

Strategic Energy Management Plan 2022



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Table of Contents

Executive Summary	1
1. Purpose	3
2. Organizational Summary.....	4
2.1 Organizational Alignment – Greenhouse Gas Emissions	4
2.2 Organizational Alignment – Energy Efficiency	4
2.3 Organizational Profile	5
3. Considerations and Goals	6
3.1 Background	6
3.2 Municipal Context.....	6
3.3 Provincial Context	7
3.4 BC Hydro	7
3.5 Life-Cycle Costing.....	8
4. Key Performance Indicators.....	8
5. Emissions Source Breakdown	8
6. How is the City Doing?	10
6.1 Overall Scorecard and Focus.....	10
6.2 Electricity Conservation and Low Carbon Electrification.....	11
6.3 Fossil Fuel and GHG Emissions Reductions.....	12
6.4 Energy Use Intensity	14
6.5 Combined Energy Sources - Portfolio Trends	17
6.5.1 Recreation Facilities	18
6.5.2 Emergency Services.....	19
6.5.3 Civic Buildings.....	20
6.5.4 Parkades.....	21
6.5.5 Operations.....	22
6.5.6 Conference Centre and Performing Arts	23
7. Benchmarking	24
8. How does the City get there?	25



8.1	Funding	26
8.2	Planning and Analysis.....	26
8.3	Project Prioritization	27
8.4	Guideline and Policy Review	27
9.	Building Portfolio Changes.....	27
9.1	Fire Station No.1	27
9.2	Nanaimo Operations Centre	28
9.3	Community Services Building.....	28
9.4	Departure Bay Activity Centre	28
9.5	Harewood Activity Centre.....	28
10.	Project Planning	29
10.1	Identification of Energy Projects.....	29
10.2	Prioritization of Energy Projects	30
10.3	Multi-Year Action Plan	30
11.	Risks & Challenges	36
12.	Energy Studies & Other Professional Services	38
13.	Awareness and Behaviour Change (Engagement Plan)	39
13.1	Energy Wise Network Program.....	39
14.	Energy Management Assessment.....	39
15.	Opportunities	41
15.1	Optimize Asset Renewals.....	41
15.2	Optimize Asset Operations	41
15.3	Efficiency & Electrification	41
15.4	New Construction	42
15.5	Renewables	42
16.	Stakeholders for Success and Acknowledgments.....	42
16.1	The Government of British Columbia	42
16.2	City Council	42
16.3	BC Hydro	42
16.4	Facilities Maintenance and Operations	43



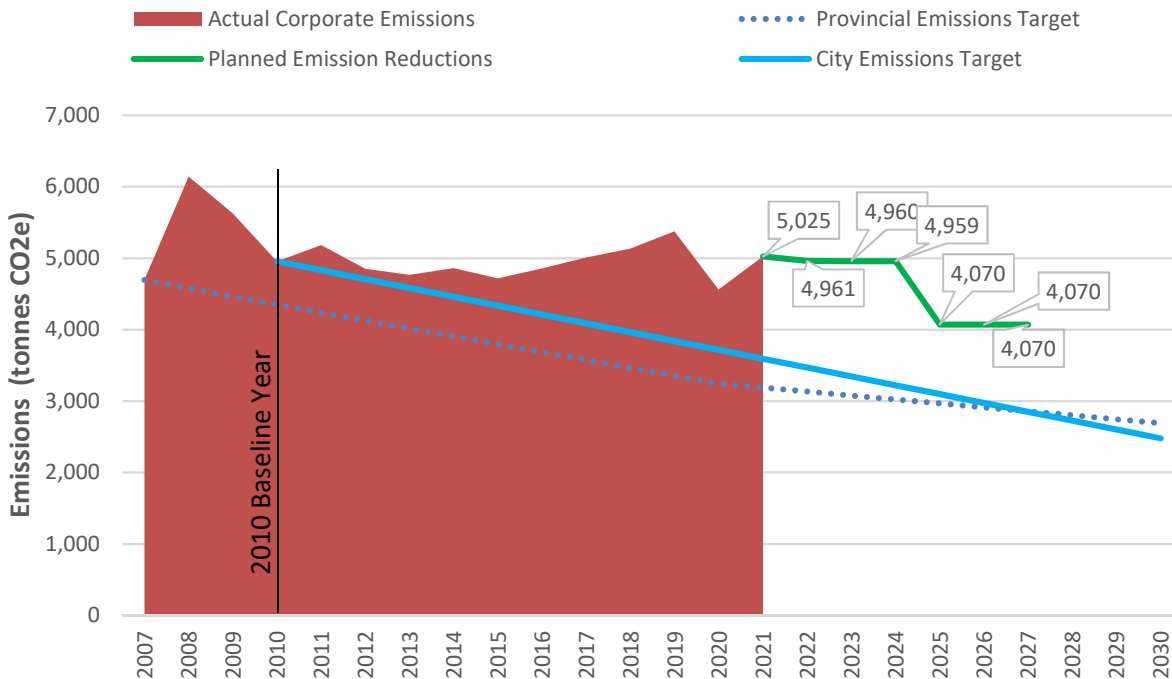
16.5	Finance	43
16.6	City of Nanaimo Employees	43
17.	Management Approval	44
	Appendix A – Site Acronyms	45
	Appendix B – Master Project List	46
	Appendix C - Fleet Renewal Initiatives.....	47
	Appendix D - Glossary of Terms.....	48
	Appendix E – Corporate Emissions Data.....	51
	Appendix F – Energy Project Investments and Cumulative Savings (Cost Avoidance).....	52
	Appendix G – Electricity Savings & Low Carbon Electrification	53
	Appendix H – Natural Gas Savings	54
	Appendix I – 2021 Project Summary.....	55
	Appendix J – 2022 Project Summary	56

Executive Summary

According to the Intergovernmental Panel on Climate Change (IPCC), climate change is the single gravest threat to humanity and the planet’s natural systems. It is crucial to act swiftly to limit the earth’s temperature rise by 1.5°C to prevent irreversible damage, and requires an all hands-on-deck approach to ensure carbon emission reductions are implemented quickly and are sustained.

The City of Nanaimo has aggressive targets for Greenhouse Gas (GHG) Emissions reduction including **50% to 58% below 2010 levels by 2030**, and **94% to 107% below 2010 levels by 2050**. The City is not achieving progress towards these goals, mainly due to municipal growth, competing priorities, and resource shortfall. Current emissions for Traditional Services exceed 2010 baseline by about 1%.

Greenhouse Gas Emissions - Traditional Services (tCO₂e)



Even with the energy conservation and emission reduction initiatives undertaken to date, growth in services, assets, and programs for the citizens of Nanaimo has outpaced efforts and significantly more aggressive measures are needed to reduce carbon to meet the 2030 target. **Corporate emissions from Traditional Services should be no more than 2,478 tCO₂e in 2030 to meet the 50% reduction target.** This requires an **average reduction of 318 tCO₂e/year** from 2023 to 2030, and significantly more aggressive action, funding, and resources to get there.



Recognizing that 2030 is not far off, significant planning is proposed for 2023 to confirm critical steps and propose capital and operating funding to implement measures to reduce carbon and work towards targets, specifically:

- A portfolio-based Carbon Reduction Pathways Study
- An Electric Vehicle Fleet Ready Study
- A Beban Park Recreation Complex – HVAC Optimization and Feasibility Study

Reducing emissions by replacing equipment at the end-of-service life would be sufficient to meet 2030 targets. However, insufficient resources exist to achieve all these renewals. A more holistic approach must be taken to look at not only the best way to group energy and GHG reduction measures within buildings and fleet, but also how to strategically bundle projects to maximize the benefit for the City, while aligning with capital renewal plans.

Highlights of the City’s current and planned activities to reduce energy and emissions are shown in the following table: **Multi-Year Action Plan Projected Results** which illustrates the City’s budgeted projects impacting Energy Use Intensity (EUI) of the buildings portfolio, planned electrical savings, fossil fuel reductions, and GHG reductions over the next four years. Many of the Key Performance Indicators (KPI) are linked; fossil fuel reduction will naturally reduce GHG emissions; Low-Carbon Electrification will offset Electrical Savings. To track the various initiatives, projects have been allocated into their best KPI matching category. Projects are only listed once. Specific investment, careful planning, staffing resources, and review of City priorities will be required.

Multi-Year Action Plan Projected Results						
Key Performance Indicators	Annual Target	2022 Planned	2023 Planned	2024 Planned	2025 Planned	4-Year Average
GHG Emission Reductions (tCO ₂ e)	318	66	1.2	0.3	889.2 ¹	239
Energy Use Index (EUI) Reduction (kWh/m ² /year)	12.0	8.8	1.1	0.3	44	14
Electrical Savings (kWh/year)	100,000	131,859	127,287	31,747	20,239	77,783
Fossil Fuel Savings (GJ/Year)	4,572	3,112	0 ²	0 ²	18,058	5,293
Low-carbon Electrification (kWh/year)	200,000	-38,415	0 ²	0 ²	-1,172,727 ¹	-302,786

¹ The Energy Team has identified a low-carbon electrification project at Nanaimo Aquatic Centre that would make significant progress towards reducing the GHG Emissions over the next four years. This project is included in the budget, however is contingent on a successful grant application to the Clean Communities Fund.

² Zeros indicate no currently planned projects with completed designs for the applicable category in the listed year. Projects may be planned, but without completed designs, the energy impact is not yet known.

1. Purpose

This Strategic Energy Management Plan (SEMP) is the City of Nanaimo’s (City) forward-looking business plan for reducing energy consumption, utility costs, and greenhouse gas (GHG) emissions from our buildings, fleet, and outdoor spaces.

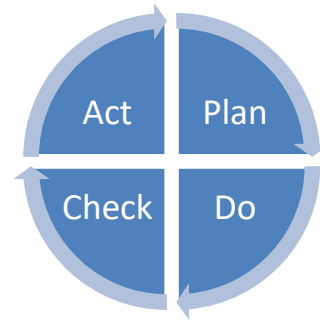
The SEMP details Nanaimo’s plan towards the 2030 emissions goals and improvements to building energy efficiency, which are detailed in Section 8.

Meeting these targets will require significant investments in asset renewal measures, including electrification and other reduction measures for both facilities and fleet, and the continued improvement in energy efficiency and system optimization.

Emissions reported herein include those from both Facilities and Fleet Operations.

This plan:

- Sets corporate objectives and targets and provides a realistic plan for achievement (Plan)
- Works within Nanaimo’s available resources to implement actions (Plan)
- Provides a realistic plan for achieving them (Do)
- Sets benchmarks and tracks progress to measure success (Check)
- Identifies opportunities and areas for improvements (Act)
- Continually improves the process of all the actions listed above



Semi-annually this SEMP is reviewed, adjusted, and updated. The Energy Manager works with staff and stakeholders when determining what changes are needed to the plan.

This SEMP includes both a Multi-Year Action Plan Detailed Project List (Table 11), and a Master Project List (Appendix B) with potential new projects and activities not yet budgeted in the 10-Year Capital Plan.

2. Organizational Summary

2.1 Organizational Alignment – Greenhouse Gas Emissions

Prior to 2019 the City used the Provincial Climate Action Targets to reduce emissions by 33% of the 2007 levels by 2020. In April 2019, recognizing the global concern raised by the International Panel on Climate Change (IPCC) to limit global warming to 1.5°C, Nanaimo City Council aligned with the IPCC Special Report on Global Warming of 1.5°C, dated 2018 and declared a Climate Emergency and set new community-wide emissions reduction goals of between:

- **50% to 58% below 2010 levels by 2030**
- **94% to 107% below 2010 levels by 2050**

In 2022 the BC Government legislated GHG emission targets for 2030, 2040, and 2050 of 40%, 60% and 80% below 2007 levels, respectively. Due to the emissions levels for Nanaimo in both 2007 and 2010, the differing baseline years between the Province (2007) and the City (2010) create more rigorous targets for the City with the 2010-based targets.

Council developed a 2019 – 2022 Strategic Plan that provides a road map for the organization and includes the following commitment:

“We will take a leadership role and focus on our environmental impact and climate change contributions in our decision making and regional participation.”

Further reinforcing support to take action on climate change, City Plan Bylaw 2022 No.6600: Nanaimo ReImagined was adopted by Council on July 4, 2022, includes clear identification that Greenhouse Gas Emissions Reduction are a key issue requiring strategic action in greener buildings and infrastructure, zero carbon mobility options, less waste and other measures.

2.2 Organizational Alignment – Energy Efficiency

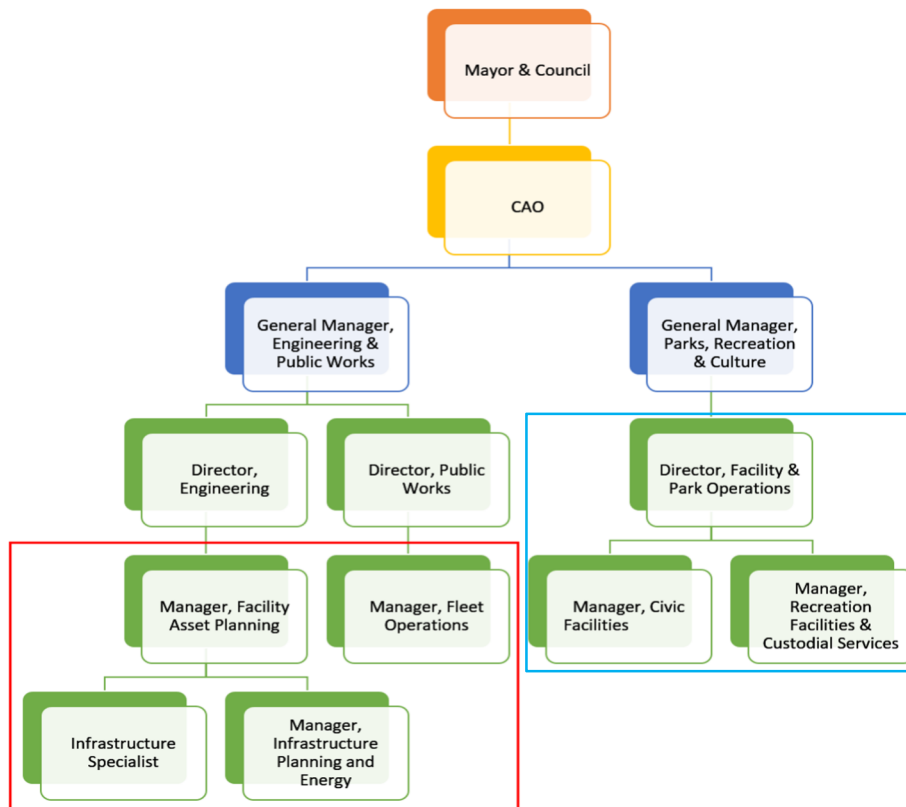
In addition to GHG emission targets, the City has set goals for improving the energy performance of 25 of the larger, strategic facilities. In the context of the SEMP, energy refers to all energy sources including electricity, natural gas (including compressed natural gas), diesel, and gasoline. The City uses a baseline year of 2008 for this comparison as it coincides with the creation of the Energy Manager role within the City, and marks the commencement of a specific effort to be more energy conscious. The goal in this area includes reducing the energy used per square metre of building area by 30% to 40% by 2030 (against a 2008 baseline).

2.3 Organizational Profile

- About 200 owned sites consuming varying amounts of energy
- About 631 Staff ³
- About 113,000 m² of floor space
- \$4,139,123 spent on energy in 2021
- Emitted 5,025 tonnes of carbon dioxide equivalent (tCO₂e) in 2021 from Traditional Services and another 664 tCO₂e from Non-traditional Services (RCMP and leased spaces)

The City’s Facility Asset Planning, Operations, and Fleet Planning staff (the Energy Team) meet annually to review energy and emissions management goals and establish suitable reductions in alignment with these objectives.

The Energy Team reports through the Director and General Manager levels, and ultimately through the Chief Administrative Officer to Council and the Mayor. The following chart does not represent the entirety of the organization, only the more pertinent relationships for energy and emissions Management. The area marked with a red line below indicates the primary Energy Team members who liaise with other management and staff within the organization; primarily those outlined in blue.



³ Staff includes permanent full-time and part time employees only. Does not include RCMP staff, Council (9 members), permanent auxiliary, temporary, or casual employees.

3. Considerations and Goals

3.1 Background

Emissions within a municipality come from a number of sources, including community-based and corporate-based. The corporate emissions are further allocated into Traditional and Non-Traditional Services. Traditional Services typically include those services that are commonly provided by a local government, while Non-Traditional Services are generally those that are not necessarily provided by all local governments. Historically emissions-reporting has only included Traditional Services⁴ however the City recognizes that all emissions have an impact to climate, and action to reduce all emissions is appropriate and important. To ensure consistency with previous reporting, the established Traditional Service-model will continue to be followed, however comments, and reporting on emissions and reduction efforts related to Non-Traditional Services are included as appropriate. In 2021, the City's Non-Traditional Services amounted to an additional 664 tCO₂e, or 13% on top of the reported emissions from Traditional Services. For Nanaimo these Non-Traditional Services are generally made up of RCMP services and City-owned buildings leased to third parties where the third party is responsible for the utility costs. As the City continues to implement the climate action strategy, projects will be implemented that reduce all corporate emissions from both Traditional and Non-Traditional Services.

3.2 Municipal Context

Historically, the Province of BC has used 2007 as the baseline year for emissions comparison, reporting, and target setting however when selecting the baseline year the City elected to use 2010 instead of 2007. With a 50-58% emission reduction target, and the revised baseline year, the City's 2030 goals are approximately 13% more aggressive than the provincial goals.

In addition to Nanaimo's emission reduction goals, another key objective is improving each building's energy efficiency. Energy efficiency is based on the amount of energy from all sources used per square meter of floor area and is typically identified as Energy Use Intensity or EUI. The City has set a target to **reduce the EUI of 25 of the larger, strategic facilities by 30% to 40% below 2008 levels by 2030**. As noted in Section 2.2, the 2008 baseline for energy efficiency aligned with the creation of the Energy Manager role at the City.

While electricity conservation efforts still play a very important role when renewing assets, and making changes to systems and how they operate, the global recognition of the effects of greenhouse gas emissions on climate change has highlighted the critical need to transition away from carbon-based fuels and switch to clean energy alternatives as quickly as possible. Fortunately, BC has the advantage of a relatively clean electrical grid, primarily energized by hydro-based power. The City has shifted focus

⁴ Per 2021 BC Best Practices Methodology for Quantifying Greenhouse Gas Emissions: For Public Sector Organizations, Local Governments, Modern Treaty Nations and Community Emissions; Published by the Province of BC: Ministry of Environment and Climate Change Strategy



from electricity conservation measures towards implementing electrification measures to achieve GHG reduction. Additional measures beyond electrification will be required to meet 2050 targets, but in the meantime, prioritization of electrification projects allows for emission reductions.

3.3 Provincial Context

In the fall of 2021, the “CleanBC: Roadmap to 2030” was released by the BC Government, and describes initiatives and directions required to put the Province on track to meet its energy and emission targets. Important for existing buildings is that the efficiency of space and water heating equipment must be greater than or equal to 100% by 2030, essentially eliminating traditional fossil fuel furnaces and boilers, and requiring greater electrification efforts and hybrid solutions. This shift will need to be included in asset renewal planning, and part of project considerations.

On May 16, 2022, the Provincial Government announced the new CleanBC Local Government Climate Action Program (LGCAP) to accelerate local climate action. The Provincial Budget has committed to provide a total of \$76 million dollars between 2022 to 2024 to local governments across BC. The City is set to receive \$325,082 per year during this term. These funds will be allocated to both corporate and community emission reduction, and energy conservation initiatives and replace previously established CARIP funding.

3.4 BC Hydro

Annually, BC Hydro sets electricity reduction targets for the Energy Team in the BC Hydro - City of Nanaimo Energy Management Contract (Agreement). In the 2022/23 Agreement, a second target was added, requiring the City to also report on progress towards the provincial GHG emission reduction targets. The electricity reduction target was reduced from 300,000 kWh in savings in past years to a current reduction target of 100,000 kWh/year.

The second target is to implement low-carbon electrification projects. With projects that switch energy sources from carbon based fuel (mainly natural gas) to electricity, electricity consumption will increase. This second target allows for a 200,000 kWh increase, and indicates the magnitude of fuel switching that should occur annually.

The two targets have to be carefully considered as asset renewals are planned. Recognising the importance of reducing emissions into the atmosphere, the Energy Team has to determine the best pathway of reducing or eliminating the use of fossil fuels, while presenting the changes to operating costs and other benefits.

The City’s planned initiatives towards these goals are detailed in Section 10, Table 11: Multi-Year Action Plan – Project List.

3.5 Life-Cycle Costing

As part of the consideration of the options available for renewing assets, the Energy Team reviews current technology, options available, allocated budgets, and factors in a total cost of ownership model which includes capital, operating, maintenance, and carbon pricing. Carbon pricing is becoming more of a factor in life-cycle cost considerations. For example, current carbon tax pricing is \$50/tCO₂e and is expected to continue to increase \$15/t annually, reaching \$170/t by 2030. These increases in carbon tax tip the operations costs in favour of electricity or other potential clean energy choices in future that have historically had a greater unit cost than natural gas. Not only will the City will pay less tax the sooner transitions are made to clean electricity, but the faster carbon emissions are reduced.

4. Key Performance Indicators

To meet the City’s emission and energy reduction goals, it’s important to track progress with Key *Performance Indicators* (KPIs). The goals outlined in Section 3 require reduced reliance on fossil fuels, and improved building efficiencies.

KPIs	
Emissions Reduction	<ul style="list-style-type: none"> • Average 6,415 GJ/year reduction required to meet 2030 emissions goal
EUI	<ul style="list-style-type: none"> • 100,000 kWh Annual Conservation target • 200,000 kWh Low Carbon Electrification (switch from fossil fuel to electricity)

The City uses Prism Utility Monitoring & Analysis (PUMA) to monitor energy consumption at eleven key facilities. The City has also recently partnered with Building Benchmarking BC (BBBC) to track and compare building energy use intensity and compare it with similar buildings in other areas of the province.

Energy and emissions reduction progress can be measured by trending the KPIs over time and is based on avoided energy consumption. As well, individual project performance can be evaluated using the new, actual performance data and comparing it with previous energy consumption.

5. Emissions Source Breakdown

The City maintains a large facility portfolio, with more than 100 civic, culture, and recreation facilities, and more than 200 when utility facilities are included. In addition, the city maintains a sizable fleet, totalling more than 200 vehicles, 90% of which rely on fossil fuels. As noted previously, the fleet emissions are not the focus of this report, but have been included in Table 1 to show a more

comprehensive accounting of emissions. For 2021, the City’s total corporate emissions were split fairly evenly between building facilities and its fleet vehicles and equipment.

Table 1: 2021 Energy Consumption and Emissions Data			
Traditional Services			
Stationary Sources	Consumption		Emissions
Electricity	19,176,893	kWh	186 tCO ₂ e
Natural Gas	47,513	GJ	2,370 tCO ₂ e
Home Heating Fuel	24,065	L	63 tCO ₂ e
	Sub-total		2,619 tCO ₂ e
Mobile Sources	Consumption		Emissions
Natural Gas	10,468	GJ	522 tCO ₂ e
Diesel	384,774	L	877 tCO ₂ e
Unleaded Gasoline	179,262	L	408 tCO ₂ e
Propane	52,719	L	82 tCO ₂ e
Employee Mileage (Unleaded)	4,560	L	11 tCO ₂ e
Contracted Serv. (Diesel & UNL)		L	508 tCO ₂ e
	Sub-total		2,406 tCO ₂ e
Total Traditional Services			5,025 tCO ₂ e
Non-Traditional Services			
Stationary Sources	Consumption		Emissions
Electricity	725,934	kWh	7 tCO ₂ e
Natural Gas	630	GJ	31 tCO ₂ e
	Sub-total		38 tCO ₂ e
Mobile Sources	Consumption		Emissions
Unleaded Gasoline (RCMP)	264,390	L	626 tCO ₂ e
Total Non-Traditional Services			664 tCO ₂ e
Total Corporate Emissions			5,690 tCO ₂ e

As with all buildings, energy needs fluctuate depending on the use and weather. Recreation facilities are the highest consumers of energy, which is expected based on the building systems. Of the highest consumers, the two indoor pools are responsible for 56% of building emissions. Following indoor pools, the three ice arenas are the next largest contributor, accounting for an additional 13% of building emissions.

To tackle the largest sources, a Facility Optimization study was completed for NAC, identifying an opportunity for approximately 70% emissions reduction. An application has been submitted to CleanBC Communities Grant Fund for 73.33% grant funding to implement this solution, with announcements expected in summer 2023. A study similar is proposed in 2023 for the City’s second highest consuming site: Beban Park Complex.

The Energy Team continues to examine asset renewal opportunities and applies a climate sensitive lens, recognizing that emission-reducing opportunities are typically governed by each asset’s expected life-cycle. A total life-cycle cost analysis considering capital cost, ongoing operations, maintenance, and energy and carbon tax costs for proposed new assets is important in the decision making process.

Although the 2050 emissions reduction goal seems far off, assets with longer service lives must be very carefully considered against the City’s 94%-107% GHG reduction and the provincial government CleanBC targets.

6. How is the City Doing?

6.1 Overall Scorecard and Focus

The City’s efforts continue to focus on opportunities which have the greatest potential to reduce GHG emissions and energy consumption. Figures 1a and 1b illustrate the proportion of total emission produced by each facility type, and similarly, total energy consumed by facility type.

In 2021, recreation centres produced approximately 76% of emissions from facilities. Similarly, they consumed about 61% of all facility energy required.

Specifically, Aquatic Facilities and Ice Arenas have the highest EUI compared with other building types within the City’s inventory of buildings, followed by Emergency Services, Performing Arts, and Operations facilities.

Figure 1a illustrates the share of total emissions produced by each facility type.

Figure 1b illustrates the share of energy consumed by each facility type.

Figure 1a: Percentage of Total GHG Emissions by Facility Type

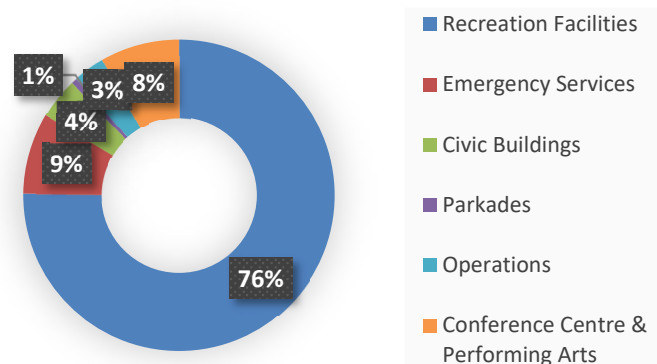


Figure 1b: Percentage of Total Energy by Facility Type

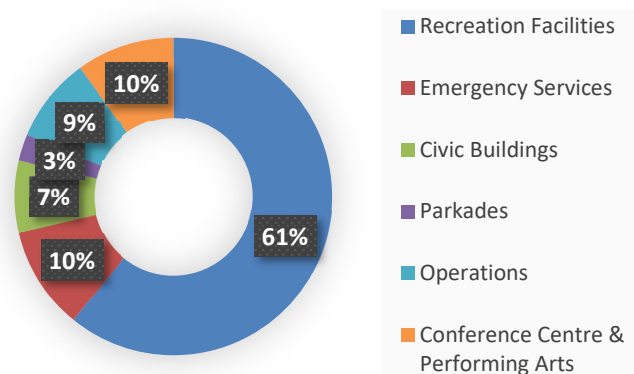


Table 2 illustrates the KPI Scorecard (buildings and fleet) progress towards emissions, energy use intensity, electricity conservation, and fossil fuel reductions targets for 2021. Values shown in green reflect those that are performing well, red are performing poorly, and yellow indicates that the performance is close to the target.

Table 2: 2021 KPI Scorecard				
Goal	Baseline (2010)	2021 Actual	2021 Target	2030 Target
GHG Emission Level (tCO₂e) (Traditional Services Only)	4,955	5,025	3,079	2,478
Energy Use Intensity (EUI) (kWh/m²)	366	243	300	256
Electrical Savings (kWh/year) (Traditional Services + Non-traditional)	-	108,635	300,000	-
Fossil Fuel Savings (GJ/year) (Traditional Services + Non-traditional)	-	0	4,315	-

NOTE: Energy Use Intensity (EUI) values are based on the 25 of the City’s larger strategic buildings.

Competing priorities within the organization and community have resulted in difficult choices for the City. The Energy Team continues to advocate for electricity conservation projects, however, is prioritizing emission reduction strategies as the more critical climate action initiative.

6.2 Electricity Conservation and Low Carbon Electrification

The City historically made very good progress towards annual electrical conservation efforts.

Figure 2: City Electrification Savings vs BC Hydro Target illustrates that over the last number of years, the City has exceeded BC Hydro’s cumulative savings targets.

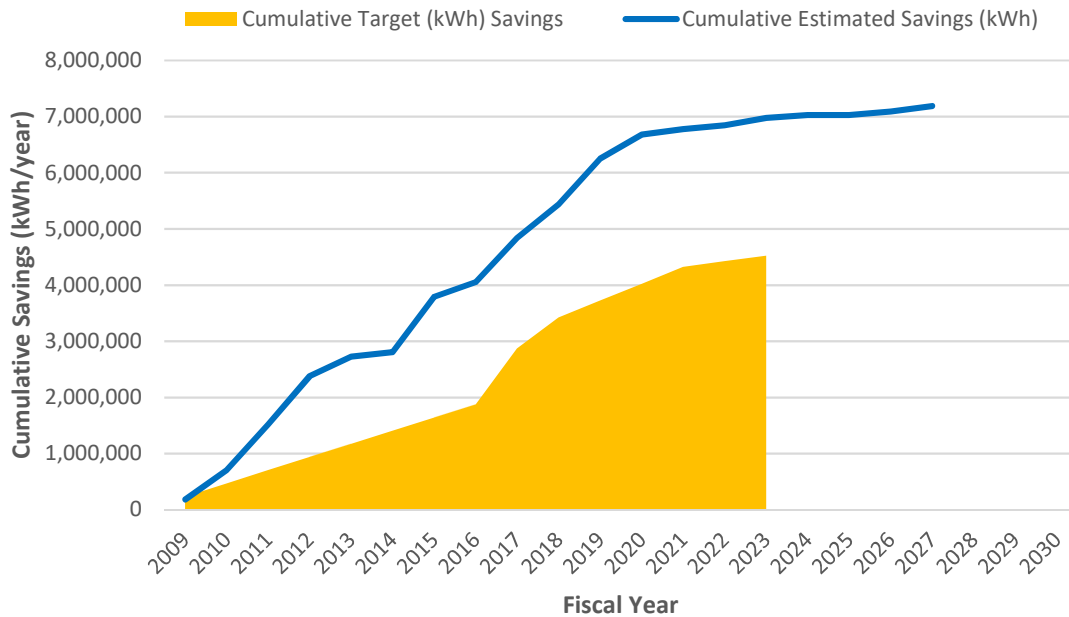
When considering asset renewal, more efficient, longer-lasting, and improved performance products are always sought. For example, since 2014 many of the electricity savings have been realized by renewing incandescent or high-pressure sodium lights with LED products. These savings continue year-over-year into the future. This accumulation of energy savings is a good indicator of the energy management program’s performance.

Based on electricity rates at the time energy projects and activities were completed, it is estimated the City has avoided spending over \$3.7 million in electricity costs since 2009.

The City has avoided over \$ 3.7 million in electricity costs as a result of conservation projects

As most of the larger City facilities have, or will soon have LED lighting technology implemented, future savings from these types of projects will become fewer as shown by the flattening of the blue line in Figure 2 which shows the predicted savings from 2022 to 2027 and takes into account projects currently budgeted in the 5-Year Capital Plan.

Figure 2: City Electrification Savings vs BC Hydro Target



The City recognizes that the annual conservation target is getting harder to reach as much of the low cost, easily implemented projects have been completed. For 2021, the estimated electricity savings from completed asset renewals equated to about 108,600 kWh against a target of 300,000 kWh savings.

With the reduced conservation target of the new Agreement, and based on the projects currently budgeted in the 5-year Project Plan, the City is intending to reach an average reduction of 100,000 kWh per year over the next five years. With the scheduled implementation of projects, savings per year will fluctuate, with some years achieving higher savings than others.

6.3 Fossil Fuel and GHG Emissions Reductions

The City is seen as an example for the community, striving to meet or exceed the community goals with available resources. Three years have passed since the declaration of a Climate Emergency however the City’s corporate emissions associated with Traditional Service-delivery have increased 6% over the benchmark year. There are a number of reasons for the increase in emissions. Nanaimo has experienced substantial population growth as one of the fastest growing cities in Canada. The City has also increased programming at facilities to meet increased demands. In addition, during the early years of the Energy Management program, much of the emphasis was on electricity conservation, which

helped to improve a building’s operational efficiency, but did not reduce emissions. This focus is reflected in the progress towards energy efficiency targets shown previously in Figure 2.

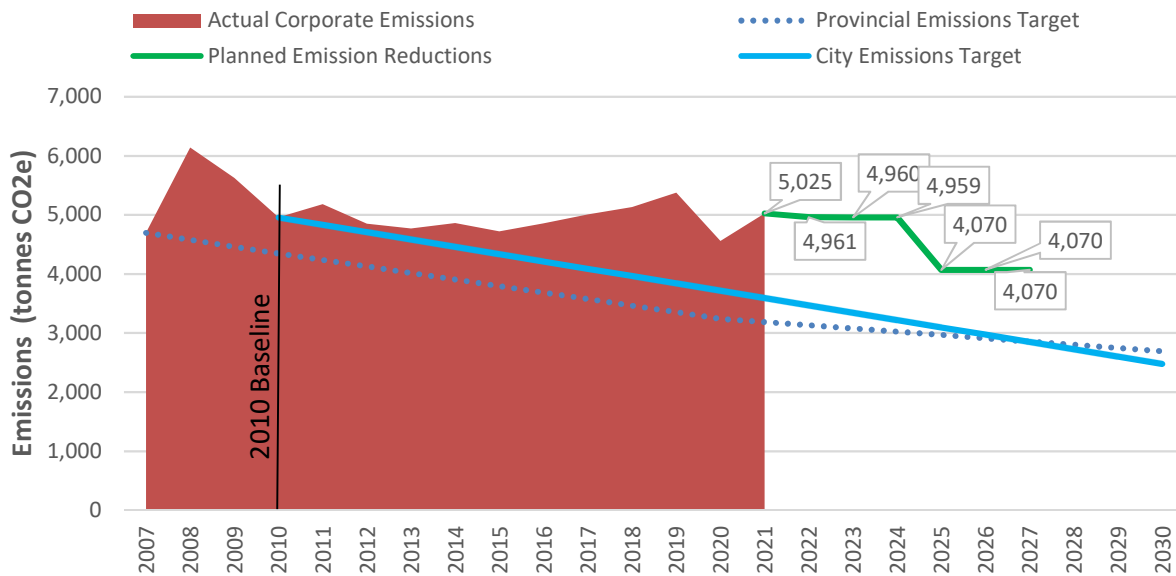
Action is needed now to replace fossil-fuel consuming equipment and vehicles with electric or other clean energy technologies if the City is to meet its 2030 climate action goals. 2023 includes a number of budgeted projects such as:

- A Corporate Carbon Reduction Pathways Study
- An Electric Vehicle Fleet Readiness Study
- Beban Park Recreation Complex – Heating, Ventilation and Air Condition Optimization and Feasibility Study

These initiatives and others are detailed in the Table 11: Multi-Year Action Plan Detailed Project List.

The City has been tracking and reporting emissions from Traditional Services to the Provincial Government since 2007. **To meet the 2030 goal of a 50% reduction of total corporate emissions, an average annual decrease of 318 tCO₂e between 2023 and 2030 will be required.** Implementing the emission reduction strategy at the Nanaimo Aquatic Centre will provide a reduction of approximately 800 tCO₂e annually, and it is anticipated that similar reductions will be available at Beban Park following the Optimization Feasibility Study planned for next year. Implementing these two projects combined would exceed the 2030 reduction targets, however cost associated is likely in excess of \$10million.

Figure 3: Greenhouse Gas Emissions - Traditional Services (tCO₂e)





As shown in the Figure 3: Greenhouse Gas Emissions – Traditional Services, the corporate emissions associated with the delivery of Traditional Services have increased 6% between 2010 and 2021. Possible reasons for this increase have been identified throughout Section 6. Budgeted projects fall short of the City’s annual reduction targets as shown by the green line in Figure 3; the Energy Team continues to seek alternate funding methods to support the emission reduction targets set by the City.

Reducing emissions based on replacing equipment near the end-of-service life would be sufficient to meet 2030 targets however, currently insufficient resources exist to achieve all these renewals. A more holistic approach would look at not only the best way to group energy and GHG reduction measures within buildings and fleet, but also how to strategically bundle projects to maximize the benefit for the City, while aligning with capital renewal plans.

Current planned emission reduction project opportunities are detailed in Table 11: Multi-Year Action Plan.

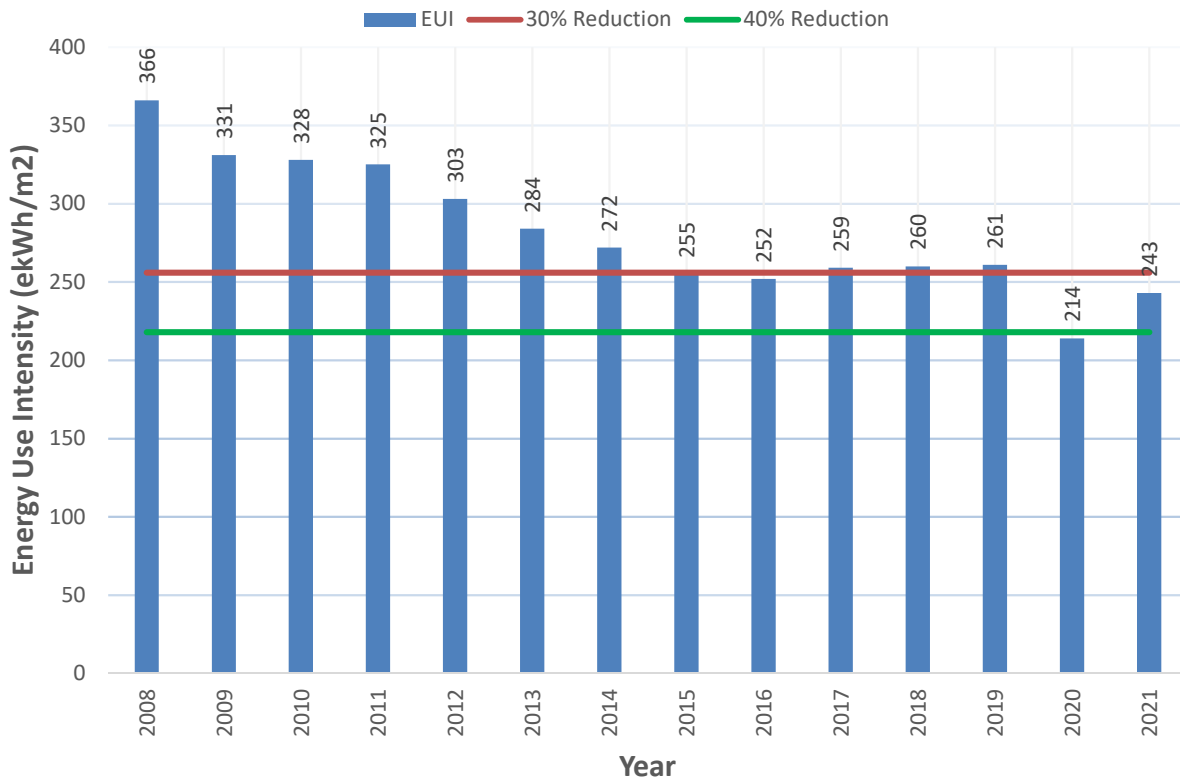
Since 2008, the City has completed a number of natural gas conservation projects and based on the billing rate of natural gas at the time these projects and activities were completed, the cumulative saving are estimated to be \$1,691,430.

6.4 Energy Use Intensity

One of the City’s key objectives is to improve each building’s energy efficiency based on floor area or Energy Use Intensity (EUI). The City has set a target to **reduce the averaged EUI** of 25 of the larger, strategic facilities by **30% to 40% below 2008 levels** by 2030.

Figure 4 illustrates the City’s overall progress toward meeting 2030 reduction target, shown below in red as a 30% reduction. A stretch target of 40% reduction is included in green. The City is making good progress, exceeding the collective target first in 2016, then again in 2020. Facility operations were impacted by the pandemic in 2020, and once service began to return to pre-pandemic levels the EUI increased (see 2021, Figure 4). Much of the progress to date has been at the larger recreation facilities including the pools and arenas. In coming years, similar efforts will be achieved in the smaller recreation facilities, fire stations, City Hall, performing arts facilities, and conference and meeting halls. By continually implementing improvements to operating efficiency of building assets, EUI is driven down illustrating the success of the City’s efforts.

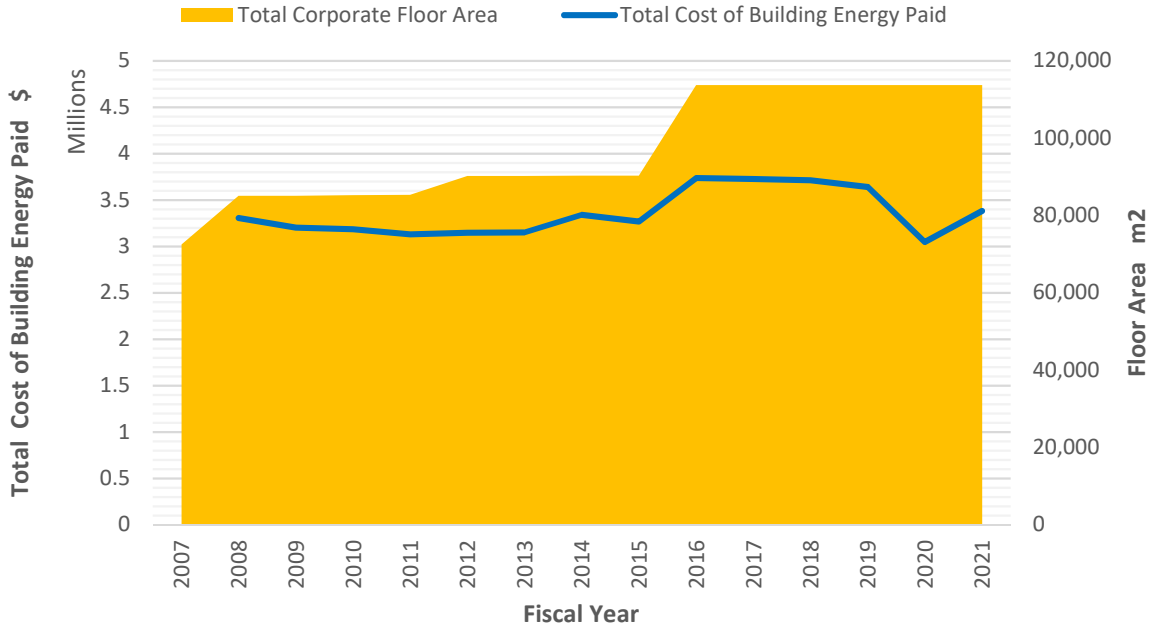
Figure 4: Energy Use Intensity (EUI) - Average of 25 Larger Strategic Facilities



Similar to emissions increasing with services increases and other growth, energy usage and EUI also increases with growth. If increasing programming within an existing facility can defer the need for a new facility to support the increased need, an increased EUI is not necessarily a bad thing. If the EUI increases but the usage hasn't changed, then a more detailed look is required. Continued improvements and behavioural education are essential to trying to maintain efficiency goals and carbon reductions.

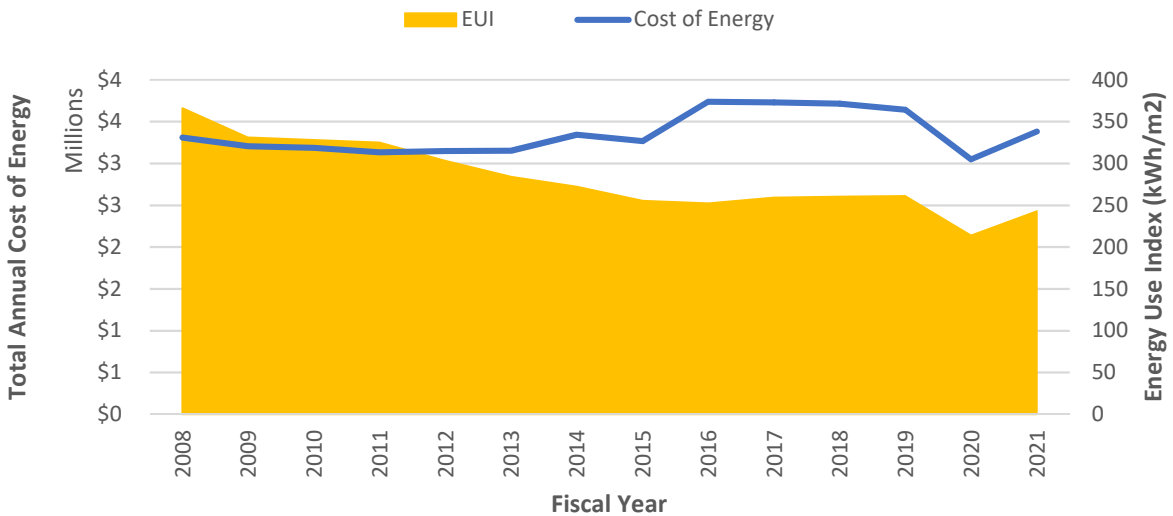
Figure 5 illustrates that the floor area associated with the facility portfolio has increased over the last 14 years. This additional area needs to be tempered (heated and cooled) requiring significant energy inputs. The City's GHG emission reduction targets are absolute and not based on EUI or other metric that allows for growth. Future construction of new facilities between now and 2030, will need to be as close as possible to net-zero GHG emissions for the City to achieve significant carbon reductions. Figure 6 shows how the City's EUI has been trending down since 2011. There was a flattening and slight increase between 2017 and 2019 however. Reported EUI and associated costs are not reliable indicators in 2020 and 2021 due to service interruption during the pandemic.

Figure 5: Total Floor Area and Total Cost of Building Energy



As Figures 5 and 6 include cost considerations, it is also important to note that the cost of electricity has increased 25.5% from 2014 to 2021. Even with these rates increases, the difference in the cost of total building energy consumption between 2008 and 2021, is only about 2.5%. While Figures 5 and 6 are total energy cost (natural gas and electricity), the electricity rate increases would have still translated into significant utility costs for the City had energy reduction measures not been implemented.

Figure 6: Energy Use Index (EUI) and Total Cost of Building Energy





It should be noted that the EUI metric is a preferred energy performance indicator compared to paid energy costs. The City can affect the operational efficiency of buildings but has no control over utility rates.

6.5 Combined Energy Sources - Portfolio Trends

Energy Use Intensity trends are also a useful tool to compare a facility's performance year over year. The following comparison tables and graphs for each facility group shows the baseline year, followed by the last 5 years of energy performance data. As the Energy Management Program began in 2008, this is the baseline year for buildings built before this time. For buildings built after 2008, the first full year of operation is the benchmark year. The acronyms used can be found in Appendix A: Site Acronyms

The EUI shown on the y-axis represents electricity and fossil fuels consumed to meet building needs divided by the floor areas. Building needs include heating, cooling, lighting, ventilation, domestic hot water, computers, building automation systems, and process loads. Process loads generally include all mechanical equipment like pump motors, actuation devices, electric vehicle charging equipment, refrigeration systems in ice arenas, elevators, and kitchen equipment.

The last bar for each facility represents the 30% reduction from the baseline goal.

6.5.1 Recreation Facilities

Recreation facilities, especially aquatics and arenas, have the highest energy needs and produce the largest amount of emissions due to their high use of natural gas. Overall, recreation facilities consume about 46% of the City’s corporate electricity use and 76% of the natural gas used in 2021. These buildings are also the primary source of energy reduction opportunities, and will yield the most significant source of corporate GHG emission reductions. The following graphs for each category of facility type illustrates the goal of reducing each facility’s energy use/m² of floor space, by 30%.

Figure 6: Recreation Facilities - 2008, 2017 to 2021 EUI Performance

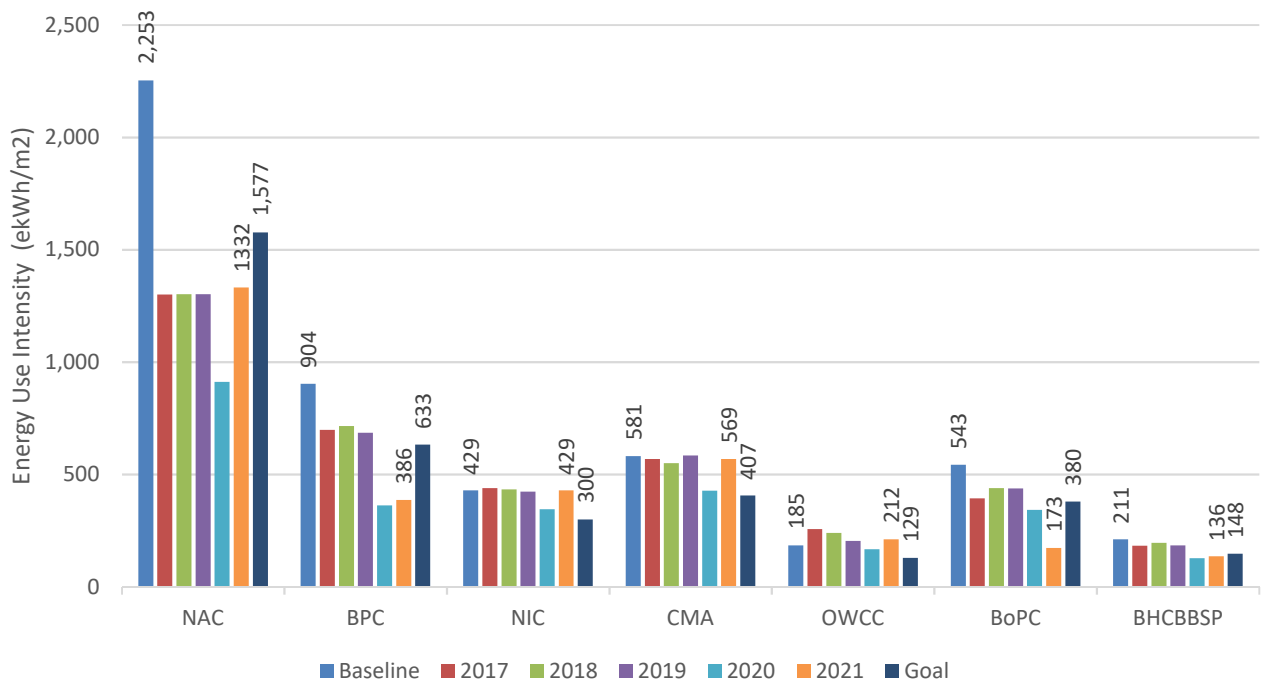


Table 3: Recreation Facilities - 2021

Facility	Floor Area (m ²)	Electricity (kWh)	Fossil Fuel (ekWh)	Total EUI (ekWh/m ²)	Total Cost (\$/m ²)	Emissions (tCO ₂ e)	Emissions (tCO ₂ e/m ²)
NAC	6,235	1,829,520	6,476,441	1,332	\$66.3	1,180	0.189
BPC	10,063	1,039,200	2,844,467	386	\$20.8	521	0.052
NIC	6,714	1,489,440	1,388,067	429	\$29.0	264	0.039
CMA	2,512	902,160	527,226	569	\$40.0	103	0.041
OWCC	3,392	478,800	239,724	212	\$18.6	48	0.014
BoPC	2,665	178,823	281,391	173	\$13.2	52	0.02
BHCBBSP	3,036	245,929	167,697	136	\$11.3	33	0.011

6.5.2 Emergency Services

Fire Rescue and Police Services provide 24-hour service to the public, and as a result require considerable energy use to operate these facilities. These facilities account for about 7% of the corporate electricity use, and 4% of the natural gas use in 2021. The new Fire Station No.1 opened in June 2022, eliminating the last large City facility using diesel oil for heating purposes and reducing GHG emissions. All remaining fire stations will be upgraded to LED lighting in the next few years, reducing Energy Use Intensity for each site. The Police Annex has increased its' EUI due to a reconfiguration of the internal spaces and significantly more staff occupying the building.

Figure 7: Emergency Services - 2008, 2017 to 2021 EUI Performance

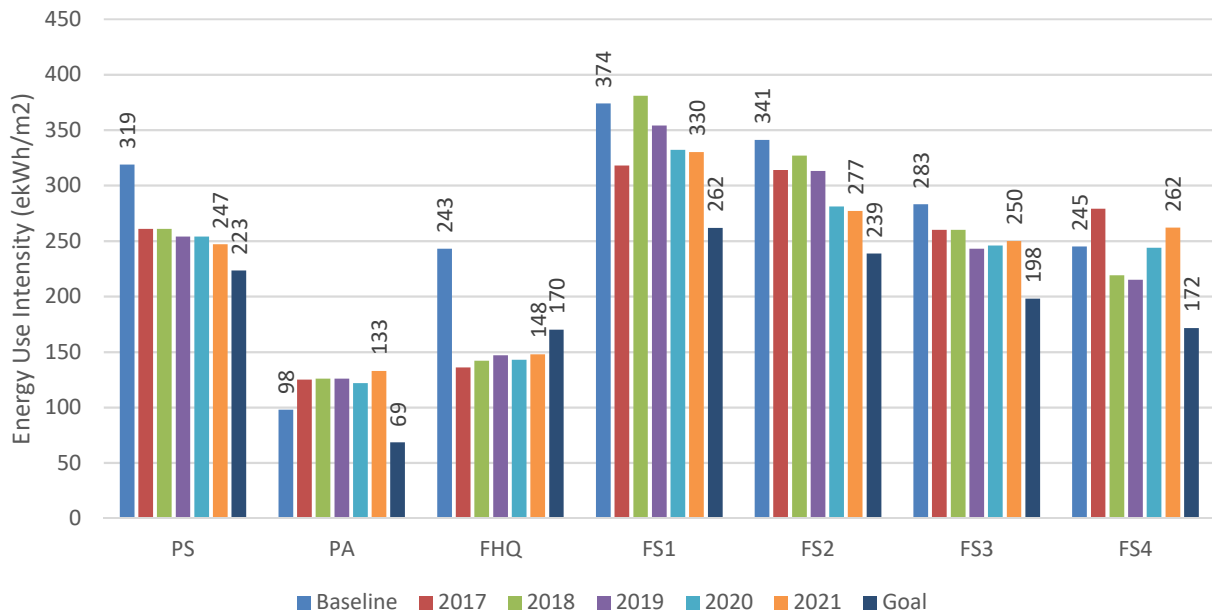


Table 4: Emergency Service - 2021

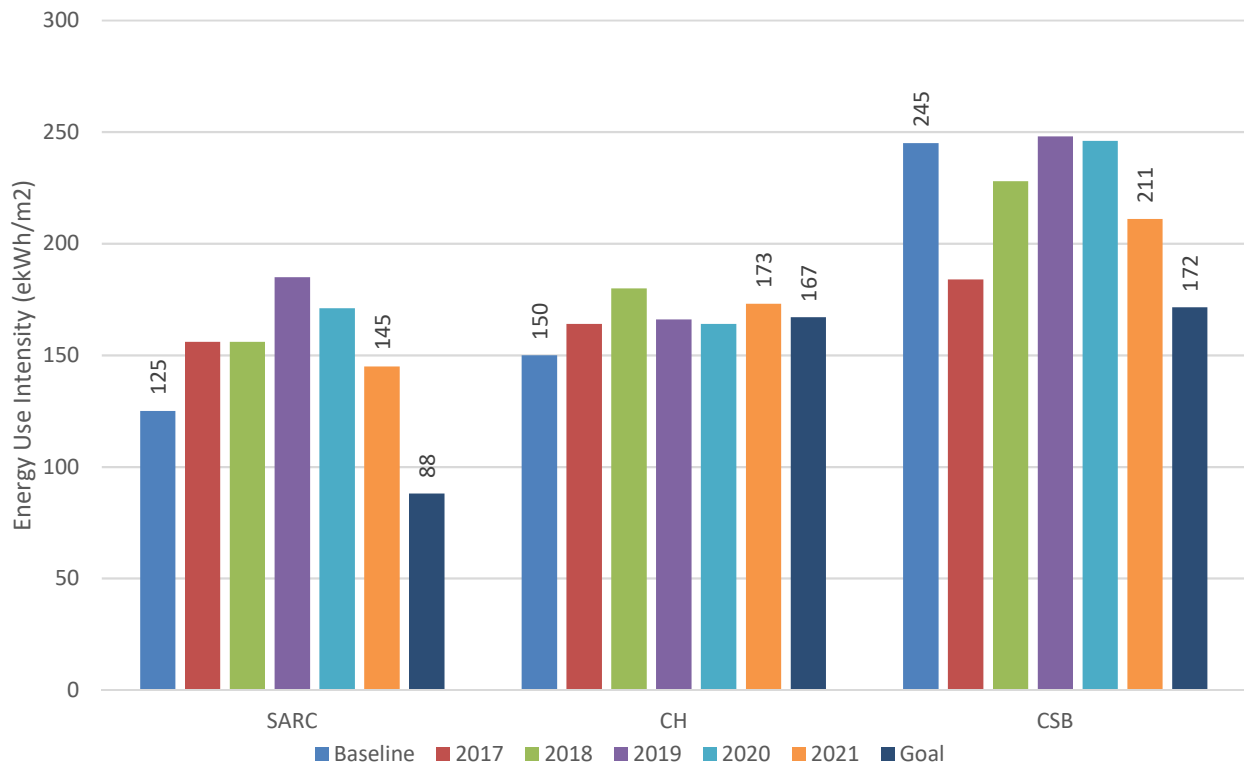
Facility	Floor Area (m ²)	Electricity (kWh)	Fossil Fuel (ekWh)	Total EUI (ekWh/m ²)	Total Cost (\$/m ²)	Emissions (tCO ₂ e)	Emissions (tCO ₂ e/m ²)
PS	3,976	842,040	140,557	247	\$26.3	33.4	0.008
PA	2,292	144,840	161,112	133	\$11.1	30.3	0.013
FHQ	651	83,177	13,333	148	\$15.8	3.2	0.005
FS1	1,382	181,860	290,280	342	\$49.1	64.8	0.047
FS2	727	78,960	122,501	277	\$21.7	22.8	0.031
FS3	658	60,893	103,612	250	\$19.2	19.2	0.029
FS4	820	108,660	105,834	262	\$22.3	20.1	0.024

6.5.3 Civic Buildings

Civic buildings generally serve the public Monday to Friday, 8 am to 4:30 pm. These facilities account for about 5% of the corporate electricity use, and 5% of the natural gas use in 2021.

Over the last few years, the Service and Resource Centre (SARC) building has seen an increase in use with more staffing being added to the building, therefore increasing EUI slightly. A lighting upgrade is planned for City Hall (CH) in 2025, which will decrease the building’s EUI. The Community Services Building (CSB) has been sold to BC Housing, and will be removed from the City’s inventory after this report publication.

Figure 8: Civic Office Buildings - 2008, 2017 to 2021 EUI Performance



Facility	Floor Area (m2)	Electricity (kWh)	Fossil Fuel (ekWh)	Total EUI (ekWh/m2)	Total Cost (\$/m2)	Emissions (tCO2e)	Emissions (tCO2e/m2)
SARC	4,862	633,120	71,945	145	\$13.4	20.2	0.004
CH	1,678	128,400	162,501	173	\$13.2	30.4	0.018
CSB	1,309	132,960	142,779	211	\$17.6	26.9	0.021

6.5.4 Parkades

These structures provide 24-hour parking year round. Overhead lighting remains on and the semi-enclosed parkades run exhaust fans to maintain acceptable air quality standards. These facilities account for about 5% of the corporate electricity use, and consumed no natural gas in 2021. Being that these facilities only use electricity for lighting, elevators, and some exhaust fans, minimal efficiency gains are expected in future since they already have LED lighting. Further decreases in lighting energy requirements are possible if controls and occupancy sensors are added in the next asset renewal cycle.

Figure 9: Parkades - 2008, 2017 to 2021 EUI Performance

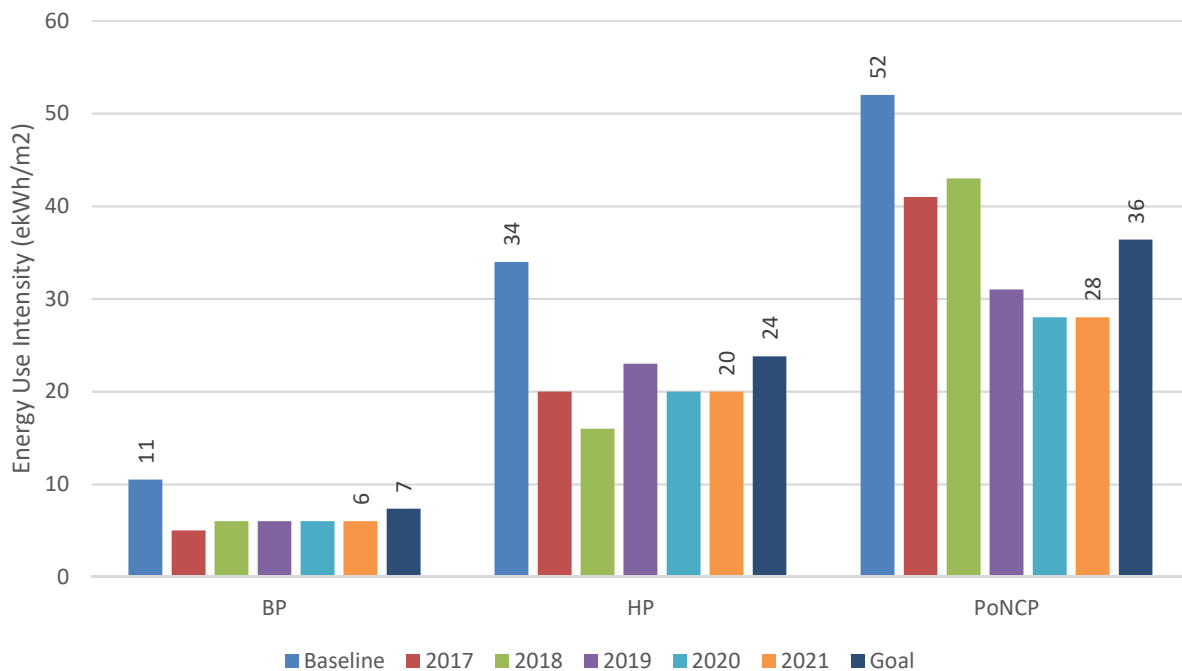


Table 6: Parkades - 2021

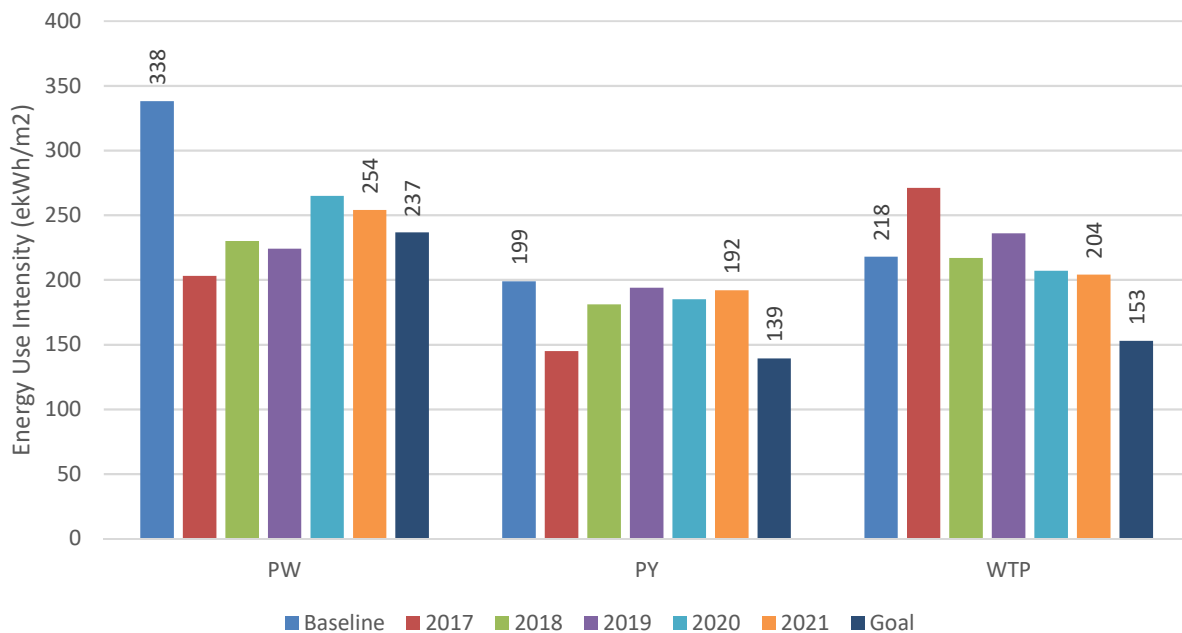
Facility	Floor Area (m ²)	Electricity (kWh)	Fossil Fuel (ekWh)	Total EUI (ekWh/m ²)	Total Cost (\$/m ²)	Emissions (tCO ₂ e)	Emissions (tCO ₂ e/m ²)
BP	9,711	54,293	0	6	\$0.64	0.53	0.0001
HP	11,976	245,501	0	20	\$2.36	2.38	0.0002
PoNP	11,816	326,160	0	28	\$3.17	3.16	0.0003

6.5.5 Operations

The Operations facilities have varied staff operating hours. Public Works Yard (PW) maintains coverage 24/7/365, primarily between 7:00 am and 4:30 pm including reduced staffing and a Commissionaire between 4:30 pm and 7:00 am. The Water Treatment Plant (WTP) operates with staff between 6:00am and 10:00pm.

Neither the Parks Operations Yard (PY) nor the Water Treatment Plant use natural gas so their emissions are relatively low. The Public Works site uses considerable natural gas for heating and could reduce its emissions considerably with electrification of heating. Installation of LED lighting would reduce electrical consumption and energy intensity however these decisions will depend on when phased building replacement is approved.

Figure 10: Operations - 2008, 2017 to 2021 EUI Performance



Facility	Floor Area (m2)	Electricity (kWh)	Fossil Fuel (ekWh)	Total EUI (ekWh/m2)	Total Cost (\$/m2)	Emissions (tCO2e)	Emissions (tCO2e/m2)
PW	3,454	564,231	311,391	254	\$20.8	61.4	0.018
PY	537	103,260	0	192	\$22.1	1.0	0.002
WTP	5,547	1,131,120	0	204	\$19.4	11.0	0.002

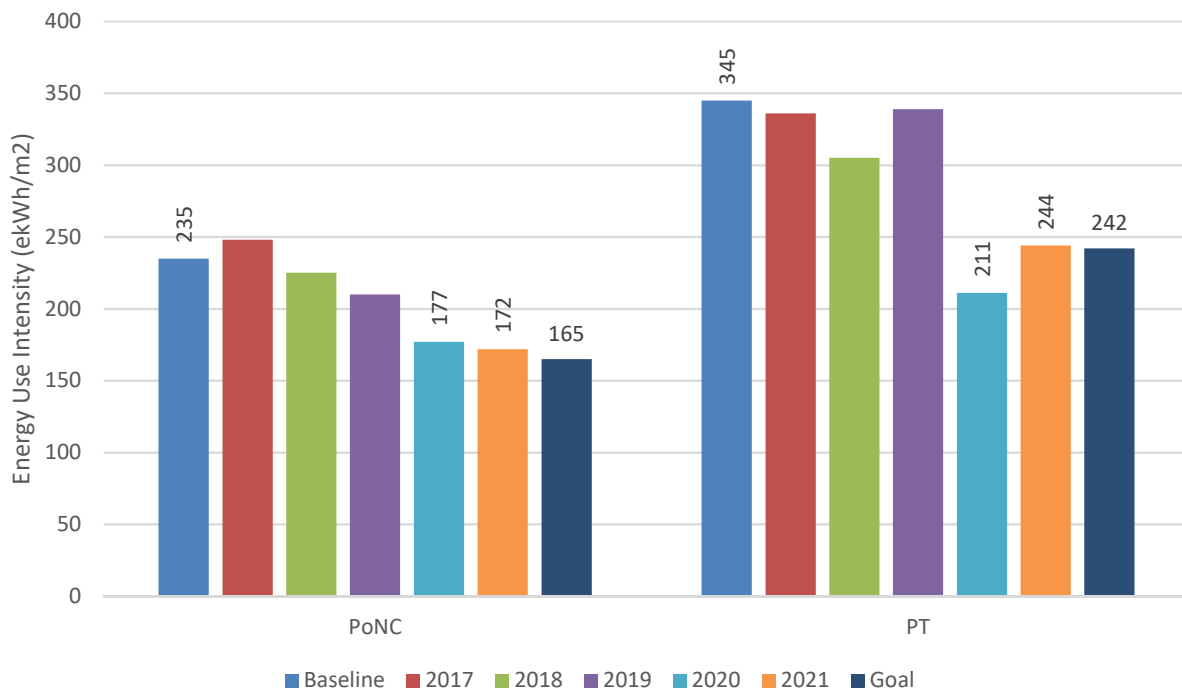
6.5.6 Conference Centre and Performing Arts

These buildings generally have regular staffing between 8:00 am and 4:30 pm throughout the week, and varied evening hours to accommodate events and performances 7-days a week.

The Port Theatre will have its new variable refrigerant flow heat pump system installed in 2022, which will improve cooling and heating using electricity. The existing natural gas boilers should perform as a backup heating source only when weather approaches low temperature conditions.

The Vancouver Island Conference Centre has a combination of electric heat pumps with natural gas backup heating. Opportunities for reducing emissions will be studied when asset renewals are being planned.

Figure 11: Port of Nanaimo Centre and Performing Arts - 2008, 2017 to 2021 EUI Performance



Facility	Floor Area (m ²)	Electricity (kWh)	Fossil Fuel (ekWh)	Total EUI (ekWh/m ²)	Total Cost (\$/m ²)	Emissions (tCO ₂ e)	Emissions (tCO ₂ e/m ²)
PoNC	8,658	1,059,180	437,504	173	\$14.49	89	0.010
PT	3,613	503,280	378,892	244	\$18.68	73	0.020

7. Benchmarking

To evaluate the effectiveness of efficiency measures implemented, it is necessary to monitor and compare individual building energy performance over time. Facility Benchmarking can be used to compare how each facility is currently performing against a *benchmark year* (a reference point) as well as its performance relative to other facilities of similar type outside the organization.

In general, there are several factors that come into play when comparing facilities, including such things as building design, location, climate, building age, type of construction, operating equipment type and condition, building controls, hours of use, and occupancy levels. While a building’s energy use performance can be normalized to account for fluctuations in weather, this has not been undertaken for this report. In addition, capturing changes in building use, services and programming, and occupancy levels is not readily feasible and has, therefore, not been factored into each building’s energy performance.

The report includes benchmarking comparisons based on billed energy use compared with six other local governments (City of Kamloops, City of North Vancouver, City of Port Coquitlam, City of Trail, City of Abbotsford, and the Capital Regional District) that are also monitoring their building energy consumption with PUMA.

The 2021 median EUI for each local government building category is shown in Table 9: Local Government Buildings – EUI Benchmarking. Overall, the City’s facilities have comparable EUIs to the other reporting municipalities. Nanaimo’s City Hall/Civic Office Spaces are lower than the comparables, while Arenas and Rinks are slightly above the average. Average recreation centres, however, have significantly higher EUI than the other reporting municipalities. This is because of the range of use included within this category; two community centres, and two indoor pools. While Community Centres are very close to the other reporting municipalities at approximately 275 kWh/m², the indoor pools have significantly greater consumption, 1,350 kWh/m². These two indoor pools are the City’s largest two consumers of energy, and the two main targets of the City’s energy and emission reduction strategies.

Table 9: Local Government Buildings – EUI Benchmarking				
Local Government Building Type	2021 Average Energy Use per m2 (EUI) - Overall	Overall Number of Buildings in 2021 Sample	2021 Average Energy Use per m2 (EUI) - Nanaimo	City of Nanaimo Buildings in 2021 Sample
City Halls /Civic Office Space	236 kWh/m ²	7	160 kWh/m ²	2
Social and Meeting Halls	244 kWh/m ²	17	194 kWh/m ²	2
Arenas and Rinks	419 kWh/m ²	7	506 kWh/m ²	2
Recreation Centres	372 kWh/m ²	27	772 kWh/m ²	4

If a building's EUI is above the median, it might be a good candidate for energy saving opportunities. If the EUI is below the median, the building may be a good example of energy efficiency leadership.

In addition to PUMA, the City has recently connected its 25 largest building sites (with gross floor areas near to or greater than 10,000 ft²) to *Energy Star Portfolio Manager* and *Building Benchmarking BC*, to share and compare building performance data with other municipalities in BC and across the country.

8. How does the City get there?

Given progress to date, to reduce corporate emissions by 50%-58% of the City's 2010 baseline by 2030, the City must cut emissions on average by approximately 318 tCO₂e each year from 2023 to 2030. In order to reach the 2030 to 2050 targets significant efforts and investments are required in the following

<h3>Optimize Existing Assets</h3>	<ul style="list-style-type: none"> • Maintain an ongoing continuous optimization program with staff to ensure equipment and systems are operating as per design
<h3>Efficiency & Electrification</h3>	<ul style="list-style-type: none"> • Replace end-of-service life equipment with more efficient models • Renew mechanical and electrical systems with more efficient design options • Switch to "electric" heating system to displace the use of fossil fuels
<h3>Deep Retrofits</h3>	<ul style="list-style-type: none"> • Convert to lower temperature heating systems, where possible • Upgrade building envelopes when deemed appropriate
<h3>Renewables</h3>	<ul style="list-style-type: none"> • Install renewables like solar photovoltaic, geo-exchange, and wastewater heat recovery and cooling systems where suitable • Secure Renewable Natural Gas for 2030 and beyond to cover shortfall in GHG reductions

areas:

The Energy Team has been working diligently to implement and influence the first two items outlined above. In recent years several Low-Carbon Electrification studies for heating, ventilation and air conditioning (HVAC) systems at several larger facilities identified some significant renewal opportunities towards reaching this target. However, to complete entire building and fleet portfolio carbon reduction plans requires three (3) more studies:

1. A Carbon Reduction Pathways study (major facilities using natural gas)
2. An Electric Vehicle Fleet Suitability Assessment study for medium and heavy duty vehicles
3. A Beban Park Recreation Complex – Heating, Ventilation and Air Condition Optimization and Feasibility study

These studies will enable the City to holistically determine carbon reduction priorities that align best with asset renewal plan across the buildings and fleet portfolios, and establish costs and optimal sequencing for implementation.

In addition, a building energy modelling study was completed in 2020 for Beban Park Recreation Complex which included options and respective costs for building envelope upgrades. This facility was built in 1976 and is the second highest consumer of energy and emitter of GHG emissions.

Electrification highlights the need for conserving electricity. By conserving electricity in other areas of operations, electrical capacity can be freed up to ensure there is sufficient power for the systems that replace those driven by fossil fuels. Overall, energy conservation still remains a core component of the City's energy management program, strategically balanced with emission reduction. Switching from using fossil fuels to clean electricity will help reduce carbon taxes being paid. Electricity reduction will help offset some of the operating costs. Both initiatives are required to be fiscally prudent.

To be effective in achieving results there are a number of key areas that need to be considered; funding, project planning and analysis, project prioritization, and guidelines and policy review.

8.1 Funding

The funding required to implement projects and renew equipment to achieve the 2030 emissions target will not be completely solidified until the three studies recommended at the beginning of this section have been completed. The projected costs of the recommended initiatives will depend on the scope, accuracy of details, and market conditions at the time of implementation.

8.2 Planning and Analysis

Short and long term plans must be carefully developed and include detailed study, preliminary design, and probable construction cost estimates to facilitate prioritization of projects within the 10-Year Capital Plan. Verification of completed projects through monitoring and analysis will also be key to ensure that investments are performing as designed to reach performance targets.

Full life-cycle financial analysis, along with input from operations and maintenance personnel should also be included in the decision making process. To allow a more accurate financial analysis, the use of carbon pricing in alignment with senior government's plan to increase carbon tax \$15/tCO₂e annually should be included, as it presents a more accurate life-cycle cost considering the entirety of the fuel costs.

8.3 Project Prioritization

The Energy Team and stakeholders need to continually seek opportunities that can lower GHG emissions. Identifying low and zero-carbon initiatives in varying states of readiness to implement, can provide value and maximize reduction opportunities.

Strategic project planning is a key component of decarbonizing the City's facilities and assets; however, the availability of funds to implement low-carbon solutions will be a constraint. Limited resources further emphasizes the importance of prioritizing asset renewals to ensure maximum, economical service lives are realized while minimizing impacting levels of service at facilities.

Typically, energy reducing projects are funded from General Revenue. In 2021, Council approved renaming the Emissions Reduction Reserve to the *Climate Action Reserve Fund, Bylaw No. 7330*, which supports emissions reducing projects. Emissions reducing projects typically have a higher price tag than regular efficiency renewals, careful planning and strategic budgeting is an important consideration when prioritizing projects.

8.4 Guideline and Policy Review

Developing guidelines and policy for decision-making on all capital projects with energy and emissions-implications will apply the correct climate lens to each capital project, whether renewing existing assets or building new. Thorough planning is necessary to ensure consistency in prioritizing project risks and implementation schedules to meet required targets.

9. Building Portfolio Changes

There have been a number of changes in the portfolio this year, as well as proposed changes for the future. They are outlined here.

9.1 Fire Station No.1

Occupancy of the newly built Fire Station No.1 building was gained in June 2022. It will house Fire Rescue Command, Fire Dispatch, Office and Administration/Business Centre, and the City of Nanaimo's Emergency Coordination Centre. The new station floor space is 2,140m², whereas the old one was 2,033 m².

The new building received financial support from BC Hydro's New Construction Program to complete energy modelling as part of the design process, and identified Energy Conservation Measures (ECMs) which were implemented.

The new facility uses a variable-refrigerant flow electric heat pump system for space heating, and is expected to save approximately 67,500 kWh/year of electricity and an additional 2,317 ekWh/year in



fuel savings. The old Fire Station used a home heating fuel (HHF, diesel) boiler system. In 2021, 24,065 L of HHF was consumed, producing 63 tCO_{2e}.

9.2 Nanaimo Operations Centre

This project is in the preliminary design phase. If the project is approved to proceed, steps will be taken to ensure operational efficiency and low and zero-carbon solutions are implemented.

Opportunities to participate in incentive or grant programs will be sought for this project.

9.3 Community Services Building

The property and building was sold to BC Housing and will be removed from the City's portfolio of facilities. Demolition of the building occurred in July 2022.

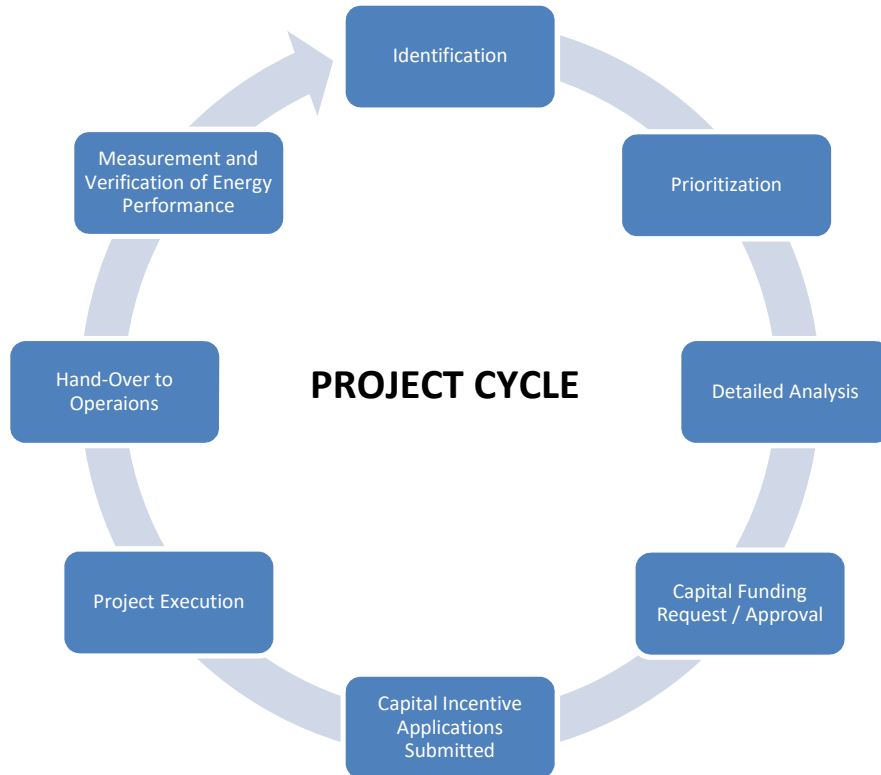
9.4 Departure Bay Activity Centre

After a building fire on March 2022, the existing building at 1415 Wingrove Street was demolished in October, 2022. This facility will not be rebuilt, and alternate opportunities will be sought.

9.5 Harewood Activity Centre

This building at 195 Fourth Street received extensive upgrading in 2021/22, and is now being used by Nanaimo Search and Rescue. The building's utility costs are being paid by the tenant. The building's old natural gas boiler system was removed, and a new electric heat pump with natural gas backup was installed.

10. Project Planning



10.1 Identification of Energy Projects

Energy projects are identified through several streams:

- **Energy Audits:** A detailed analysis of building operations carried out by a qualified engineering consultant that seeks opportunities and assesses the technical and financial viability of energy and emissions saving opportunities.
- **Capital Projects:** The Energy Team applies an energy-efficiency and emissions reduction lens to renovations, retrofits and asset replacements. This lens is made up of the City's green and sustainable building objectives, policies, and climate objectives.
- **Facility Operators:** Integration of staff knowledge and experience with energy consuming systems, building components, unique facility use circumstance.

10.2 Prioritization of Energy Projects

Projects need to be prioritized to match the needs, service levels, and climate action targets set by the City. Some of the key elements considered are:

1. End of life and asset renewal cycles.
2. Risk associated with of failure of the asset.
3. GHG reductions available.
4. Energy savings potential.
5. Fiscal performance (operations and maintenance savings, marginal capital cost increase, total cost of ownership).

Upon identification and prioritization of projects, a more detailed engineering and preliminary costing analysis is carried out to confirm technical feasibility, and quantify energy savings and emission reductions in an effort to minimize risks and uncertainty. This further analysis ultimately lends itself to improved strategic project planning, selection, and delivery. Study costs can sometimes be supported with financial assistance from BC Hydro, FortisBC, Natural Resources Canada, CleanBC, and other programs. Once a study is complete and the project benefits have been confirmed, further capital incentive funding is sought through available application processes.

The City's overall performance is measured by trending *key performance indicators* over time. The Energy Team also evaluates the performance of individual projects based on avoided energy consumption (reductions in kWh or GJ of energy); comparing the energy consumption values before and after construction. This then allows calculation of the emissions reduction resulting from the project.

10.3 Multi-Year Action Plan

Each year, the Energy Team meets with Facility Managers and Operations and Maintenance staff to discuss strategic priorities and provide updates to the Multi-Year Action Plan. The Multi-Year Action Plan identifies electrical and fossil fuel energy saving opportunities, and the projected GHG emissions and electricity reduction from currently approved capital projects. The Multi-Year Action Plan evolves as new and potentially better opportunities are uncovered through energy studies and advances in technology.

The five-year financial plan is reviewed and approved annually. Each year the annual budget is also approved, providing authority to spend that year's funding. This includes the projects shown in the first year of the Multi-Year Action Plan. Future projects occurring in years 2-5 of the financial plan are anticipated to proceed, however require approval of the annual budget before being confirmed.

Table 10 highlights the projected results from planned initiatives from 2022 to 2025.

Table 10: Multi-Year Action Plan Projected Results						
Key Performance Indicators	Annual Target	2022	2023	2024	2025	4-Year Average
TRADITIONAL SERVICES						
GHG Emission Reductions (tCO ₂ e)	318	66	1.2	0.3	889.2 ⁵	239
Energy Use Index (EUI) Reduction (kWh/m ² /year)	12.0	8.8	1.1	0.3	44	14
Electrical Savings (kWh/year)	100,000	131,859	127,287	31,747	20,239	77,783
Fossil Fuel Savings (GJ/Year)	4,572	3,112	0 ⁶	0 ⁶	18,058	5,293
Low-carbon Electrification (kWh/year)	-200,000	-38,415	0 ⁶	0 ⁶	-1,172,727 ⁵	-302,786
Investment Required		\$941,024			\$5,600,000	
City Funds		\$908,316	\$469,420	\$270,497	\$1,493,520	
Grant Funds (Note: for 2025 project Clean Communities Fund application submitted)			\$32,708		\$4,106,480	
NON-TRADITIONAL SERVICES						
GHG Emission Reductions (tCO ₂ e)		105				
Electricity Savings (kWh/year)		0				
Fossil Fuel Savings (GJ/Year)		2,145				
Low-carbon Electrification (kWh/year)		-135,897				
City Funds		\$1,050,000				
Clean BC Grant Incentive Funding			\$74,640			

The goals planned for 2023 and 2025 in Table 10 are set using SMART (specific, measurable, achievable, realistic, time-bound) methodology, and **while attainable, will not be achieved without operational changes and additional capital funding.**

⁵ The Energy Team has identified a low-carbon electrification project at Nanaimo Aquatic Centre that would make significant progress towards reducing the GHG Emissions over the next four years. This project is included in the budget, however is contingent on a successful grant application to the Clean Communities Fund.

⁶ Zeros indicate no currently planned projects with completed designs for the applicable category in the listed year. Projects may be planned, but without completed designs, the energy impact is not yet known.

As shown in Table 10, Electrical Savings are expected to be met for the next two years (2022 and 2023) but it will soon get more difficult to achieve significant kilo-Watt-hour savings once all the buildings have been equipped with LED lighting unless deeper retrofits like upgrades to building enclosure are done.

Table 11 is the current project list of the Multi-Year Action Plan. Projects highlighted in yellow fall into the “low carbon electrification” category and may qualify for current provincial incentives under the new Clean BC program.

Table 11: Multi-Year Action Plan Detailed Project List									
2022 - 2032 Multi-Year Action Plan Detailed Project List					Activity: D = Design C = Construction S = Study B = Behavioural				
Year	Program Type	Location & Project Description	In Cap. Plan?	Estim'd Project Cost	Year Costed	Activity Type	Saved kWh/yr	Saved GJ/yr	Saved tCO2e/yr
2022	City Funded	NAC - LCE Study of RTU #6, #8 and MUA #1	N	TBD	2022	S	TBD	TBD	TBD
	City Funded	Replace RTU #6 (Fitness Gym) , #8 (Physiotherapy office) and MUA #1 (Basement Mech. Space)	Y	TBD		C			
	CleanBC Custom	PT - Replace Chiller with VRF HP System	Y	\$1,042,005	2020	C	-135,897	2,145	106
	City Funded	NAC HVAC Renewal and Optimization Study	Y	\$50,000	2022	S			
	FS1	Decommission and remove old HHF Boiler	Y						63
	BCH CNC	FS-1 Replace Fire Station #1 - ECMs developed New Construction Program Energy Modelling Agreement with BC Hydro	Y			C	67,425		1.48
	City Funded	FS 2 - Replace RTU #1	Y	\$15,800		D & C			
	City Funded	FS 3 - Replace RTU #1	Y	\$13,900		D & C			
	BCH Custom	NAC - Interior Lighting Upgrade (remaining areas)	Y	\$45,815	2019	C	32,558	0	1.5
	BCH Custom	BP - Interior Lighting Upgrade	Y	\$86,709	2021	C	70,134	0	0.7
2022 Total				\$1,254,229			34,220	2,145	173
2023	City Funded	NAC - HVAC Renewal - AHU-1 and AHU-2 with heat recovery, partial ASHP, condensing boiler retrofit	Y	\$200,000	2022	D			
	City Funded	BPRC - HVAC Optimization and Feasibility Study	Y	\$100,000	2022	S			
	City Funded + BC Hydro Funding	EV Ready Fleet Study	N	\$50,000	2022	S			
	City & Grant?	Carbon Reduction Pathways Study	N	TBD		S			
	City Funded	CMA - Interior Lighting Upgrade	Y	\$162,300	2020	C	54,624	0	1.2
	City Funded	150 Commercial St - Replace RTU #1 - serves basement	Y	\$22,900		C			
	City Funded	BP - Upgrade Parking Lot Lighting - (Pool, SC and entrance)	Y	\$142,100	2020	C	3,430	0	0.19
	City Funded	OWCC - Interior Lighting Upgrade - remaining areas	Y	\$152,900	2019	C	69,233	0	1.52
	City Funded	SARC - Recommission HVAC to improve air flow and heating/cooling inconsistencies.	Y	\$42,800	2021	C	TBD		
	City Funded	PS - Renewal of heat pumps HP-0-01 and HP-2-06.	Y	\$26,200		C			
	City Funded	NIC - Replace heat pump unit #2 (Server Room)	Y	\$8,300		C			
	City Funded	NAG - Roof top unit #1 - services basement, replace with heat pump	Y	\$54,100		C			

Table 11: Multi-Year Action Plan Detailed Project List

2022 - 2032 Multi-Year Action Plan Detailed Project List				Activity: D = Design C = Construction S = Study B = Behavioural					
Year	Program Type	Location & Project Description	In Cap. Plan?	Estim'd Project Cost	Year Costed	Activity Type	Saved kWh/yr	Saved GJ/yr	Saved tCO2e/yr
	City Funded	Caledonia Park - replace forced air furnace	Y	\$5,700		C			
	City Funded	Bastion - Remove and dispose of existing wall wash lights and install with new marine grade lights.	Y	\$19,500		C			
	City Funded	Envir. - Replacement of Unit 154 (Dodge Journey) with EV	Y	\$52,000					
	City Funded	RCMP - Replacement of Unit 155 (Dodge Grand Caravan) with EV	Y	\$52,000					
	City Funded	Replace Unit #203	Y	\$65,000					
	City Funded	Replace Unit #229	Y	\$80,000					
	City Funded	Replace Unit #251	Y	\$80,000					
	City Funded	Replace Unit #296	Y	\$65,000					
	City Funded	Roads - Replacement of Unit 297 (Toyota Tacoma Pickup) with EV	Y	\$52,000					
	City Funded	Water - Replacement of Unit 298 (Toyota Tacoma Pickup) with EV	Y	\$52,000					
	City Funded	Replace Unit #211	Y	\$60,000					
	City Funded	Roads - Replacement of Unit 215 (Dodge Ram 1500) with EV	Y	\$60,000					
	City Funded	Replace Gator with electric version	Y	\$24,500					
2023 Total				\$1,629,300			0	0	0
2024	City Funded	CH - Interior Lighting Upgrade	Y	\$98,100	2019	D & C	20,239	0	0.45
	City Funded	FS 2 - Interior Lighting Upgrade	Y	\$51,500	2019	D & C	7,481	0	0.16
	City Funded	FS 3 - Interior Lighting Upgrade	Y	\$43,200	2019	D & C	4,699	0	0.1
	City Funded	FS 4 - Interior Lighting Upgrade	Y	\$78,500	2019	D & C	19,567	0	0.43
	City Funded	PW - Replace AHU #1 - Admin Area	Y	\$46,300		C			
	City Funded	PW - Replace AHU #2 - Admin Area	Y	\$46,300		C			
	City Funded	PW - Replace AHU #3 - Admin Area - serves hallway and offices	Y	\$46,300		C			
	City Funded	PW - Replace AHU #5 - Admin Area	Y	\$46,300		C			
	City Funded	PW - Replace AHU #4 - Admin Area - serves south offices	Y	\$39,900		C			
	City Funded	Comox Park - replace forced air furnace	Y	\$5,900		C			
	City Funded	Elaine Hamilton Park - replace forced air furnace in washroom fieldhouse	Y	\$5,900		C			
	City Funded	CMA - Replace 2 Natural Gas Furnaces	Y	\$33,000		C			
	City Funded	PT - Replace 2 Natural Gas Boilers	Y	\$124,800		D & C			
	City Funded	Parks Ops - Replacement of Unit 104 (Nissan NV200) with EV	Y						
	City Funded	Parks Ops - Replacement of Unit 108 (Nissan NV200) with EV	Y						
	City Funded	Bylaw - Replacement of Unit 117 (Nissan Leaf) with EV	Y						
	City Funded	Engineering - Replacement of Unit 151 (Dodge Journey) with EV	Y						
City Funded	Construction - Replacement of Unit 246 (GMC Canyon Extra Cab 2 WD) with EV	Y							

Table 11: Multi-Year Action Plan Detailed Project List

2022 - 2032 Multi-Year Action Plan Detailed Project List				Activity: D = Design C = Construction S = Study B = Behavioural					
Year	Program Type	Location & Project Description	In Cap. Plan?	Estim'd Project Cost	Year Costed	Activity Type	Saved kWh/yr	Saved GJ/yr	Saved tCO2e/yr
	City Funded	Water - Replacement of Unit 250 (GMC Canyon Extra Cab 4 wd) with EV	Y						
	City Funded	Parks Ops - Replacement of Unit 254 (Ford F150 Ext Cab 2 wd) with EV	Y						
	City Funded	Sewer - Replacement of Unit 282 (Ford F150 Ext Cab 2 wd) with EV	Y						
2024 Total				\$666,000			51,986	0	1.14
2025	City Funded	CMA - Investigate options for mechanical conversion to low charge or CO2 with considerations for cooling tower and rink slab replacement.	Y	25,000		S			
	City and CleanBC Funded	NAC HVAC Renewal - AHU-1 and AHU-2 with heat recovery, partial ASHP, condensing boiler retrofit	Y	5,400,000	2022	C			889
	City Funded	Large Rec Centres - Buildings - Recommissioning Studies	N	TBD		S			
	City Funded	BP Kin Pool - Replace Boiler	Y	\$175,600	2019	C			
	City Funded	NCC - Replace Boiler	Y	\$354,000		D & C			
	City Funded	PT - Replace two natural gas boilers	Y	\$127,300	2019	C			
	City Funded	NIC – Replace heat pump unit (Unit #1 offices)	Y	\$10,600		C			
2025 Total				\$6,092,500			0	0	889
2026	City Funded	CMA - Renew DHW tank	Y	\$36,600		C			
	City Funded	NIC - Replace AHU - RTU	Y	\$240,000		C			
	City Funded	PT - Interior Lighting Upgrades - Theatre House Lights	Y	\$293,100	2021	C	63,905	0	1.41
	City Funded	NIC 1 - Replace 6 natural gas tube heaters	Y	\$81,100		C			
	City Funded	NIC 2 - Replace 3 natural gas tube heaters	Y	\$40,600		C			
2026 Total				\$691,400			63,905	0	1.4
2027	City Funded	PW - Replace 6 gas radiant heaters in Tire Storage Shop with radiant electric heating panels	Y	\$43,800		C			
	City Funded	PS - Replace hot water tank (domestic water unit)	Y	\$15,500		C			
	City Funded	PS - Replace Boiler	Y	\$27,300		D & C			
	City Funded	NAC - Replace AHU #3 - Change Room	Y	\$43,200		D & C			
	City Funded	NAC - Replace AHU #4 - Kitchen/Cafeteria	Y	\$43,200		D & C			
	City Funded	NAC - Replace AHU#7 - Multipurpose Room A & B	Y	\$29,700		C			
	City Funded	NAC - Replace MAU 2 (dry side)	Y	\$66,400		C			
	City Funded	NAC - Replace MAU #2	Y	\$66,300		D & C			
	City Funded	FCA - renew all remaining non-LED lighting	Y	\$204,700		C			
	City Funded	NIC - Replace cooling tower	Y	\$379,000		C			
	City Funded	BPRC SC - Renewal of lighting that is non-LED	Y	\$231,000		D & C			
	City Funded	BPRC SC - Upgrade Theatrical Lighting	Y	\$63,700	2021	D & C			
2027 Total				\$1,213,800			0	0	0

Table 11: Multi-Year Action Plan Detailed Project List

2022 - 2032 Multi-Year Action Plan Detailed Project List					Activity: D = Design C = Construction S = Study B = Behavioural				
Year	Program Type	Location & Project Description	In Cap. Plan?	Estim'd Project Cost	Year Costed	Activity Type	Saved kWh/yr	Saved GJ/yr	Saved tCO2e/yr
2028	City Funded	Animal Shelter - Replace oil furnace with heat pump or natural gas	Y	\$25,000	2017	C			
	City Funded	Police Ops - Renewal of heat pumps HP-1-02 and HP-1-15	Y	\$30,700		C			
	City Funded	PS - Renewal of seven (7) roof top units	Y	\$117,200		C			
	City Funded	PS - Replace air handling unit #1.	Y	\$55,700		D & C			
	City Funded	PS - Replace air handling unit #2.	Y	\$79,300		D & C			
	City Funded	PS - Replace make-up it unit #1.	Y	\$74,200		D & C			
	City Funded	OWCC - Replace water cooled multistack heat pump - Unit 301 - Gym 1	Y	\$39,000		C			
	City Funded	OWCC - Replace water cooled multistack heat pump - Unit 302 - Gym 2	Y	\$39,000		C			
	City Funded	OWCC - Replace cooling tower	Y	\$155,000		C			
	City Funded	BP - Replace AHU #4	Y	\$160,400		D & C			
	City Funded	Robins Park - Replace forced air furnace	Y	\$6,300		C			
	City Funded	BPRC SC - Replace Carrier Chiller #1 and #2	Y	\$232,200		D & C			
	City Funded	NIC - Replace Boiler & tank system #1	Y	\$126,400		D & C			
	City Funded	NIC - Replace Boiler & tank system #2	Y	\$126,400		D & C			
	City Funded	PT - Interior Lighting Upgrade - Theatre Common Areas	Y	\$290,000		D & C			
2028 Total				\$1,556,800			0	0	0
2029									
	City Funded	PW - Replace Trane Furnace in Signs and Lines Area	Y	\$18,000	2020	C			
	City Funded	BP Kin Pool - Replace natural gas hot water tank	Y	\$11,500	2020				
2029 Total				\$29,500			0	0	0
2031	City Funded	FS 3 - Replace Natural Gas Furnace	Y	\$13,500		C			
	City Funded	BPC - Replace AHU#5	Y	\$18,700		D & C			
	City Funded	NAC - Replace AHU #6 - Fitness Gym	Y	\$47,000		D			
	City Funded	BoP - Replace AHU #1	Y	\$54,000		C			
2031 Total				\$133,200			0	0	0
2032	City Funded	OWCC - Cooling Tower Replacement	Y	\$155,000		D & C			
	City Funded	PS - Replace cooling tower.	Y	\$150,700		D & C			
2032 Total				\$305,700			0	0	0

11. Risks & Challenges

There are several risks and challenges that should be considered in planning and executing initiatives within this SEMP, namely:

Table 12: Risk Matrix			
Risk	Issue	Impact	Response
Increasing Building Use, Hours, or Occupancy	Increasing use of facilities increases the EUI, offsetting the positive impact of energy efficiency measures	LOW: Not able to meet EUI reduction goal	Accept: Higher asset utilisation is a good thing when paired with delivery of programs and aligning with community accessibility
Growth of Operational Area	Growth increases FTEs and floor areas and increases total energy use, offsetting positive impact of energy efficiency measures	LOW: Increasing building areas and number of FTEs is expected to occur over the coming years	Accept: Additional operational area and FTEs can be quantified. However new buildings should ideally be designed to be net zero GHG emissions
Locking in to Fossil Fuel Infrastructure	Installing new equipment reliant on fossil fuels locks in consumption and required carbon tax payments for the life of the new equipment	HIGH: Prevents reductions in GHG emissions required to meet targets	Avoid: City's energy policy should be consistent with CleanBC policy – For existing buildings the efficiency of space and water heating equipment must be greater than or equal to 100% by 2030

Table 12: Risk Matrix

Risk	Issue	Impact	Response
Existing High Efficiency Boiler Efficiency Realization	High efficiencies are only realized during specific operating conditions	<p>LOW:</p> <p>Operational savings required to offset additional cost might not be realized</p>	<p>Mitigate:</p> <p>Ensure that required design modifications are completed to ensure existing boilers operate at design efficiency. May result in additional capital cost for modifications</p>
Deteriorating Performance of Existing Assets	Existing building systems operating in an inefficient manner due to failing equipment and sub-optimal control sequences	<p>MEDIUM:</p> <p>Lowest cost approach to improving energy efficiency and lowering GHG emissions is to make the most of the assets we currently have</p>	<p>Mitigate:</p> <p>A sustained effort to optimize existing building systems is required.</p>
Limited Capital	Major retrofits of existing facilities, as well as other measures, will be required to achieve the GHG reduction goal and these are costly	<p>MEDIUM:</p> <p>Capital will always be limited</p>	<p>Mitigate:</p> <p>Perform Total Cost of Ownership financial analysis of projects and highlight non-financial benefits as well</p>

12. Energy Studies & Other Professional Services

Knowing the source of the greatest emissions and energy consumption within the organization is key in reducing them. In 2019 the City engaged the services of Prism Utility Monitoring and Analysis Utility Monitoring Inc. (PUMA), providing internet-based access to natural gas and electricity consumption data for the 11 sites listed below.

PUMA enables the City to monitor, analyze, track changes, and report on energy use and building performance using actual consumption data. This service is very valuable for comparing the performance of building sites, energy use, emissions generated, and operating costs. These can be regularly reported to Facility Managers using this service. The PUMA services has been renewed until Aug. 1, 2023.

The PUMA services uses approximately three years of historical billing data from BC Hydro and FortisBC to create baseline modelling dating back to 2016 for:

- Nanaimo Aquatic Centre
- Beban Park Recreation Complex – including Beban Pool, Frank Crane Arena and Beban Social Centre
- Beban Park – including Beban Fieldhouse, Centennial Building and Beban Sports Fields
- Nanaimo Ice Centre
- Cliff McNabb Arena
- Service and Resource Centre
- Port Theatre
- Oliver Woods Community Centre
- Bowen Park – Administration Building and Bowling Club
- City Hall
- Bowen Park – Kin Outdoor Pool

The City engages professional consultants to conduct studies, preliminary and detailed design, and cost analyses which is necessary in determining energy and emissions reduction opportunities. Generally, these studies can hone in on specific opportunities and should be completed for sites with a high Energy Use Intensity. Studies are a critical part of the planning process of energy management as they provide the details required for sound decision making and prioritization of resources.

Often, studies are eligible for up to 50% funding to a maximum of \$20,000 or \$30,000 from either BC Hydro, CleanBC, or FortisBC. With the CleanBC Custom Incentive programs, the completion of the study and design can lead to potential construction incentives as well. The CleanBC current maximum incentive limit is \$750,000 per corporation, and up to \$200,000 construction-incentive per site.

Table 13: Energy Studies & Other Professional Services Underway in 2022

No.	2022 Professional Consulting Services	Cost	Incentive Amount	Source of Incentive	Completion
1	NAC -HVAC Renewal and Optimization Study (Clean Communities Fund Feasibility Study)	\$47,500	\$0		20-May-22
2	NAC - AHU Renewals of RTU-6 and RTU-8, Phase 1 and 2	\$16,500	\$0		15-Sep-22
3	NAC - AHU Renewal of MUA-1	\$7,500	\$0		15-Sep-22
4	NAC & Bowen Complex Lighting Upgrade - Construction Services	\$1,000	\$0		In Progress
5	Prism Utility Monitoring Analysis (PUMA) - 1 year contract ends Aug 1, 2023	\$6,480	\$0		In Progress
6	VICC - Lighting Audit/Design Study	\$27,500	\$0		Not Started

13. Awareness and Behaviour Change (Engagement Plan)

With training, encouragement, and feedback on their efforts, City staff can impact energy and emission reductions.

Both BC Hydro and FortisBC offer training opportunities that can be utilized to promote these behavioural actions. The BC Hydro’s Energy Wise Network Program (EWNP) and FortisBC Conservation and Outreach Program, both provide webinars and workshops with operators, led through the Energy Team and management staff.

Also, Facility Maintenance, Custodial, and Operations staff can significantly affect energy and emission reduction efforts by ensuring equipment and systems and operating optimally and by doing simple things like shutting off lights when rooms are not in use.

13.1 Energy Wise Network Program

BC Hydro offers an Energy Wise Network Program (EWNP) to promote increased awareness and behavioural change towards energy and emissions conservation efforts. This EWNP can provide funding for prizes and food, support from an engagement consultants, and educational opportunities through webinars and workshops.

14. Energy Management Assessment

As part of the Commercial Energy Manager agreement between BC Hydro and the City, every 2-3 years an Energy Management Assessment (EMA) is facilitated by a consultant who leads a stakeholder-based

workshop to comprehensively review four (4) key energy management areas of influence – business, operations, people, and technology.

The purpose is to identify aspects of the program that can be strengthened in order to deliver even higher levels of energy efficiency and conservation. The outcome of the last workshop and review (held July 15 and 18, 2022) was a report with the following recommended areas of focus:

Table 14: EMA Recommended Actions	
Business Leadership	
1	Ensure all members of the Senior Leadership Team review and approve the <i>Strategic Energy Management Plan (SEMP)</i> , and related policy documents.
2	Present to top management on what is happening and importance of the SEM. Present impact of not taking action, and non-energy benefits.
3	Educate new Council on the Strategic Energy Management program making them aware of investment requirements in order to meet targets and commitments.
Business Investment	
1	Leverage non-energy benefits (especially carbon reduction) to help move projects forward. Additional social, environmental and political benefits.
Business Plan	
1	Report on Strategic Energy Management Plan status and program progress on a regular basis to senior management and other user groups. Communicate in digestible way depending on audience.
Business Policy	
1	Refresh energy policy and consider ways to integrate with other related policies (Green Buildings - new construction for corporate / Energy Management Conservation Policy), both of which are under review as of July 2022.
2	Reconsider energy project decision making criteria stipulated within existing policies (i.e. not just 8 year simple payback, but total Life Cycle Costing (NPV) and non-energy benefits).
People - Roles	
1	Have Energy Manager position report to senior management/council on a more regular schedule than every 2 yrs.
2	Engage a cross-departmental team with representation from as many departments as possible (e.g. zero-waste task force).
People - Accountability	
1	Find ways to understand why people are not behaving as though they are accountable for energy.
2	Leverage education and awareness as a way to increase accountability for responsible energy use/waste. Communicate that people can do certain things.
Operations - Design	
1	When involving staff, clearly set boundaries and limitations, especially as it relates to budget constraints as to what suggestions can move forward.
2	During renovations & new constructions, look at long term vision for space usage to avoid duplication of future efforts.
3	Leverage grant funding including CleanBC New Construction Program where suitable.

15. Opportunities

Within most facilities there are various opportunities for optimizing energy use and reducing emissions, improving performance and reducing maintenance, namely:

15.1 Optimize Asset Renewals

When making plans to renew any asset that consumes or can affect energy use, consider improved products, designs, and control options. The consideration, study and evaluation of options, whether simple or detailed, is an important step in aligning best practices in both asset management and energy and emissions management.

15.2 Optimize Asset Operations

Regular verification and documentation of proper equipment and system operation, calibration, and optimization opportunities should be a high priority because they can provide immediate benefits, and are usually achieved without incurring major capital expense.

15.3 Efficiency & Electrification

15.3.1 Heat Recovery

Heat recovery will continue to be a primary means of reducing energy and GHG emissions in both retrofit and new construction projects. By harvesting waste heat from building exhaust and other sources with heat pumps, natural gas consumption can be substantially lowered along with associated GHG emissions.

15.3.2 High Efficiency and Low-Carbon Heating Plants

To achieve GHG emission reduction targets, it is paramount that heating systems transition from fossil fuel as the energy source, to electric or other low-carbon heating systems. Typically, natural gas was the least expensive form of energy for creating boiler heat; however, recognizing City Council's proclamation of a Climate Emergency, more benign heating systems are required to meet environmental goals.

15.3.3 Deep Retrofits

Converting existing high-temperature HVAC systems common in older facilities that have natural gas boilers, to lower temperature systems that can for example, use air or ground-source heat pumps. Upgrading building envelopes presents another opportunity to lower energy consumption and GHG emissions, but must be balanced with appropriate consideration for the long term plans for a facility and capital cost.



15.4 New Construction

All new City facility designs should strive for lowest possible energy use and GHG emissions which meet applicable standards and user comfort needs.

It is recommended that all new construction and major renovation projects participate in new construction incentive funding programs to help ensure a high level of performance is balanced with cost considerations. An example of this would be the benefits from the BC Hydro New Construction Program received following the planning and design of the new Fire Station No.1.

15.5 Renewables

Solar thermal, solar photo-voltaic, biomass heating, geo-exchange and wastewater energy recovery are some of the renewable energy choices potentially applicable for some City facilities.

To differing degrees, these systems can offset natural gas and purchased electricity use; however, a site specific feasibility and financial analysis should be completed in evaluating their benefits.

16. Stakeholders for Success and Acknowledgments

Acknowledging and collaborating with stakeholders is essential in ensuring a successful Strategic Energy Management Plan is executed. The following are some of the key stakeholders:

16.1 The Government of British Columbia

The Government of British Columbia is a leader in promoting a greener economy with its CleanBC Roadmap to 2030.

16.2 City Council

City Council's commitment to environmental responsibility is key to supporting energy and emissions management, and meeting the organization's carbon reduction targets. The Energy Team thanks City Council's support for access to capital, and the priority given to energy conservation and GHG emission reduction efforts.

16.3 BC Hydro

The Energy Team thanks BC Hydro for their support in providing seminar and webinar opportunities for Energy Managers and supporting team members, peer networking, and incentive funds for energy managers, studies, capital projects, and access to their technical experts. The funding provided by BC Hydro for the Energy Manager position is critical in the success of the program.



Thank you to Meredith Toward, Key Account Manager, for her guidance and support in the local government sector, and for providing assistance to move initiatives forward.

16.4 Facilities Maintenance and Operations

As best practices in Energy Management become more embedded in building maintenance, operations, and project management, the Energy Team appreciate Facility Maintenance and Operations staff willingness to collaborate and share expertise.

16.5 Finance

Thank you to the Finance Department for providing ongoing support to the Energy and Emissions Management Program and team activities, and for securing the necessary funding to keep things moving forward.

16.6 City of Nanaimo Employees

Thanks to all City of Nanaimo employees for the actions you take – such as turning off lights and computer monitors and contributing to a culture of sustainability.



17. Management Approval

By signing below, the City of Nanaimo management acknowledges receipt and approval of this Strategic Energy Management Plan.

Scott Pamminger

December 14, 2022

Scott Pamminger
Manager, Infrastructure Planning & Energy

Jennifer McAskill

December 14, 2022

Jennifer McAskill
Manager, Facility Asset Planning

Art Groot

December 22, 2022

Art Groot
Director, Facility and Park Operations

Bill Sims

December 21, 2022

Bill Sims
General Manager, Engineering & Public Works



Appendix A – Site Acronyms

NAC	Nanaimo Aquatic Centre
BPC	Beban Park Complex
NIC	Nanaimo Ice Centre
CMA	Cliff McNabb Arena
OWCC	Oliver Woods Community Centre
BoPC	Bowen Park Complex
BHCBBSP	Beban House, Centennial Building, and Beban Sports Pavilion
PA	Police Annex
PS	Police Station
SARC	Service and Resource Centre
CH	City Hall
CSB	Community Services Building
FHQ	Fire Headquarters
FS1	Fire Station 1
FS2	Fire Station 2
FS3	Fire Station 3
FS4	Fire Station 4
BP	Bastion Parkade
HP	Harbourfront Parkade
PoNCP	Port of Nanaimo Centre Parkade
PW	Public Works
PY	Parks Yard
WTP	Water Treatment Plant
VICC	Vancouver Island Conference Centre
PT	Port Theatre
HAC	Harewood Activity Centre

Appendix B – Master Project List

MASTER PROJECT LIST (Ideas / Concepts not yet in 10 Year Capital Plan)									
						Savings (Negative numbers equals an increase)			
#	Site / Department	Project Description	Estimated Project Cost	Year Costed	Recomm'd Implement'n	kWh/yr	GJ/yr	tCO2e/yr	Incentive Potential
BUILDINGS									
1	NAC	Replace MAU #1 - Wet Side, RTU #6 (Gymnasium), and RTU #8 (Physiotherapy)	TBD	2020	2021	TBD	TBD	TBD	TBD
2	2020 Labieux Rd	NEW Nanaimo Operations Centre Facilities	TBD	2021	TBD	TBD	TBD	TBD	TBD
3	NIC	Supply and install 100 kW Solar PV system	\$155,450	2021	2023	111,175	0	2.45	TBD
4	BPC	Leisure Pool Air Handling Units - Replace HV-3 and HV-5 with single larger system	\$850,000	2020	2023	-199,371	2,848	140	Y
5	NAC	Install a Water-to-Water Heat Pump for Dehumidification and Heat Recovery + 300 kW Electric Boiler	\$2,025,000	2021	2023	TBD	TBD	1009	Y
6	BPC	Exhaust Air Heat Pump for Heat Recovery with 450 kW electric boiler	\$881,300	2018	TBD	TBD	TBD	769	Y
7	OWCC	Replace Nat. Gas boiler with electric	\$217,800	2019	2028	-167,400	938	45	TBD
8	500 Bowen, 741 Third St., or 2300 Bowen	Wastewater Heat Recovery - Feasibility Review (study) of Sewer Heat Recovery with HP	TBD	TBD	TBD	TBD	TBD	TBD	Y
9	2235 Dorman Rd	Merle Logan & Second Artificial Turf Fields - Lighting Upgrade	\$280,000	2021	TBD	43,200	0	0.95	TBD
10	Beban Social Centre	Install Ductless Split Heat Pumps - Rooms 1 to 3	TBD	TBD					
11	Beban Social Centre	Install Dustless Split Heat Pumps - Rooms 4 to 6	TBD	TBD					
12	Beban Social Centre	Install Ductless Split Heat Pumps - Rooms 7 and 8	TBD	TBD					
13	Various locations	Renewal of HPS Street Lights to LED (Phases 4, 5)	TBD	TBD					
14	Various locations	Carbon Reduction Pathways Study	TBD		2023				Y

Appendix C - Fleet Renewal Initiatives

Vehicle Unit # or Location	Renewal Initiative	Department	Planned Replacement Year	Planned Replacement Type
107	Replaced Unit #107 with new Hyundai Kona, Unit #124	Parks	2021	EV
209	Replaced Unit #209 with new Hyundai Kona, Unit #125	Public Works	2021	EV
210	Replaced Unit #210 with new Hyundai Kona, Unit #126	Public Works	2022	EV
154	Replace Dodge Journey	Environment	2023	EV
155	Replace Dodge Grand Caravan	RCMP	2023	EV
215	Replace Dodge Ram 1500	Roads	2023	EV
244	Replace GMC Canyon Extra cab 2 wd	Drainage	2023	EV
245	Replace GMC Canyon Extra cab 2 wd	Drainage	2023	EV
297	Replace Toyota Tacoma Pickup	Roads	2023	EV
298	Replace Toyota Tacoma Pickup	Water	2023	EV
104	Replace Nissan NV200	Parks	2024	EV
108	Replace Nissan NV200	Parks	2024	EV
117	Replace Nissan Leaf	Bylaw	2024	EV
151	Replace Dodge Journey	Engineering	2024	EV
246	Replace GMC Canyon Extra cab 2 wd	Construction	2024	EV
250	Replace GMC Canyon Extra cab 4wd	Water	2024	EV
254	Replace Ford F150 Ext cab 2wd	Parks	2024	EV
282	Replace Ford F150 Ext cab 2wd	Sewer	2024	EV
Public Works	Replace (3) existing EV Charging Stations with intelligent Charge Point CT – 4023 Dual Head units		2021	



Appendix D - Glossary of Terms

This glossary defines terms as they are intended to be interpreted in the context of climate change.

Biomass: organic matter used as a fuel, especially in a power station for the generation of electricity.

Business-as-Usual: where no measures are taken to reduce carbon footprint, to shift to sustainable practices, and to mitigate cumulative greenhouse gas emissions.

Carbon Neutrality: achieving carbon neutrality refers to reducing a local government's greenhouse gas emissions as much as possible and balancing the remaining emissions through the purchase of qualified offsets or GHG reduction projects.

Carbon Offset: a carbon offset is a credit for GHG reductions achieved in one location that can be purchased to counterbalance emissions generated in another location.

CARIP: The Climate Action Revenue Incentive Program (CARIP) was a conditional grant program that typically provided funding to local governments that have signed the B.C. Climate Action Charter equal to 100 percent of the carbon taxes they pay directly to support local government operations. The program was discontinued in 2021, and replaced with LGCap in 2022.

Climate: the average weather in a given region over a long period of time, typically 30 years or longer.

Climate Change: statistically significant variations in the climate that can be caused by natural Earth processes (e.g., volcanic eruptions and ocean currents), external factors (e.g., changes in solar intensity), or by human activity (e.g. greenhouse gas emissions and changes in land use).

CO₂e: carbon dioxide equivalent. Universal measurement for GHG emissions reporting. All individual GHG emitting gases are converted to an equivalent amount of carbon dioxide using their respective global warming potential.

De-carbonization: removing carbon from the energy supply by shifting to efficient and renewable sources that emit zero carbon emissions.

Electrification: the process of replacing systems and equipment that use fossil fuels with technologies that use electricity, an energy source that has a much lower carbon intensity. Electrification projects are becoming more prevalent within the master project list which provides significant opportunities to reduce carbon emissions.

Energy Retrofit: the process of upgrading a building's energy-consuming systems. It may involve improving or replacing lighting fixtures, ventilation systems or windows and doors, or adding insulation where it makes economic sense. It also means including energy efficiency measures in all renovation and repair activities.



Geo-exchange System: an electrically powered heating and cooling system for interior spaces that utilizes the earth (or pond or lake) for both a heat source and a heat sink.

Greenhouse Gas (GHG): the six gases listed that trap heat in the atmosphere including:

- Carbon dioxide – CO₂
- Methane – CH₄
- Nitrous oxide – N₂O
- Sulphur Hexafluoride – SF₆
- Per fluorocarbons – PFCs
- Hydro fluorocarbons – HFCs

Gigajoule (GJ): is the typical unit used for measurement of natural gas consumption. It is approximately equivalent to 27 litres of fuel oil, 39 litres of propane, and 26 litres of gasoline or 277 kilowatt-hours of electricity. One GJ is equal to 277.78 kWh.

Hydro-electricity (or Hydropower): electricity that is generated by hydropower; the production of electrical power through the use of the gravitational force of falling or flowing water.

Kilowatt-hour (kWh): The kilowatt-hour is a unit of energy equal to one kilowatt of power sustained for one hour or 3600 kilojoules. It is commonly used as a billing unit for energy delivered to consumers by electric utilities. 1000 kWh is equal to 3.6 GJ.

LED: Light-emitting diode.

LGCAP: Local Government Climate Action Program (LGCAP) provides local governments and Modern Treaty Nations with predictable and stable funding to support the implementation of local climate action that reduces emissions and prepares communities for the impacts of a changing climate. This program was initiated in 2022.

Low Carbon Energy Sources: a shift away from coal and gas as a source of energy and using instead, lower carbon-emitting energy sources like electricity (specifically, in BC) renewables (solar, wind, and tidal), nuclear and biomass, to name a few.

Mitigation: Reducing greenhouse gas emissions using policy, regulatory, and project-based measures. Also refers to measures that enable natural systems to naturally sequester greenhouse gases (e.g. preventing forested areas from being developed into urban cities). These actions prevent future climate change from happening so that fewer adaptation measures are needed by local municipalities. Examples include: renewable energy programs, energy efficiency frameworks, and land-use policies.

Net-Zero Ready: a building built to high energy-efficiency standards such that it could (with additional measures) generate enough onsite energy to meet its own energy needs.

Non-Traditional Services: Services only sometimes provided by the local government including:

- Landfill
- Transit services
- Police Services (including fleet)
- New construction (facilities, roads, etc.)
- Primary power generation
- Social housing
- Tree farms
- Community Services provided or administered from a leased, municipally-owned facility where the lease-holder pays the utility costs.

Resilience: the capacity of a system, community, or society exposed to hazards to adapt, by resisting or changing, in order to reach and maintain an acceptable level of functioning and structure.

Risk: a measure of the expected outcome of an uncertain event, which is estimated by combining an event's likelihood with the expected consequences. The concept of risk helps to grapple with uncertainty and allows for the comparison of potential impacts.

Solar Energy: radiant energy generated by the sun that is converted to electricity, hot air, or hot water.

Strategic Energy Management Plan (SEMP): a long-term plan for the city to manage the energy and emissions generated by operating municipal services and facilities. The strategy is built on a framework of conservation, efficiency, and integrated planning.

Traditional Services: Services provided by the local government including:

- Administration and Governance
- Drinking, Storm, and Waste Water
- Solid Waste Collection, Transportation and Diversion
- Roads and Traffic Operations/Maintenance
- Arts, Recreation and Cultural Services
- Fire Protection

Uncertainty: a state of incomplete knowledge that can result from a lack of information or from disagreement about what is known. It can have various sources from imprecision in the data, to ambiguously defined concepts or terminology, to uncertain projections of human behaviour.

Appendix E – Corporate Emissions Data

Corporate Emissions (Traditional Services ¹)	Historical Data															Aspirational Reductions									
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	
Corporate Emissions Target ³ (tCO2e)	4,696	4,577	4,458	4,338	4,219	4,100	3,981	3,862	3,742	3,623	3,504	3,385	3,266	3,146	3,079	3,012	2,946	2,879	2,812	2,745	2,678	2,612	2,545	2,478	
Actual Corporate Emissions ⁴ (tCO2e)	4,696	6,142	5,625	4,955	5,181	4,842	4,765	4,859	4,718	4,854	5,007	5,132	5,416	4,559	5,251										
Estimated Emission Reductions in Buildings ⁵ (tCO2e)	0	0	136	46	242	93	67	6	133	38	215	355	66	9	2	63.99	1.23	0.31	889.2	0.62	0.72				
Estimated Emission Reductions in Fleet ⁶ (tCO2e)																									
Estimated Total Annual Reductions (tCO2e)	0	0	136	46	242	93	67	6	133	38	215	355	66	9	2	63.99	1.23	0.31	889.2	0.62	0.72	0	0	0	
Cumulative Total Estimated Reductions (tCO2e)	0	0	136	182	424	517	584	590	723	761	976	1,331	1,397	1,406	1,408	1,472	1,473	1,474	2,363	2,363	2,364	2,364	2,364	2,364	

Corporate Emissions (Non-Traditional Services ²)	Historical Data															Aspirational Reductions									
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	
Estimated Emission Reductions (tCO2e)																105				0.62		0.5			
Cumulative Total Estimated Reductions (tCO2e)																105	105	105	105	106	106	106	106	106	

¹ **Traditional Services** - defined as services that are most commonly provided by the majority of local governments - (i.e. Administration & Governance; Drinking, Storm and Waste Water, Solid Waste Collection; Transportation & Diversion; Roads & Traffic Operations; Art, Recreation and Cultural Services; Fire Protection; and Contracted Services.)

² **Non-Traditional Services** - defined as services NOT commonly provided by the majority of local governments - (i.e. RCMP; leased facilities; processing of waste, recycleables; new construction; landfills and associated buildings and equipment ; airports or court houses; business travel; and employee commuting.)

³ BC Climate Action Target 33% reduction of emissions (2007 Baseline) by 2020. In April 2019, City of Nanaimo established new targets of 50% to 58% reduction of corporate emissions (2010 baseline) by 2030, and 94% to 107% reduction by 2050.

⁴ Includes Stationary Sources (buildings) + Mobile Sources (fleet fuels) + Contracted Emissions + growth in assets.

⁵ Estimated Reductions (calculated or modelled) achieved through behavioural change, process changes, renewals with more efficient and/or different energy sources for buildings.

⁶ Estimated Reductions (calculated or modelled) achieved through behavioural change, process changes, renewals with more efficient and/or different energy sources for vehicles.

Appendix F – Energy Project Investments and Cumulative Savings (Cost Avoidance)

Appendix F - Energy Project Investments and Cumulative Savings (Cost Avoidance)

Year	Projects Electrical Energy Savings (kWh)	Energy Production (kWh)	Natural Gas (GJ)	Oil (Litres)	GHG (tCO2e)	Projects Electrical Energy Savings \$	Energy Production Revenue \$	Power Factor \$	LGS Credits \$	MGS Credits \$	Natural Gas \$	Oil \$	Carbon Tax Avoided \$	Total Cost Avoidance \$	Sustainability Funded Project Costs \$	Other Dept Funded Project Costs \$	Incentives Received For Projects \$	Total Energy Project Costs \$	Net Project Costs After Incentives	% of Electric Target	% of Nat Gas Target	% of GHG Target
2009	183,092	0	2,578	0	136	11,901	0	6,485	0	0	36,092	0	3,388	57,866	88,058	58,441	64,627	146,499	81,872	78	450	45
2010	521,875	0	420	4,679	46	33,922	0	957	0	0	5,880	3,509	1,155	45,423	95,718	73,871	134,350	169,589	35,239	223	73	15
2011	814,468	0	3,984	7,388	242	57,013	0	0	44,980	0	55,776	5,541	6,052	169,362	397,084	272,825	220,692	669,909	449,217	348	695	80
2012	859,307	0	950	9,083	93	60,151	0	1,724	38,462	0	13,300	6,812	2,329	122,779	151,875	975,295	205,712	1,127,170	921,458	172	166	31
2013	347,992	0	327	14,892	67	27,839	0	0	69,600	0	4,578	3,723	1,666	107,406	301,143	138,510	83,653	439,653	356,000	70	57	22
2014	77,488	511,220	4	1,527	6	6,974	52,877	0	18,291	0	56	1,573	156	27,050	94,040	112,532	119,295	206,572	87,277	33	1	2
2015	990,063	686,720	2,185	0	133	89,106	74,323	2,240	23,091	27,575	22,943	0	3,330	168,284	551,053	1,424,464	44,555	1,975,517	1,930,962	423	381	44
2016	261,223	803,440	624	0	38	23,510	86,454	750	44,581	29,617	6,552	0	939	105,949	166,507	338,584	180,391	505,091	324,700	112	109	12
2017	787,878	880,510	3,250	0	196	70,909	99,149	842	23,337	18,182	34,125	0	5,880	153,275	158,422	404,317	129,108	562,739	433,631	337	567	65
2018	597,096	801,620	5,929	0	357	53,739	91,458	0	0	0	62,255	0	10,710	126,703	208,009	809,721	98,515	1,017,730	919,215	255	1035	118
2019	814,089	755,760	450	0	27	73,268	87,797	0	0	0	4,725	0	810	78,803	281,331	321,197	58,660	602,528	543,868	348	79	9
2020	426,584	698,600	0	0	9	40,525	81,767	0	0	0	0	0	375	40,901	42,700	537,943	21,378	580,643	559,265	182	0	3
2021	107,732	762,130	0	0	2.1	10,235	87,239	0	0	0	0	0	105	10,340						46	374	
2022	131,859	TBD	2,145	TBD	169.9	12,527	TBD	0	0	0	28,764	0	11,044	52,335						56		
Subtotal	6,920,746	5,900,000	22,846	37,569	1,522	571,618	661,065	12,998	262,341	75,374	246,281	21,159	36,415	1,266,474	2,535,940	5,467,700	1,360,936	7,422,997	6,083,439			
Cumulative Totals	48,175,466	25,753,080	157,353	374,494	10,398	3,742,165	-	124,419	-	-	1,715,389	196,118	231,576	9,038,903								

NOTES:

1. **Energy Production Revenue** NOT included in Total Cost Avoided; Energy Production site is at Reservoir No.1 ERF.
2. **Non-cumulative** - Energy Production, LGS and MGS credits
3. **Incentives for Projects** DOES NOT include incentives received for BCH - EM Agreement
4. **Phase 3: Street Lighting** - Savings of 217,721 kWh included in 2020 kWh above. BCH doesn't include this in their reported savings.

Appendix G – Electricity Savings & Low Carbon Electrification

Electrical Savings & Low Carbon Electrification (LCE)						
Fiscal Year	Targeted Annual Savings (kWh)	Cumulative Targeted Savings (kWh)	Completed / Planned - Estimated Annual Savings (kWh)	Completed / Planned - Cumulative Estimated Savings (kWh)	Low Carbon Electrification Target (kWh)	Completed / Planned Low Carbon Electrification (kWh)
2009	234,000	234,000	183,092	183,092		
2010	234,000	468,000	521,875	704,967		
2011	234,000	702,000	814,468	1,519,435		
2012	234,000	936,000	859,307	2,378,742		
2013	234,000	1,170,000	347,992	2,726,734		
2014	234,000	1,404,000	77,488	2,804,222		
2015	234,000	1,638,000	990,063	3,794,285		
2016	234,000	1,872,000	261,223	4,055,508		
2017	1,000,000	2,872,000	787,878	4,843,386		
2018	550,000	3,422,000	597,096	5,440,482		
2019	300,000	3,722,000	814,089	6,254,571		
2020	300,000	4,022,000	426,584	6,681,155		
2021	300,000	4,322,000	95,049	6,776,204		
2022	100,000	4,422,000	130,864	6,907,068	-200,000	-174,312
2023	100,000	4,522,000	127,287	7,034,355	-200,000	0
2024			31,747	7,066,102		0
2025			20,239	7,086,341		-1,172,727
2026			63,905	7,150,246		
2027			74,594	7,224,840		
2028			21,968	7,246,808		
2029						
2030						

NOTES:

1. A negative (-) number in the table above represents an increase in electricity use, replacing the use of a fossil fuel.
2. Future projected estimated savings are based on the Multi-Year Plan and projects in the 10-Year Capital Plan.

Appendix H – Natural Gas Savings

Natural Gas Savings

Fiscal Year	Natural Gas Estimated Savings (GJ)	Cumulative Estimated Natural Gas Savings (GJ)	Annual Reduction Target (GJ)	Cumulative Target (GJ)
2009	2,578	2,578	573	573
2010	420	2,998	573	1,146
2011	3,984	6,982	573	1,719
2012	950	7,932	573	2,292
2013	327	8,259	573	2,865
2014	4	8,263	573	3,438
2015	2,185	10,448	573	4,011
2016	624	11,072	573	4,584
2017	3,250	14,948	573	5,157
2018	5929	21,648	573	5,730
2019	450	22,583	573	6,303
2020	0	22,583	573	6,876
2021	2	22,585	573	7,449
2022	2,145	24,730	4,315	11,289
2023			4,315	15,129
2024			4,315	18,969
2025			4,315	22,809
2026			4,315	26,649
2027			4,315	30,489
2028			4,315	34,329
2029			4,315	38,169
2030			4,315	42,009

Projected in Multi-Year Action Plan based on applicable projects listed.

Appendix I – 2021 Project Summary

2021 STRATEGIC ENERGY & EMISSIONS MANAGEMENT - PLANNED PROJECTS														
PROJECTS (not started)	Description	KWH	GJ	CO2e	\$ Saved	Budget Sustain	Budget Dept	Grant	Budget total	Pay Back	Comments	% Target	Start Date	% complete
Beban Park Complex	Design of Exhaust air Heat Pump + 450 kW electric boiler		14,973	769	-\$130,000	0	\$610,000		\$610,000		Need to present results of study to Council. Grant application? GHG Reduction of 92%; other choices available as well which would impact Operating costs.			
Beban Leisure Pool	Design of HV-3 and HV-5 Leisure Pool Air Handling Units Replacement	-199,371	2,848	141	\$11,617	0	\$850,000		\$850,000		Council has approved Investing in Canada Infrastructure Program CleanBC Communities Grant application for \$686,840			
Nanaimo Aquatic Centre	Design of Water-to-Water HP for dehumidification and heat recovery + 300 kW electric boiler		20,222	1,009	-\$29,200	0	\$1,460,000	\$12,354	\$1,460,000		Need to present results of study to Council. CleanBC Study Grant \$12,253.50 GHG Reduction of 98%; other choices available as well which would impact Operating costs.			
Oliver Woods Community Centre	Replace standard efficiency natural gas boiler with an electric boiler	-167,400	938	45	-\$7,899	0	\$217,200	\$0	\$217,200		Need to present Report for Decision to Council. Prism's construction cost estimate \$188k + PM + Engineering. Design is complete.			
TOTAL		-366,771	38,981	1,964	-\$155,482	0	3,137,200	12,354	3,137,200					
BEHAVIOURAL PROJECTS														
Quarterly Energy and Emissions Management presentation (Q1 - Q4)	Promote awareness and seeking input/suggestions													
Kill-a-Watt meter loan	Promote awareness													
BC HYDRO APPROVED PROJECTS (in progress)														
Fire Station No.1	BC Hydro New Construction Program - Energy Study and Modelling	67,425		78.5	\$7,417	0		\$46,762	\$808,500		New Construction Program Energy Study Agreement executed on Sept. 13, 2019. See email April 24, 2020, re: 5 ECMs. Old heating system used heating oil. Study incentive \$28,003.50 and \$18,758 Construction for ECMs.			
TOTAL		67,425	0	79	\$7,417	0	0	\$46,762	\$808,500					
OTHER PROJECTS (in progress)														
Port Theatre	Heat Recovery Chiller HP system	-135,897	2,145	106	\$13,608	0	\$712,199	\$74,640	\$1,042,110		Tender issue on Sept 23; closes on Oct. 20			
TOTAL		-135,897	2,145	106	\$13,608	0	712,199	74,640	1,042,110					
PROJECTS COMPLETED 2021														
Fleet	Replace Suzuki SX4 Unit #107 with Electric Hyundai Kona #124.			TBD							Unit #124 put into service on Aug. 17, 2021 for Parks Ops - PM.			
Nanaimo Ice Centre	Entire interior lighting renewal	80,034	0	1.8	\$10,055	0	\$165,000	\$8,515	\$156,000					
Beban Pool	Lighting renewal bath & change rooms	15,140	0	0.3	\$1,450	0	\$25,000	\$0	\$25,000		Shaw Electric completed work under Maint. Contract			
TOTAL (completed)		95,174	0	2.1	\$11,505	0	190,000	8,515	181,000					

Appendix J – 2022 Project Summary

2022 STRATEGIC ENERGY & EMISSIONS MANAGEMENT - PLANNED PROJECTS														
PROJECTS (Not started)	Description	KWH	GJ	CO2e	\$ Saved	Climate Action Reserve Fund	Budget Dept	Grant	Budget total	Pay Back	Comments	% Target	Start Date	% complete
Fleet	EV Fleet Plan for Medium and Heavy-Duty Vehicles										Business Case submitted to SLT for 2023 Budget consideration/approval, requesting \$50k.			
	TOTAL	0	0	0	0	0	0	0	0	0				
BEHAVIOURAL PROJECTS		KWH	GJ	CO2e	\$ Saved			Grant	Budget		Comments			
Quarterly Energy and Emissions Management presentation (Q1 - Q4)	Promote awareness and seeking input/suggestions										Distribution of this Projects spreadsheet every 3 months.			
Kill-a-Watt meter loan	Promote awareness										Continue loan circulation and advertise			
BC HYDRO APPROVED PROJECTS (in progress)		KWH	GJ	CO2e	\$ saved	Budget Sustain	Budget Dept	Grant	Cost	Pay Back	Comments			
Nanaimo Aquatic Centre	Renew RTU #6, #8 and MUA #1 - Study										May apply for CleanBC funding			
	TOTAL	0	0	0	0	0	0	0	0	0				
OTHER PROJECTS (in progress)		KWH	GJ	CO2e	\$ Saved	Budget Sustain	Budget Dept	Grant	Cost	Pay Back	Comments			
Fire Station 2	Renew RTU #1 with electric unit			0.00			\$15,800	TBD			Existing unit is a Carrier M# 48FCEA05A2A5-OA0A0, Gas-fired 48,000 BTU, DX cooling. Replacement all electric Heat Pump unit ordered Nov. 25, 2022.			
Fire Station 3	Renew RTU #2 with electric unit			0.00			\$13,900	TBD			Existing unit is a York M# 2E036N08P1AAA4-UPG, Gas-fired 36,000 BTU with DX cooling. Replacement Heat Pump with gas backup, ordered Nov. 25, 2022.			
	TOTAL	0	0	0	0	0	29,700	0	0	0				
PROJECTS (Completed)		kWh	GJ	CO2e	\$ Saved	Budget Sustain	Budget Dept	Grant	Cost	Pay Back	COMPLETED 2022			
Serauxmen Stadium	Renew hallway lights, 15 - T12 (40W) 2 - lamp fixtures with Lithonia CSS L48 AL03 44W LEDs, install occ sensors.	995	0	0.01	\$100	\$0	\$1,569	0	\$1,569					
Port Theatre	Installation of new Variable Refrigerant Flow Heating and Cooling System	-135,897	2,145	106		\$255,166	\$1,042,005	\$74,640	\$1,042,005		Secured CleanBC incentive (BCH-07692) May 6, 2021			
Bowen Park Complex	Renewal of all interior lighting with LED	31,720	0	0.31	\$3,648	\$0	\$123,544		\$123,544		Construction completed Dec. 31, 2022.			
Nanaimo Aquatic Centre	Renewal of all remaining non-LED with new	70,134	0	0.68	\$6,663	\$0	\$63,570	\$13,950	\$63,570		Construction completed Sept. 30, 2022			
Fire Station 1 - New Build	ECM#4: Interior Lighting Power Density (LPD) Reduction, ECM#6 Interior Lighting Control, ECM#7 Exterior LPD Reduction	29,010	0	0.28	\$2,857	\$0	\$334,000	\$18,758	\$315,242		New build replaces old Fire Station No. 1 on same site. Grant is applicable to these ECMs and ECM#10 below. New Construction Program Energy Study Agreement executed on Sept. 13, 2019. See email April 24, 2020, re: 5 ECMs. Old heating system used heating oil. Study incentive \$28,003.50 and \$18,758 Construction for ECMs.			
Fire Station 1 - New Build	ECM#10: Air-source VRF with HRV (Fuel switching - low carbon electrification)	-38,415		63.0	\$4,446	\$0	\$465,500		\$465,500		FS1: new build includes electric VRF system. Old build used a diesel fuel boiler.			
Fleet Services	Replacement of Unit #210 with new Unit #126 Kona EV	TBD	TBD	TBD	TBD			\$8,000	\$45,000		Vehicle for the Cross Connection Control position at PW.			
Fleet Services	Purchase new Unit #127 Kona EV	TBD	TBD	TBD	TBD			\$8,000	\$45,000		Vehicle for the PRC - Trails and Natural Areas Lead Supervisor. This vehicle is a new addition to the fleet.			
Nanaimo Aquatic Centre	Scope development for optimization & Preliminary Design Development targeting HVAC and Heating Plant Renewal and Optimization						\$50,000		\$50,000		AME Consulting selected. Phase 1 and 2 (April & May)			
	TOTAL (completed)	-42,453	0	169.9	7,303.0	0.0	849,500.0	34,758.0	920,742.0					