distributed refrigerant-based manifolds throughout the building, and refrigerant coils connected to the building's ventilation systems and heating systems. This system allows for heat to be recovered from spaces with cooling demand to other spaces in the building, provides air-source heat pump technology for both heating and cooling to all connected areas, and would combine the building's HVAC systems into one package. This could help streamline maintenance requirements for the building compared to maintaining completely separate mechanical systems, and may help to simplify the building's HVAC control systems by using a single digital platform.

.2 Design Considerations

This measure would clearly require a major shutdown of the building as the new VRF systems was being installed, making this measure's feasibility difficult outside of a building-wide renovation. VRF systems offer high energy efficiency, but also offer a risk by having all mechanical systems combined to one platform; detailed design, coordination with contractor hired to implement this system, and careful system commissioning is critical for long term system operation.

.3 Savings Summary

Savings associated with this measure are shown in the following table.

Table 13: ECM-8 Annual Savings Summary

No.	Description	Natural Gas Savings (GJ)	Electricity Savings (kWh)	Utility Cost Savings ($)	Emissions Savings (tCO2e)	Capital Cost ($)	Payback Period (years)
ECM-9	Conversion to Distributed VRF	-	205,936	$20,139	2.3	$3,217,500	25+

7. FINANCIAL MODELLING

This section shows the expected impacts of utility cost savings and cumulative cost savings between 2025 and 2050.

7.1 ECM-1: Convert Basement to Forced Air Heating – Financial Performance

The annual cost savings under this measure are shown in the following figure.

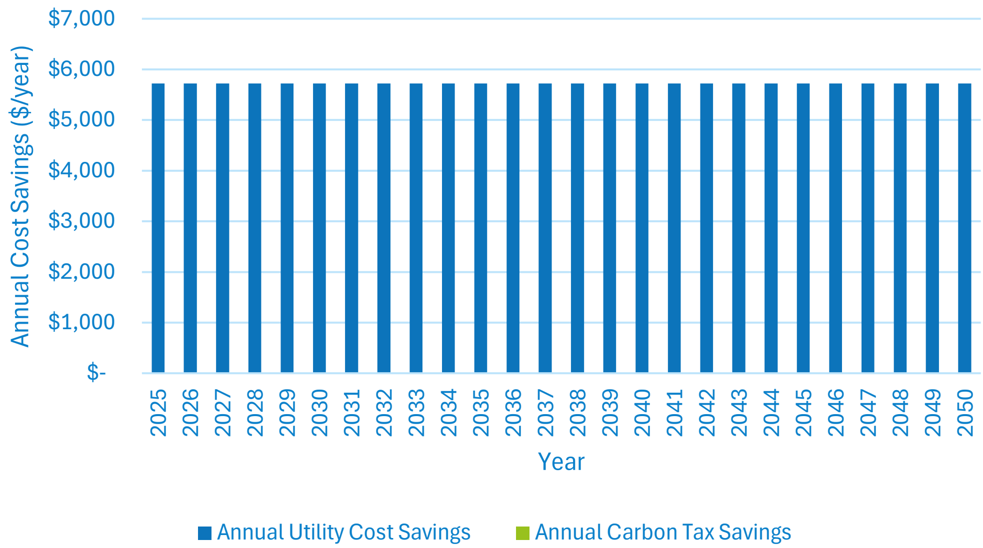

Figure 7: ECM-1 Annual Cost Savings

The assumed cost savings in 2025 versus 2050 is shown in the following table (shown in 2024 dollars).

Table 14: ECM-1 Cost Savings Summary

Description	Utility Cost Savings ($)	Carbon Tax Cost Savings ($)	Combined Cost Savings ($)
2025 Annual Cost Savings	$5,725	$-	$5,725
2030 Annual Cost Savings	$5,725	$-	$5,725

7.2 ECM-2: PV Array – Financial Performance

The annual cost savings under this measure are shown in the following figure.

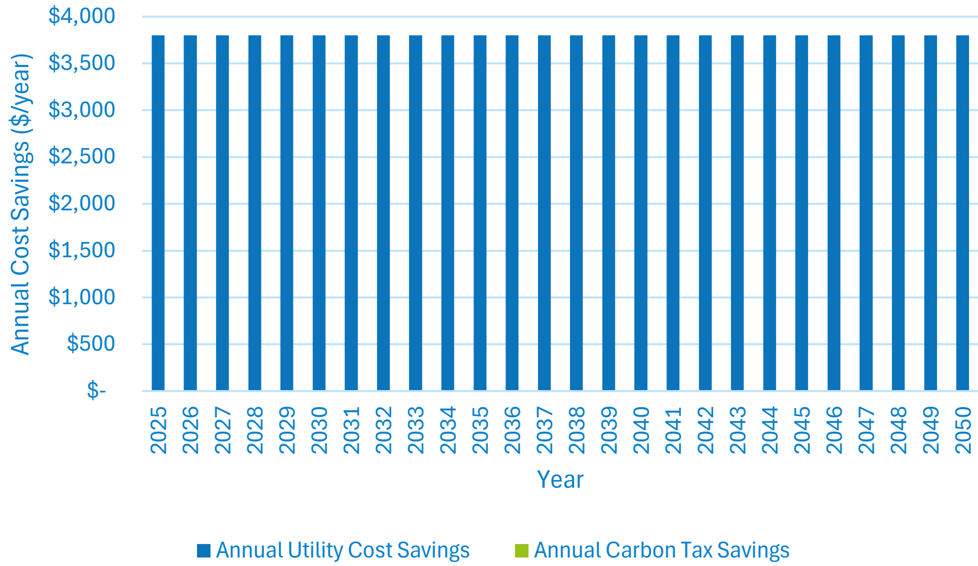

Figure 8: ECM-2 Annual Cost Savings

The assumed cost savings in 2025 versus 2050 is shown in the following table (shown in 2024 dollars).

Table 15: ECM-2 Cost Savings Summary

Description	Utility Cost Savings ($)	Carbon Tax Cost Savings ($)	Combined Cost Savings ($)
2025 Annual Cost Savings	$3,800	$-	$3,800
2030 Annual Cost Savings	$3,800	$-	$3,800

7.3 ECM-3: Ultra-Low Flow Hot Water Fixtures– Financial Performance

The annual cost savings under this measure are shown in the following figure.

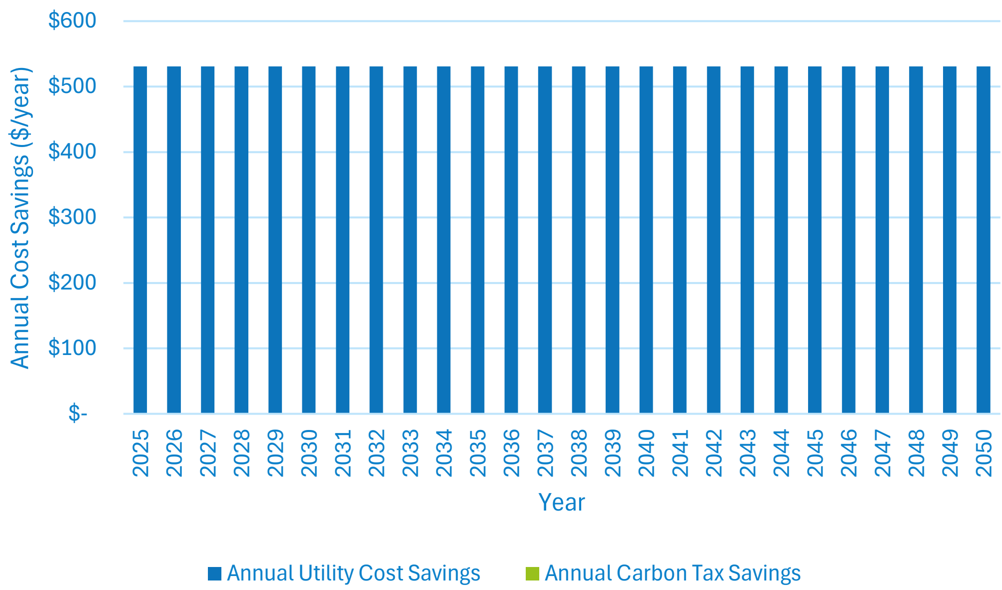

Figure 9: ECM-3 Annual Cost Savings

The assumed cost savings in 2025 versus 2050 is shown in the following table (shown in 2024 dollars).

Table 16: ECM-3 Cost Savings Summary

Description	Utility Cost Savings ($)	Carbon Tax Cost Savings ($)	Combined Cost Savings ($)
2025 Annual Cost Savings	$531	$-	$531
2030 Annual Cost Savings	$531	$-	$531

7.4 ECM-4: DHW CO2 Heat Pumps – Financial Performance

The annual cost savings under this measure are shown in the following figure.

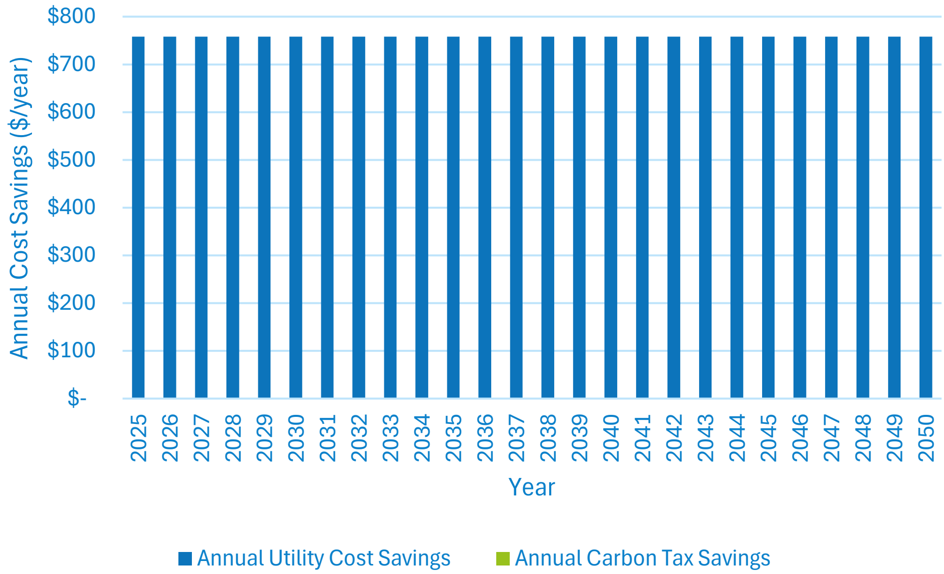

Figure 10: ECM-4 Annual Cost Savings

The assumed cost savings in 2025 versus 2050 is shown in the following table (shown in 2024 dollars).

Table 17: ECM-4 Cost Savings Summary

Description	Utility Cost Savings ($)	Carbon Tax Cost Savings ($)	Combined Cost Savings ($)
2025 Annual Cost Savings	$758	$-	$758
2030 Annual Cost Savings	$758	$-	$758

7.5 ECM-5: Wallpack Battery for Demand Response – Financial Performance

The annual cost savings under this measure are shown in the following figure.

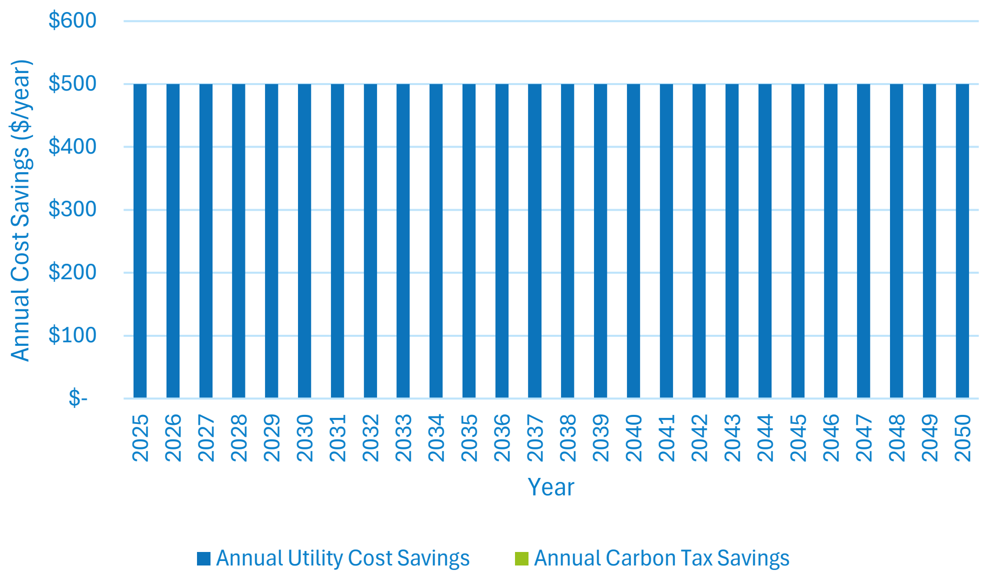

Figure 11: ECM-5 Annual Cost Savings

The assumed cost savings in 2025 versus 2050 is shown in the following table (shown in 2024 dollars).

Table 18: ECM-5 Cost Savings Summary

Description	Utility Cost Savings ($)	Carbon Tax Cost Savings ($)	Combined Cost Savings ($)
2025 Annual Cost Savings	$500	$-	$500
2030 Annual Cost Savings	$500	$-	$500

7.6 ECM-6: ASHP Connected to Fire Hall Garage– Financial Performance

The annual cost savings under this measure are shown in the following figure.

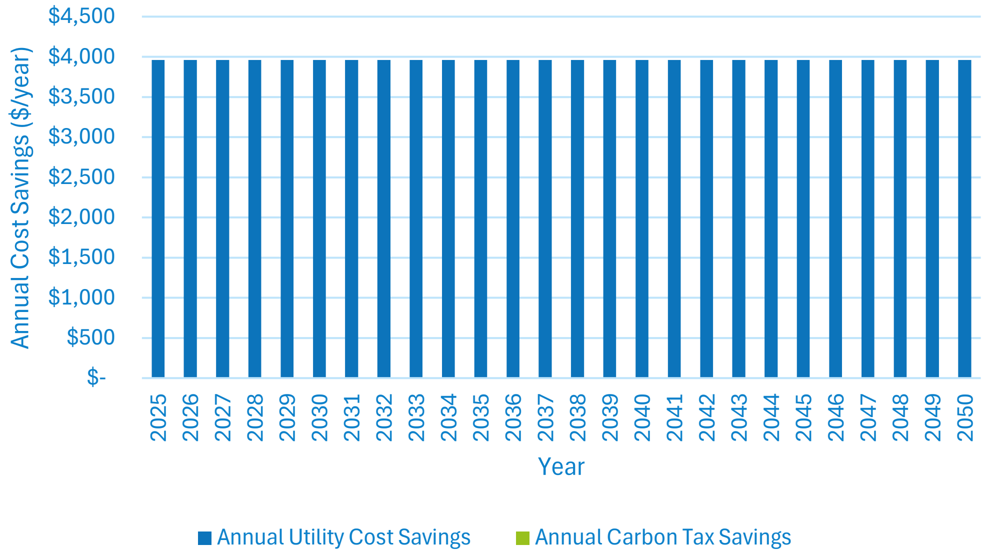

Figure 12: ECM-6 Annual Cost Savings

The assumed cost savings in 2025 versus 2050 is shown in the following table (shown in 2024 dollars).

Table 19: ECM-6 Cost Savings Summary

Description	Utility Cost Savings ($)	Carbon Tax Cost Savings ($)	Combined Cost Savings ($)
2025 Annual Cost Savings	$3,962	$-	$3,962
2030 Annual Cost Savings	$3,962	$-	$3,962

7.7 ECM-7: Solar Thermal Collector (DHW) – Financial Performance

The annual cost savings under this measure are shown in the following figure.

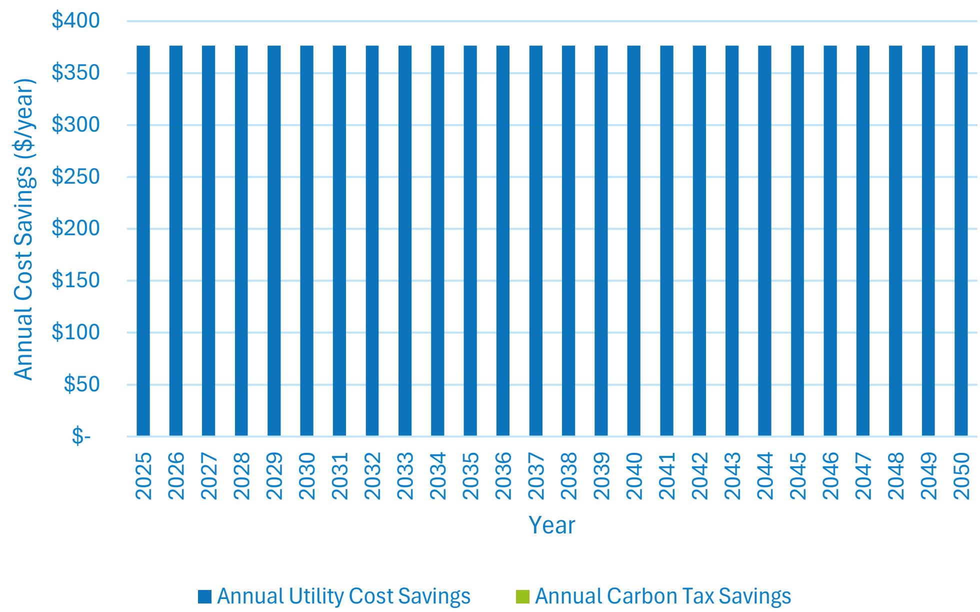

Figure 13: ECM-7 Annual Cost Savings

The assumed cost savings in 2025 versus 2050 is shown in the following table (shown in 2024 dollars).

Table 20: ECM-7 Cost Savings Summary

Description	Utility Cost Savings ($)	Carbon Tax Cost Savings ($)	Combined Cost Savings ($)
2025 Annual Cost Savings	$376	$-	$376
2030 Annual Cost Savings	$376	$-	$376

7.8 ECM-8: FL Lighting Conversion to LED – Financial Performance

The annual cost savings under this measure are shown in the following figure.

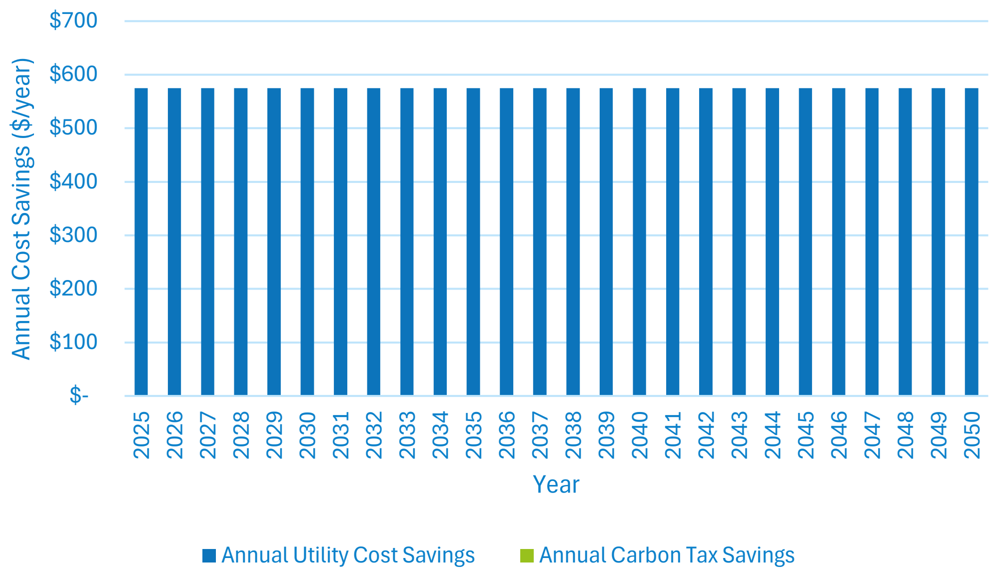

Figure 14: ECM-8 Annual Cost Savings

The assumed cost savings in 2025 versus 2050 is shown in the following table (shown in 2024 dollars).

Table 21: ECM-8 Cost Savings Summary

Description	Utility Cost Savings ($)	Carbon Tax Cost Savings ($)	Combined Cost Savings ($)
2025 Annual Cost Savings	$575	$-	$575
2030 Annual Cost Savings	$575	$-	$575

7.9 ECM-9: Conversion to Distributed VRF – Financial Performance

The annual cost savings under this measure are shown in the following figure.

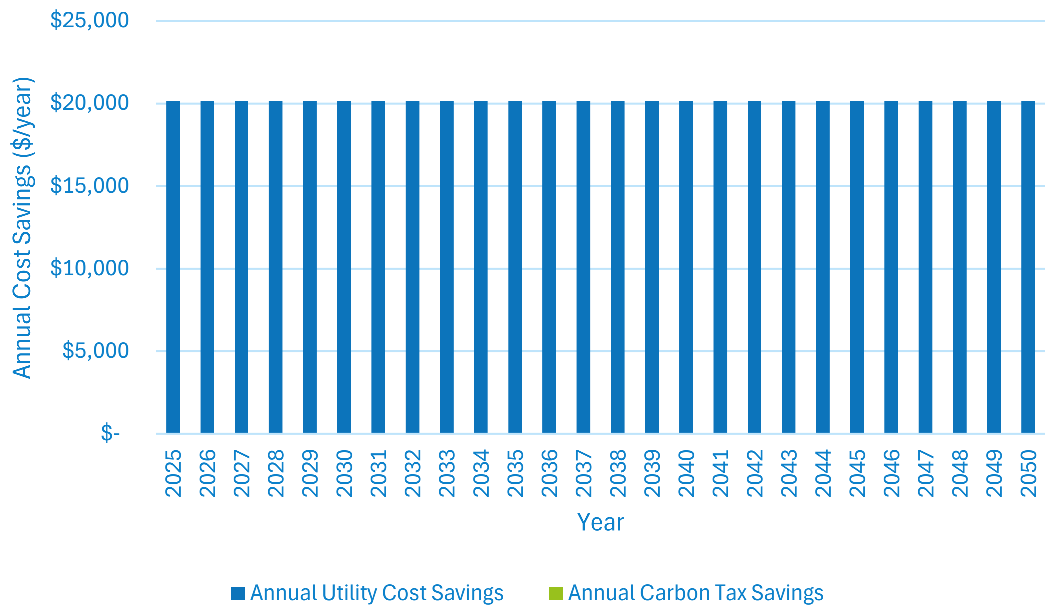

Figure 15: ECM-9 Annual Cost Savings

The assumed cost savings in 2025 versus 2050 is shown in the following table (shown in 2024 dollars).

Table 22: ECM-9 Cost Savings Summary

Description	Utility Cost Savings ($)	Carbon Tax Cost Savings ($)	Combined Cost Savings ($)
2025 Annual Cost Savings	$20,139	$-	$20,139
2030 Annual Cost Savings	$20,139	$-	$20,139

8. RECOMMENDATIONS AND CONCLUSION

This report investigated nine different opportunities for energy conservation at the District of Saanich's Municipal Hall, including energy efficiency measures, electrification measures, on site generation measures, and one demand response measure. The impact of these measures is summarized in the following table.

Table 23: ECM Savings Summary

No.	Description	Natural Gas Savings (GJ)	Electricity Savings (kWh)	Utility Cost Savings ($)	Emissions Savings (tCO2e)	Capital Cost ($)	Payback Period (year)
ECM-1	Convert Basement to Forced Air Heating	-	58,543	$5,725	0.7	$127,400	22.3
ECM-2	PV Array	-	52,000	$3,800	-	$215,000	25+
ECM-3	Ultra-Low Flow Hot Water Fixtures	-	5,427	$531	0.1	$37,700	25+
ECM-4	DHW CO2 Heat Pumps	-	7,753	$758	0.1	$81,900	25+
ECM-5	Wallpack Battery for Demand Response	-	-	$500	-	$150,000	25+
ECM-6	ASHP Connected to Fire Hall Garage	-	40,511	$3,962	0.5	$35,100	8.9
ECM-7	Solar Thermal Collector (DHW)	-	3,848	$376	0.0	$26,650	25+
ECM-8	FL Lighting Conversion to LED	-	8,000	575	-	$135,000	25+
ECM-9	Conversion to Distributed VRF	-	205,936	$20,139	2.3	$3,217,500	25+

It is recommended that ECM-1 is carried out to improve occupant comfort through improved ventilation. It's also recommended that ECM-6 and ECM-8 are considered for implementation to significantly reduce the amount of electricity needed to meet heating demand. If a more comprehensive retrofitting of the building is being considered, then ECM-9 would be considered as a suitable design alternative to like-for-like replacements of major mechanical equipment.

END OF REPORT