



The City of North Bay

Energy Conservation and Demand Management Plan



June 2024

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Executive Summary

The City of North Bay recognizes that energy conservation and demand management is an integral part of the organization's long-term sustainability as it strives to build a healthy and vibrant community. In 2008, the City established its initial Green Plan. During the life of the plan (2008 to 2012) the City reduced its greenhouse gas (GHG) footprint on the environment from the consumption of fossil fuels by a reduction of approximately 5% from the base year (2007), while adding and expanding assets to the organization.

In 2013, the City of North Bay used its experience working through its initial plan to establish a Conservation and Demand Management Plan that not only meets its regulatory requirements under the Electricity Act (1998), O. Reg. 507/18, but will continue to guide the organization as it embeds environmental awareness into the City's processes and decision-making in order to minimize its carbon footprint on the environment while meeting social and economic responsibilities. During the life of the initial CDM plan (2013-2017) the City reduced its GHG footprint from the consumption of fossil fuels by a reduction of 13.7% from the base year (2012), while adding and expanding assets to the organization. This exceeds the 2.5% per year reduction of GHG goal from the initial plan.

The City of North Bay's Conservation and Demand Management (CDM) Plan establishes a commitment to improve monitoring, tracking, and reporting systems, embeds conservation into departmental planning and budgeting, and identifies energy conservation opportunities throughout the corporation. A central consideration of the City of North Bay's Conservation Management Plan was to ensure it was aligned to the City's Corporate Business Plan's Vision and Mission.

Successful implementation of the CDM Plan will support economic and community development, demonstrate financial responsibility, promote a healthy community, support the organization's goal to foster a culture of continuous improvement and enhance communication to our stakeholders.

The City has demonstrated that it is capable of reducing energy consumption despite pressures that include growth in services, addition of assets, and year-to-year weather variations. The objectives, goals, and targets detailed in the CDM Plan were established recognizing the need to balance competing environmental, economic, and social aims of the community.

Over the life of the CDM Plan the City has targeted to annually reduce its greenhouse gas emissions into the environment by 3% per year. The path to achieving this target is detailed in this Plan.

The Plan articulates the City of North Bay's commitment to reducing its impact on global climate change by making energy and demand management an integral part of the City's operations, planning, and the way it delivers services to the community.

Background

The Conservation and Demand Management Plan is the City's roadmap to reduce its impact on the environment through energy reduction and process improvements to improve the City's long-term sustainability.

In 2008, the City of North Bay developed and implemented a corporate wide Green Plan. The five-year plan established in 2008 used 2007 as its baseline. Targets and objectives were established, and the City reported its progress through an annual report summarizing its performance against the baseline and the previous year. In 2013, the City committed to establishing a new Green Plan that built on the previous Green Plan and would meet the requirements established by the Electricity Act (1998).

The initial City of North Bay Energy and Conservation Demand Management Plan (2013 – 2017) used 2012 as its baseline. The City of North Bay developed an updated CDM Plan which outlined the City's energy management plan for the following 5 years (2018-2022). The City of North Bay's current Energy and Conservation Demand Management Plan will cover 2023 – 2027. The plan continues to use 2007 as its baseline to realize Ontario's commitment to meet the reductions promised in the Paris Accord of a 30% reduction in GHG emissions from 2005-2030 and progress against the plan will be reviewed annually.

The plan will assist the City of North Bay to meet its regulatory requirements under the Energy and Demand Management Regulation under the Electricity Act (1998). The above requirement came into effect on December 12, 2018. Under the new regulation public agencies are required to report annually to the Ministry of Energy their energy use and greenhouse gas emissions, develop and implement energy management plans, and report on results.

CDM Results

The initial Conservation and Demand Management Plan (2013-2017) was the City's roadmap to reduce its impact on global climate change by making energy and demand management as an integral part of the City's operations, planning, and the way it delivers services to the community. The City has demonstrated that it is capable of reducing energy consumption despite pressures that include growth in services, addition of assets, and year-to-year weather variations.

The initial CDM plan sought to reduce electricity from the grid by 2.5% per year, reduce natural gas consumption by 2% per year, reduce the use of traditional fuels by 3% per year, and realize a 2.5% reduction of GHG or 300 tonnes of CO_{2e} gases annually. From the baseline year (2012), the City has met 3 of the 4 targets by reducing the use of traditional fuels by 3.43% per year, reducing electricity from the grid by 2.95% per year, and reducing greenhouse gasses by 2.73% per year. The City did not meet the natural gas target and realized an increase of 3.70% in natural gas consumption per year.

Plan Development

The City of North Bay's Energy Conservation and Demand Management Plan uses a framework established in the development of its original Green Plan. The City utilized its experience from previous years to establish objectives, goals, and targets for the new Energy CDM Plan.

The development of the initial draft was completed by department managers and directors. The draft was presented and discussed by senior managers to ensure it was aligned with the City of North Bay's Strategic Plan. The provided input from leaders and doers of the organization was crucial to the development process.

The plan was developed using the Ontario Provincial Government's Guide to Preparing Conservation and Demand Management Plans.

Key steps in developing the plan are illustrated in the following figure.



Through this process, the City of North Bay's Corporate Mission Statement, Goals, Objectives, and Targets were established. To establish new Goals, Objectives, Mission Statements and ultimately develop a more targeted plan to reduce GHG emissions, the City analyzed the data from previous CDM plans (2013-2017 and 2018-2022).

Mission Statement

North Bay commits to actively and sustainably reduce its impact on global climate change by making energy and demand management an integral part of the City's operations, planning, and service delivery.

Objectives

- Reduce corporate dependency on conventional (GHG intensive) forms of energy (electricity, natural gas, and transportation fossil fuels) through smart management of all assets.
- Use renewable forms of energy where feasible to reduce GHG impacts.
- Support and enhance the City's corporate culture with respect to energy conservation through management leadership and employee engagement.
- Incorporate life-cycle and global climatic impact analysis into business plans and policies.
- Engage and develop community partners.
- Exemplify energy conservation leadership that can be emulated by ABC's and the community at large.
- Communicate progress to all stakeholders.

Goals

- Re-mandate steering and working committees.
- Develop Energy Management Systems to establish a more effective energy measuring, tracking, and monitoring system.
- Establish a Sustainable Buildings Program.
- Integrate Energy Conservation & Demand Management Programs into the Wastewater and Water Distribution as well as Facilities operations and modernization plans.
- Review and update the Green Fleet Plan to continue to improve energy efficiency of the municipal fleet.
- Support energy conservation training and education to expand corporate ability to better address global warming impacts on the corporation.
- Reduce energy related costs.
- Make energy conservation and demand management an element of departmental budget and purchasing processes.
- Meet regulatory requirements.
- Establish a funding plan to help finance energy conservation and demand management projects including expanding renewable energy projects.
- Develop a Communication Plan to spread information to the corporation and to the community.

Targets

- Reduce electricity from the grid by 2.5% per year.
- Reduce the use of traditional transportation fuels by 4% per year.
- Realize a 3% reduction of GHG or 429 tonnes of CO₂e gases annually.

An expanded discussion of the City of North Bay's Objectives and Goals is presented in Appendix 1.

Baseline Year

The City of North Bay's Green Plan (2008-2012) used 2007 as its baseline. The initial CDM Plan (2013-2017) used 2012 as its baseline for comparison due to the availability of data and a re-confirmation of the commitment to reduce energy. The 2018-2022 CDM Plan established 2007 as its baseline for comparison due to availability of data and Ontario's commitment to meet the reductions promised in the Paris Accord of a 30% reduction in GHG emissions from 2005-2030.

The new CDM Plan (2023 – 2027) has also established 2007 as its baseline for comparison. The baseline year will be used for analysis and measurement of progress for future energy and emission reduction calculations.

Table 1 below is a high-level summary of 2023 versus the baseline year. Detailed annual consumption data is summarized in Appendix 2.

Table 1: City of North Bay 2023 versus 2007 Energy Use – All Sectors

| 2007 Baseline | Electricity (kWh) | Natural Gas (m³) | Transportation Fuel (L) | Total |
|---|--------------------------|------------------------------------|--------------------------------|--------------|
| Total Quantity Used | 23,093,113 | 1,359,460 | 1,489,778 | |
| Total GHG Produced (tonnes of CO_{2e}) | 16,326 | 2,630 | 15,166 | 34,122 |

| 2023 | Electricity (kWh) | Natural Gas (m³) | Transportation Fuel (L) | Total |
|--|--------------------------|------------------------------------|--------------------------------|--------------|
| Total Quantity Used | 19,305,833 | 879,321 | 1,638,134 | |
| Total GHG Produced (tonnes CO_{2e}) | 13,649 | 1,701 | 16,676 | 32,026 |

| 2007 vs 2023 | Electricity (kWh) | Natural Gas (m³) | Transportation Fuel (L) | Total |
|--|--------------------------|------------------------------------|--------------------------------|--------------|
| 2023 vs 2007 Reduction Quantity Achieved | 3,787,280 | 480,139 | -148,356 | |
| GHG Reduction Achieved in 2023 vs 2007 (tonnes CO_{2e}) | 2,677 | 929 | -1,330 | 2,276 |
| Percent GHG Reduction Achieved (30% Goal) | 16.40 % | 35.32 % | - 8.67 | 6.64 % |

Greenhouse Gas Emissions

Another important metric that the City will measure to monitor its progress is the reduction of greenhouse gas emissions to the environment. The City has established a target of reducing its greenhouse gas emissions by 3% per year or the approximate equivalent of 429 tonnes of CO_{2e} gases to the environment.

A summary of its performance from 2023 relative to the 2007 baseline is presented in Appendix 4.

Table 2 below summarizes the greenhouse gases generated in 2023 by the City of North Bay.

Table 2: City of North Bay 2022 versus 2023 Energy Use – All Sectors

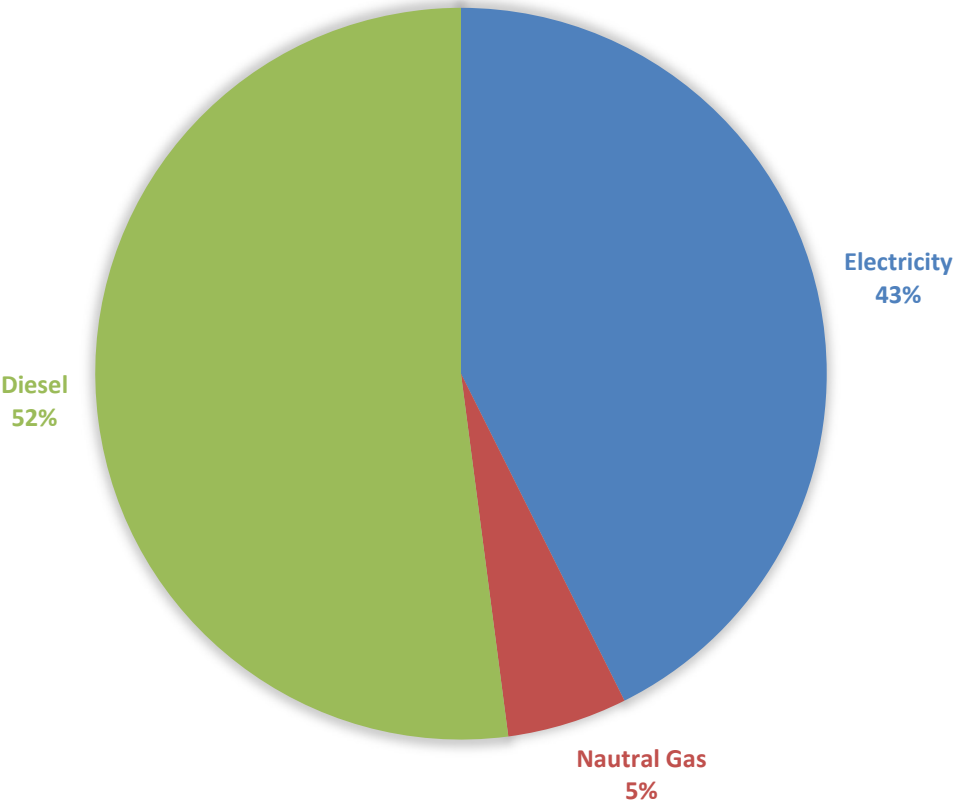
| 2023 | Electricity (kWh) | Natural Gas (m ³) | Transportation Fuel (L) | Total |
|---|-------------------|-------------------------------|-------------------------|--------|
| Total Quantity Used | 19,305,833 | 879,321 | 1,638,134 | |
| Total GHG Produced (tonnes of CO_{2e}) | 13,649 | 1,701 | 16,676 | 32,026 |

| 2022 | Electricity (kWh) | Natural Gas (m ³) | Transportation Fuel (L) | Total |
|--|-------------------|-------------------------------|-------------------------|--------|
| Total Quantity Used | 19,315,494 | 876,021 | 1,530,554 | |
| Total GHG Produced (tonnes CO_{2e}) | 13,656 | 1,694 | 15,581 | 30,931 |

| 2022 vs 2023 | Electricity (kWh) | Natural Gas (m ³) | Transportation Fuel (L) | Total |
|--|-------------------|-------------------------------|-------------------------|--------|
| 2022 vs. 2023 Reduction Quantity Achieved | 9661 | -3,300 | -107,580 | |
| GHG Reduction Achieved in 2022 vs 2023 (tonnes CO_{2e}) | 7 | -6 | -1,095 | -1,094 |
| Percent Reduction Achieved | 0.05% | -0.38 % | -7.03 % | -3.54 |

Figure 1 provides a summary of energy used and overall greenhouse gas emissions for the City of North Bay in 2023. Electricity and Transportation Fuel comprise the majority of emissions. In 2023, the City of North Bay produced 32,026 tonnes of CO_{2e}, a decrease of 2,096 tonnes compared to 2007.

Figure 1: 2023 GHG Emissions Summary



North Bay's Energy Projects

Since 2007, the City of North Bay has investigated, developed, and implemented many energy efficiency projects.

A summary of major initiated, completed, and future energy related projects is presented in Appendix 5.

Listed below is a sampling of some of the projects/programs.

Completed Energy Projects

- Replacement of HPS street lights with LED fixtures
- Converting traffic lights to LED's
- Evaluating and replacing decorative lights
- Lighting and heating upgrades at City/YMCA Aquatics Center
- Utilization of landfill gas for the production of electricity
- Evaluation of Cogeneration Project at Wastewater Treatment Plant
- Installation of residential water meters
- Reduction of the City's fleet size
- Elimination of Janey Avenue pumping station
- Education and Awareness Training Pilot with LAS/AMO
- Upgrading bus barn overhead doors to improve building envelope performance
- Purchasing of fully electric Zamboni
- Sewage Treatment Plant digester gas utilization
- On-demand bus system
- Water meter installation and water conservation
- Community Energy Park
- Demand Response Initiatives
- Interval metering
- Parking lot lighting review
- Investigating a new low energy filter technology for the Aquatics Centre
- Outdoor area lighting review (Lot 8 and City Hall Grounds)
- Quantitative energy audit of the City Hall building envelope
- Renewing the Pete Palangio Ice Plant chiller
- Improved use of Building Automation Systems
- Landfill Gas Well System Expansion
- Traffic study complete and time of day signal plans were enhanced. Installed low prior pre-emption systems in Transit buses which operates through the GTT emergency vehicle pre-emption system.

Current Projects

- Improve traffic flows/automate signalization systems.
- High efficiency pumps at the Wastewater Treatment Plant
- City Hall window replacements

- Emission Reduction in Fleet – Implementation of hybrid and electric vehicles (buses, SUV's) as well as reducing gas powered tools by replacing with battery powered tools.
- Side street detection and pedestrian push buttons are being installed at intersections that are not running a coordinated pattern.
- Reduced Idling – monitoring to avoid excessive idling. Selected vehicles have automatic shut offs which stops needless idling, wear on engines, and reduces fuel consumption and emissions.

Future Energy Projects

Going forward, the City has identified several potential projects. These include:

- Waste Water Treatment Plant blower upgrades
- Building envelope upgrades at Pete Palangio
- Memorial Gardens ice plant condenser upgrade

Renewables

Solar Initiatives

In 2008, the City commissioned a 60 panel (10-kilowatt) solar photovoltaic array on the roof of City Hall (Figure 2). In 2023, 5232 kWh of solar power energy was produced, resulting in \$4,196 in revenue. Since commissioning to the end of 2023, the system generated 95,145 kWh of electricity. The electricity was originally sold to the Ontario Power Authority under the Renewable Standard Offer Program (RSOP) for 42¢ per kilowatt hour. Beginning in November 2010 the City was approved to transfer the RSOP to the OPA's microFIT program and received 80.2¢ per kWh for all power produced until May 2028.



Figure 2: 10 kWh solar panels on the roof of City Hall. **Figure 3:** Solar Hot Water on roof of new Water Plant

In 2010 the City commissioned its new Water Filtration Plant which uses a solar hot water system on its roof (shown in Figure 3) to heat water used for filter cleaning.

Landfill Gas to Electricity

The City partnered with North Bay Hydro Services to install a power generation facility that utilizes landfill gas produced at the Merrick Landfill Site. The station was commercialized in June 2012. Prior to providing landfill gas to the power generation facility the City operated a landfill gas flaring station. In 2013, the landfill collected and supplied 7,829,552 m³ of landfill gas (LFG). Utilization of the LFG for electricity generation reduced greenhouse gas emissions by 58,829 tonnes. Without the flare and generator, Merrick would have produced approximately 2.5 times more greenhouse gas emissions than all the energy used by the City in its operations. In its first full year of operation the project generated \$391,984 in LFG sales for the City. At its peak, the Merrick Project will generate enough electricity to satisfy the electrical power needs of approximately 1200 homes per year. In 2023, the landfill gas to electricity operation produced a total of 2,753,137.07 kWh. Each kWh is sold with a unit price of 3.8 cents. This generated a total income of \$104,619.21. It has produced a total income of \$2,151,359.17 since its commissioning.

Figure 4: Landfill Gas Utilization to Electricity Facility and Landfill Gas Flaring Station located at the City's Merrick Landfill Site



Table 3 presents a summary of the LFG to electricity project in terms of finances and energy produced.

Table 3: Merrick Landfill Gas to Electricity Project

| | |
|--|------------------------|
| Total Costs | \$4,000,000 |
| Start Date | May 2010 |
| Construction Start Date | July 2011 |
| Completion Date | June 12, 2013 |
| Electricity Generated (2023 average/month) | 220,630 kWh |
| Projected Annualized Revenue | \$1.05 to 1.15 Million |
| Projected Annual Revenue to the City | \$350,000 to \$450,000 |
| Expected Payback | 10 Years |

Sewage Treatment Plant Energy Audit

In 2022 the City employed the services of engineering consultant RV Anderson to complete an audit for the energy use at the Sewage Treatment Plant. The report will include recommendations for improvements to the treatment process which would enhance effluent quality and/or reduce energy consumption. It will also include suggestions for potential energy reducing strategies and/or energy production, such as, for example, hydropower from wastewater outfall. As of June 2024, the project is in draft form.

Education, Training, and Awareness

Education, training and awareness is an integral part of the project plan and is critical to the success of the projects in terms of achieving and sustaining proposed savings. They are also essential in creating, maintaining and improving a sustainable energy culture within the Corporation of the City of North Bay and throughout the community. The overall intent of the training program is to complement the technological and organizational changes proposed in the plan and maximize the energy savings resulting from projects. The City of North Bay has made numerous efforts to ensure resources and operations are assisting in meeting the goals of the CDM plan to the best of the operation's current abilities while factoring in variances shown by isometric data, feasibility studies, and concerns.

Training on building systems and energy efficiency will allow the building staff to modify operations to increase efficiencies, identify opportunities for energy savings measures and raise awareness of energy efficiency among all staff.

In 2014, the City undertook a partnership with LAS to complete an Energy Conservation Education and Awareness Training initiative. The purpose of this workshop was to help inspire the change of typical workplace behaviours from energy consuming to energy conserving. To do this, the workshop promoted the understanding of energy consumption as well as to offer many workplace energy conservation tips. The training also included helpful tips that participants can utilize to reduce their energy consumption in their homes.

In an office environment it is recognized that lighting can account for up to 40% of energy costs, space heating and cooling can account for between 20-40% and plug loads for 5-10%. Thus, training sessions included ways to save costs through conservation by exploring means to reduce lighting consumption, heating and cooling demand, and plug loads. In addition, the training sessions will provide a vehicle to communicate past and present progress on energy conservation and demand management and introduce future conservation and demand management plans.

Recognizing beneficial advances that have been previously made towards achieving the City's goals is an important step in sustainability. These advances are continuing to be made to further increase the value and impact of these initiatives. Raising awareness through controllable environmental initiatives is implemented corporately, impacting all City assets. Staff have been given several tools to increase their own energy efficiency.

The City of North Bay website is a great resource for both staff and the public to become informed and learn more about environmental services and renewability. The website provides information on composting, recycling, pesticide use and water conservation and can be found at the following address: <https://www.northbay.ca/our-community/environment-sustainability/>

Action Items, Responsibilities and Timelines

Appendix 1 expands the City of North Bay's Objectives and Goals previously presented. It also provides for responsibilities and timelines.

Appendix 1: City of North Bay's Expanded Objectives and Goals

1. Re-Mandate steering committee and working committee.

- a. Steering committee meets quarterly to review corporate and departmental progress, exchange CDM information, learn about new opportunities etc.

Timing: Ongoing.

2. Update Energy Data Management System to establish a more effective Monitoring and Tracking System that includes:

- a. Efficient Data Collection
- b. User Friendly Interface for major asset groups
- c. Quarterly and Annual Reports
- d. Identify, investigate, and implement where viable sub-metering capabilities

Timing: Ongoing

3. Establish a Sustainable Buildings Program

- a. Develop a Sustainable Building Policy.
- b. Complete 2 Building Energy Studies targeted on major energy consumers with potential for significant improvement over the next 5 years.
- c. Integrate Sustainable Building Best Practices into all new building construction and retrofit projects.
- d. Improve utilization of BAS where available
- e. Investigate feasibility of a corporate wide open protocol BAS
- f. Identify peak demand for development of peak demand management strategies
- g. Include major departments and ABC's
- h. Improve energy efficiency for new and existing residential and commercial buildings in the community.

Timing: Establish a corporate subcommittee mandated to establishing a Sustainable Buildings Program in 2023-2027.

4. Wastewater and Water Distribution and Facilities

- a. Integrate CDM into operations and modernization plans.

Timing: Driven by the Senior Facilities and Environment Engineer, Director of Public Works, Manager Water/Wastewater, and Manager Distribution/Collection the CDM plan will be integrated in current operations planning modernization plans. Plan development is targeted for 2023-2027.

5. Establish key partners and relationship.

- a. To identify and develop viable projects
- b. To fill technical and resource gaps where applicable
- c. To effectively utilize all available funding avenues to finance best in class projects that meet the corporation's goals.

Timing: Ongoing.

6. Improve the energy efficiency of the municipal fleet.

- a. Establish goals to be achieved by 2027
- b. Establish plan for switching to more efficient vehicles during the normal replacement cycle
- c. Investigate and evaluate potential of alternative fuels

Timing: Ongoing.

7. Update Green Fleet Plan

- a. Identify new potential projects
- b. Audit operating practices

Timing: Ongoing.

8. Establish a funding plan to help finance energy conservation and demand management projects including expanding renewable Fts.

- a. Utilize multiple funding options.
- b. Wherever possible funding for projects should include all available sources including other government incentives, utility and/or equipment incentives etc.
- c. Develop policy and guidelines for the CDM Project Fund.

Timing: 2023 - 2027.

9. Facilitate communication to the corporation and to the community

- a. Communication of performance
- b. Continue to enhance energy conservation culture
- c. Communication to Developers/Builders for new construction

Timing: Items (a) and (b) are ongoing. Develop a communication plan to communicate results to other local groups.

10. Incorporate energy conservation into project management

- a. Examine life cycle cost vs up front cost when planning

Timing: Ongoing

11. Education, Awareness and Training

- a. Identify potential Energy Conservation Education and Awareness Training.
- b. Complete workshops for designated staff.

Timing: 2023 - 2027

12. Meet all provincial regulatory requirements.

- a. The Electricity Act

Timing: Ongoing.

Appendix 2: City of North Bay Detailed Energy Consumption Data

2.1 Electricity

Table 5: The City of North Bay's Electricity Annual Consumption Data 2007-2023

| Facility | Baseline 2007 kW-hrs | 2022 kW-hrs | 2023 kW-hrs | Variation 2007 vs. 2023 kW-hrs | Variation 2022 vs. 2023 kW-hrs |
|------------------------|-------------------------------------|------------------------|------------------------|---|---|
| Trout Lake WTP | 4,944,149 | 4,025,158 | 4,270,475 | -673,674 | 245,317 |
| Sewage Plant | 3,499,040 | 3,037,825 | 2,847,262 | -651,778 | -190,562 |
| Street Lights | 3,306,186 | 2,036,369 | 2,036,369 | -1,269,817 | 0 |
| Pete Palangio Arena | 1,610,640 | 1,025,296 | 1,037,835 | -572,805 | 12,538 |
| City Hall | 1,624,320 | 1,513,689 | 1,567,944 | -56,376 | 54,255 |
| Public Works | 1,421,790 | 627,471 | 602,696 | -819,094 | -24,775 |
| Memorial Gardens Arena | 1,231,920 | 1,931,082 | 1,739,300 | 507,380 | -191,781 |
| Reservoirs/ Water PS | 1,087,204 | 631,083 | 670,059 | -417,145 | 38,976 |
| Aquatic Centre | 933,840 | 773,580 | 733,193 | -200,647 | -40,387 |
| Parks/Beaches | 825,000* | 825,000* | 825,000* | 0 | 0 |

| Facility | Baseline 2007 kW-hrs | 2022 kW-hrs | 2023 kW-hrs | Variation 2007 vs. 2023 kW-hrs | Variation 2022 vs. 2023 kW-hrs |
|----------------------------|-------------------------------------|------------------------|------------------------|---|---|
| Sewage Lift/ Pump Stations | 495,138 | 447,734 | 478,395 | -16,743 | 30,660 |
| West Ferris Arena | 590,600 | 358,542 | 380,994 | -209,606 | 22,452 |
| Fire Stations | 287,326 | 288,430 | 315,548 | 28,222 | 27,118 |
| Other Parking Lots | 195,000* | 195,000* | 195,000* | 0 | 0 |
| Parking Garage | 151,412 | 44,881 | 63,002 | -88,410 | 18,121 |
| Traffic Lights | 269,138 | 158,964 | 153,747 | -115,391 | -5,217 |
| Merrick Landfill | 126,532 | 691,107 | 668,586 | 542,054 | -22,520 |
| Marina | 135,828 | 99,802 | 97,451 | -38,377 | -2,351 |
| Lee Park | 125,200 | 76,017 | 78,494 | -46,706 | 2,478 |
| Marsh Landfill | 86,850 | 140,484 | 165,193 | 78,343 | 24,709 |
| Other Waterfront | 75,000* | 75,000* | 75,000* | 0 | 0 |
| Transit/Shelters | 70,000 | 85,340 | 77,970 | 7,970 | -7,371 |

| Facility | Baseline 2007 kW-hrs | 2022 kW-hrs | 2023 kW-hrs | Variation 2007 vs. 2023 kW-hrs | Variation 2022 vs. 2023 kW-hrs |
|---------------------|-------------------------------------|------------------------|------------------------|---|---|
| Public Library | NO DATA | 227,640 | 226,320 | NO DATA | -1,320 |
| Annual Total | 23,092,113 | 19,315,494 | 19,305,833 | -3,786,280 | -9,660 |

Note: Numbers with an asterisk (*) are estimate.

Figure 5 presents annual electricity consumption of the top 10 users of the City from 2007 to 2023. These locations plus the Public Library consume most of the City's electricity and this is where the majority of energy efficiency recommendations are focused.

Figure 5: Electricity Consumption by Facility (2008-2023)

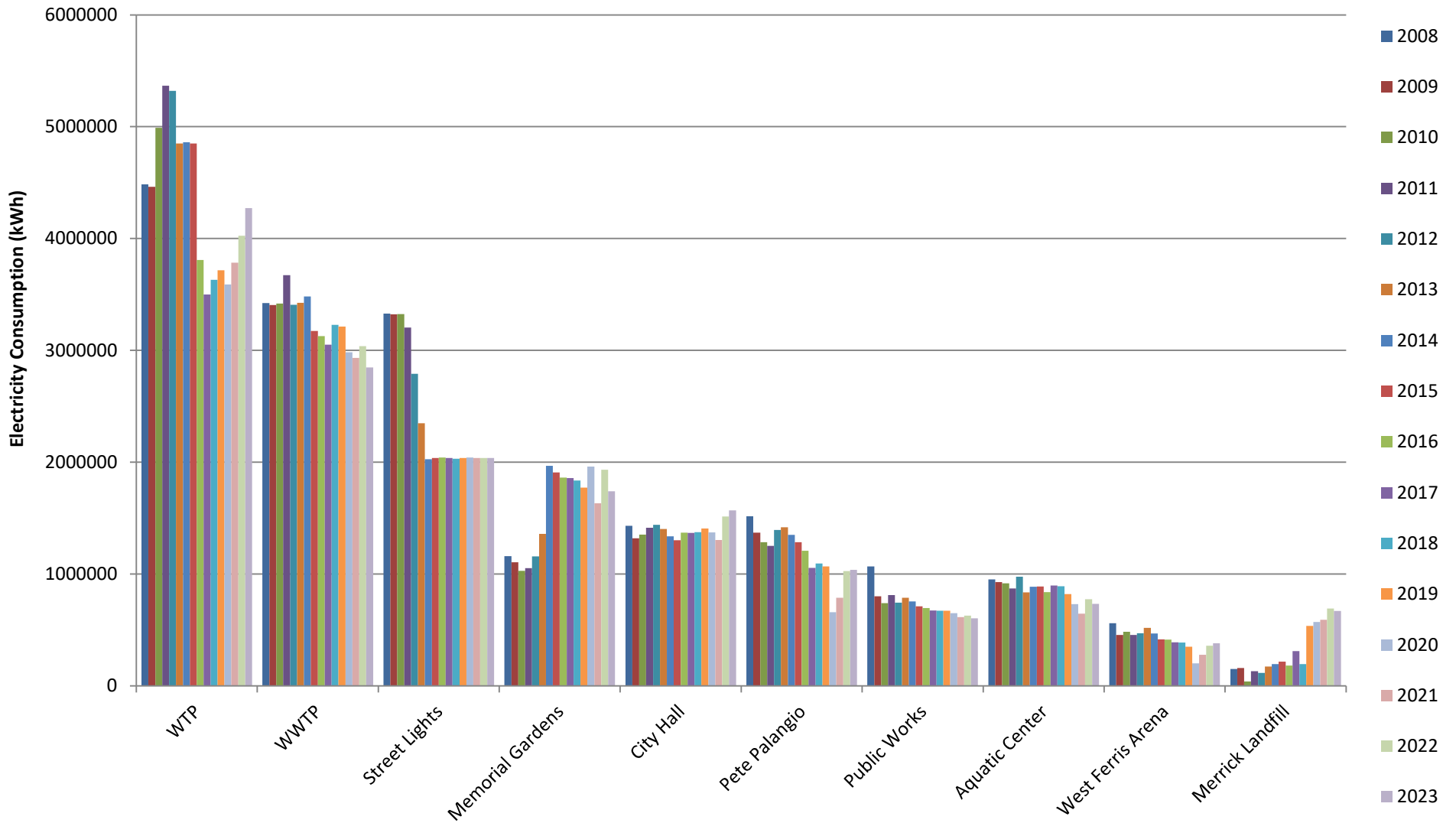
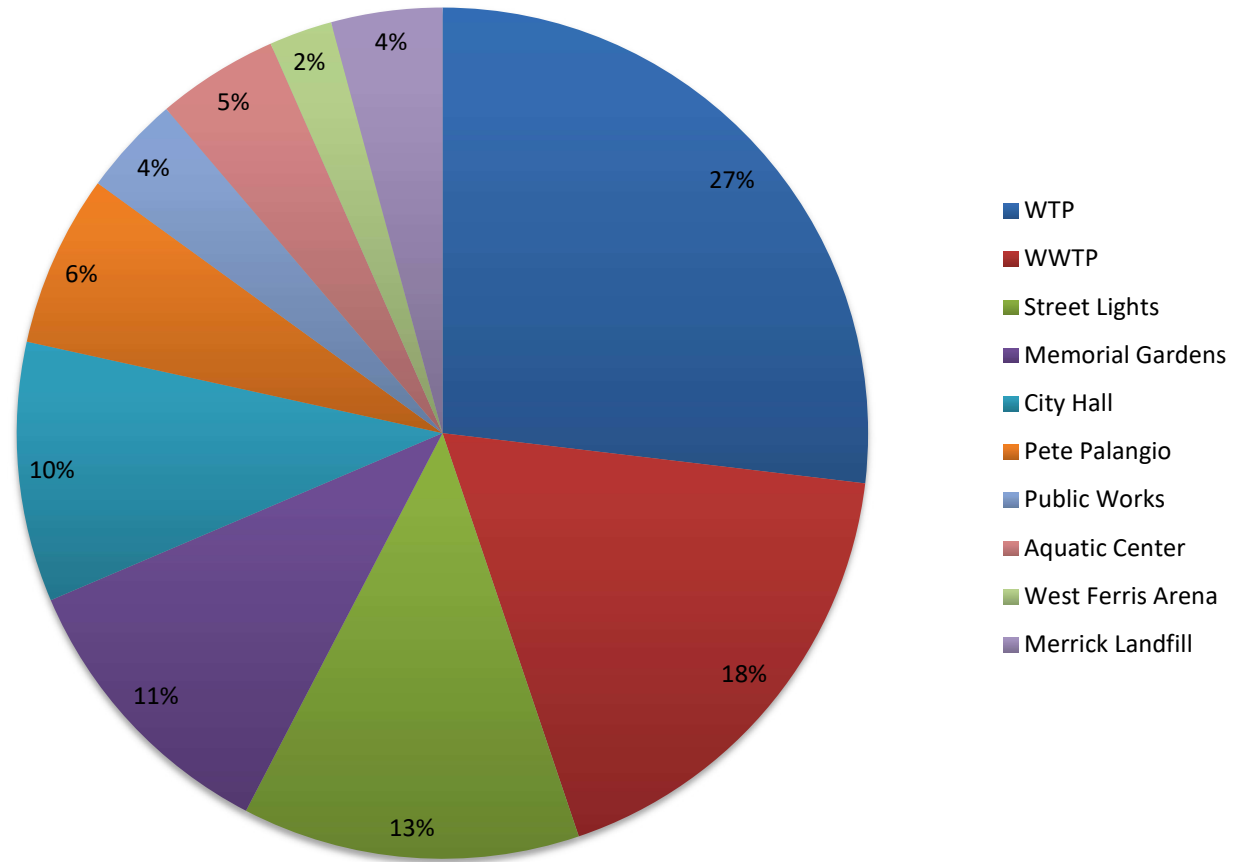


Figure 6 presents the electricity used by facility by the percentage of total used in 2023 by the City of North Bay. The top 10 users are identified.

Figure 6: Breakdown by Facility of 2023 Electricity Consumption



2.2 Natural Gas

Table 6: The City of North Bay’s Natural Gas Annual Consumption Data 2007-2023

| Facility | Baseline 2007 m3 | 2022 m3 | 2023 m3 | Variation 2007 vs 2023 m3 | Variation 2022 vs 2023 m3 |
|------------------------|------------------------|------------|------------|---------------------------------|---------------------------------|
| Public Works | 299,538 | 64,061 | 80,068 | -219,470 | 16,007 |
| Aquatic Center | 320,024 | 59,892 | 45,968 | -274,056 | -13,924 |
| Memorial Gardens Arena | 186,361 | 133,913 | 118,244 | -68,117 | -15,669 |
| Sewage Treatment Plant | 161497 | 143,626 | 154,780 | -6,717 | 11,154 |
| Pete Palangio Arena | 102,424 | 156,712 | 166,558 | 64,134 | 9,846 |
| West Ferris Arena | 64,681 | 30,158 | 50,697 | -13,984 | 20,539 |
| City Hall | 54,996 | 71,812 | 69,381 | 14,385 | -2,431 |
| Fire Station 1 | 49,740 | 41,979 | 35,086 | -14,654 | -6,893 |
| Lee Park | 22,441 | 16,900 | 12,503 | -9,938 | -4,397 |
| Fire Station 2 | 18,117 | 10,924 | 11,768 | -6,349 | 844 |

| Facility | Baseline 2007 m3 | 2022 m3 | 2023 m3 | Variation 2007 vs 2023 m3 | Variation 2022 vs 2023 m3 |
|-------------------------|---------------------------------|--------------------|--------------------|--|--|
| Fire Station 3 | 15,270 | 14,168 | 11,421 | -3,849 | -2,747 |
| New Bus Terminal | 12,993 | 12,564 | 15,589 | 2,596 | 3,025 |
| Water Treatment Plant | 11,966 | 38,099 | 39,940 | 27,974 | 1,841 |
| Fire Station 4 | 12590 | 7,751 | 4,904 | -7,686 | -2,847 |
| Kinnette Playground | 5,713 | 5,618 | 6,085 | 372 | 467 |
| Police Playground | 3,680 | 4,183 | 2,385 | -1,295 | -1,798 |
| Marathon Beach | - | 102 | 533 | 533 | 431 |
| Laurentian Playground | 1256 | 1,858 | 1,615 | 359 | -243 |
| Graniteville Playground | 1,077 | 1,146 | 477 | -600 | -669 |
| 330 Main East | 0 | 10,926 | 10,154 | 10,154 | -772 |
| 1105 Lakeshore Drive | 0 | 11,306 | 10,891 | 10,891 | -415 |

| Facility | Baseline 2007 m3 | 2022 m3 | 2023 m3 | Variation 2007 vs 2023 m3 | Variation 2022 vs 2023 m3 |
|---------------------|---------------------------------|--------------------|--------------------|--|--|
| Library | - | 38,322 | 30,274 | 30,274 | -8,048 |
| Annual Total | 1,359,460 | 876,021 | 879,321 | -480,139 | 3,300 |

Figure 7 presents the annual Natural Gas consumption of the top 10 users of the City since 2007.

Figure 7: Natural Gas Consumption by Facility (2007-2023)

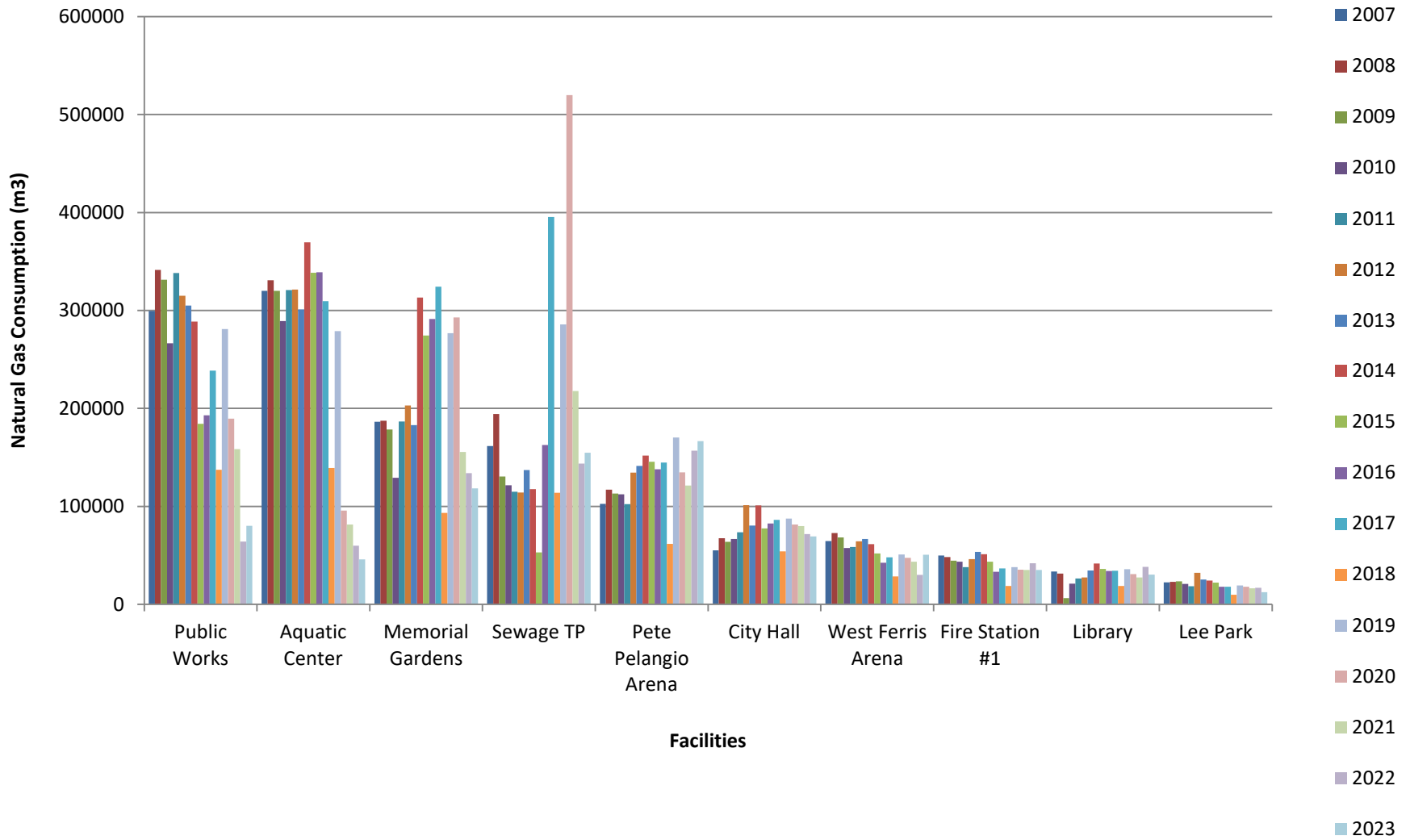
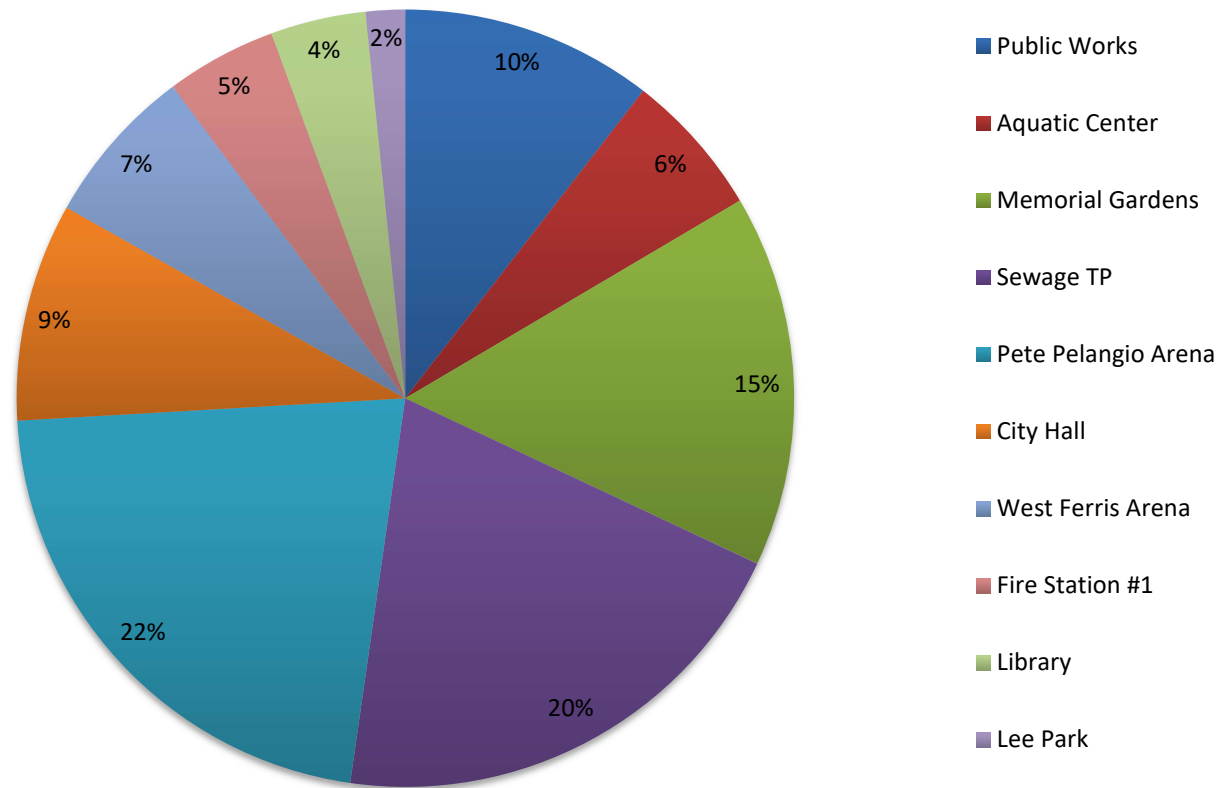


Figure 8 illustrates natural gas consumed by facility by the percentage of total used in 2023 by the City of North Bay. The top 10 users are identified.

Figure 8: Breakdown by Facility of 2023 Natural Gas Consumption



2.3 Transportation Fuel

Table 7: Annual Transportation Fuel Consumption Data

| Function | 2007 (L) | 2021 (L) | 2022 (L) | 2023 (L) |
|--------------------------------|------------------|------------------|------------------|------------------|
| Fleet/Garage | NO DATA | 9,674 | 9,563 | 15,884 |
| Police | NO DATA | 124,266 | 108,605 | 113,586 |
| Parks | 70,174 | 63,736 | 69,478 | 78,743 |
| Transit | 868,826 | 417,752 | 500,133 | 584,372 |
| Ambulance | NO DATA | 109,194 | 119,500 | 98,672 |
| Public Works | 501,824 | 451,199 | 486,369 | 497,244 |
| Hydro | NO DATA | 100,881 | 95,916 | 94,104 |
| Water/Wastewater Plant | NO DATA | 9,272 | 9,441 | 9,302 |
| By-law, Parking, Survey | 2,447 | 17,327 | 15,000 | 15,934 |
| Fire | 46,507 | 34,931 | 36,967 | 40,464 |
| Landfill | - | - | 78,875 | 88,890 |
| Arena | NO DATA | 572 | 708 | 940 |
| City Total | 1,489,778 | 1,349,895 | 1,530,554 | 1,638,134 |
| Reduction | - | -139,883 | 40,776 | 148,356 |
| CO_{2e} (tonne) | 15,346 | 13,742 | 15,581 | 16,676 |

Figure 9 presents the annual transportation fuel consumption by department in the City of North Bay since 2007.

Figure 9: Transportation Fuel Consumption by Function (2007-2023)

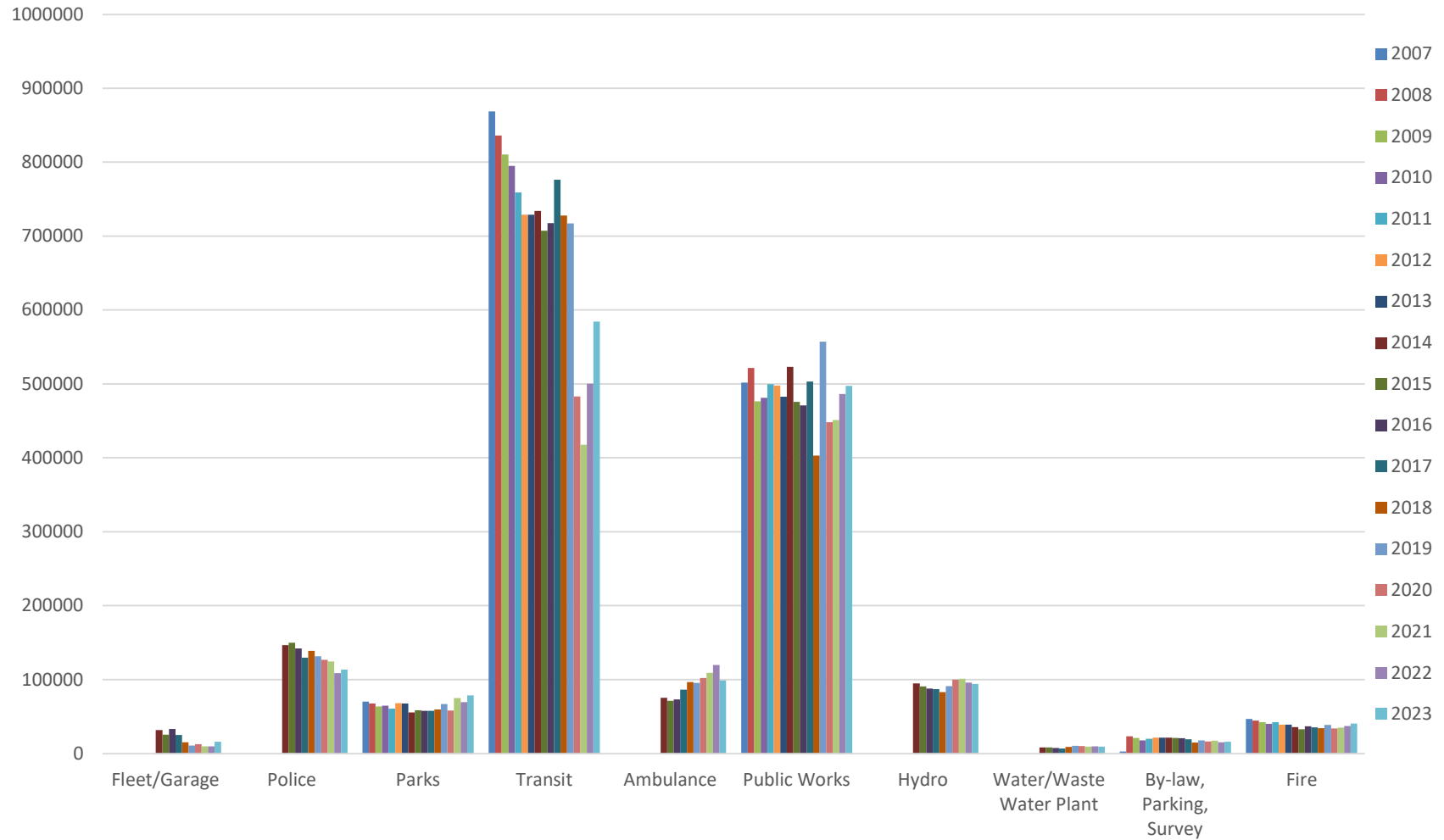
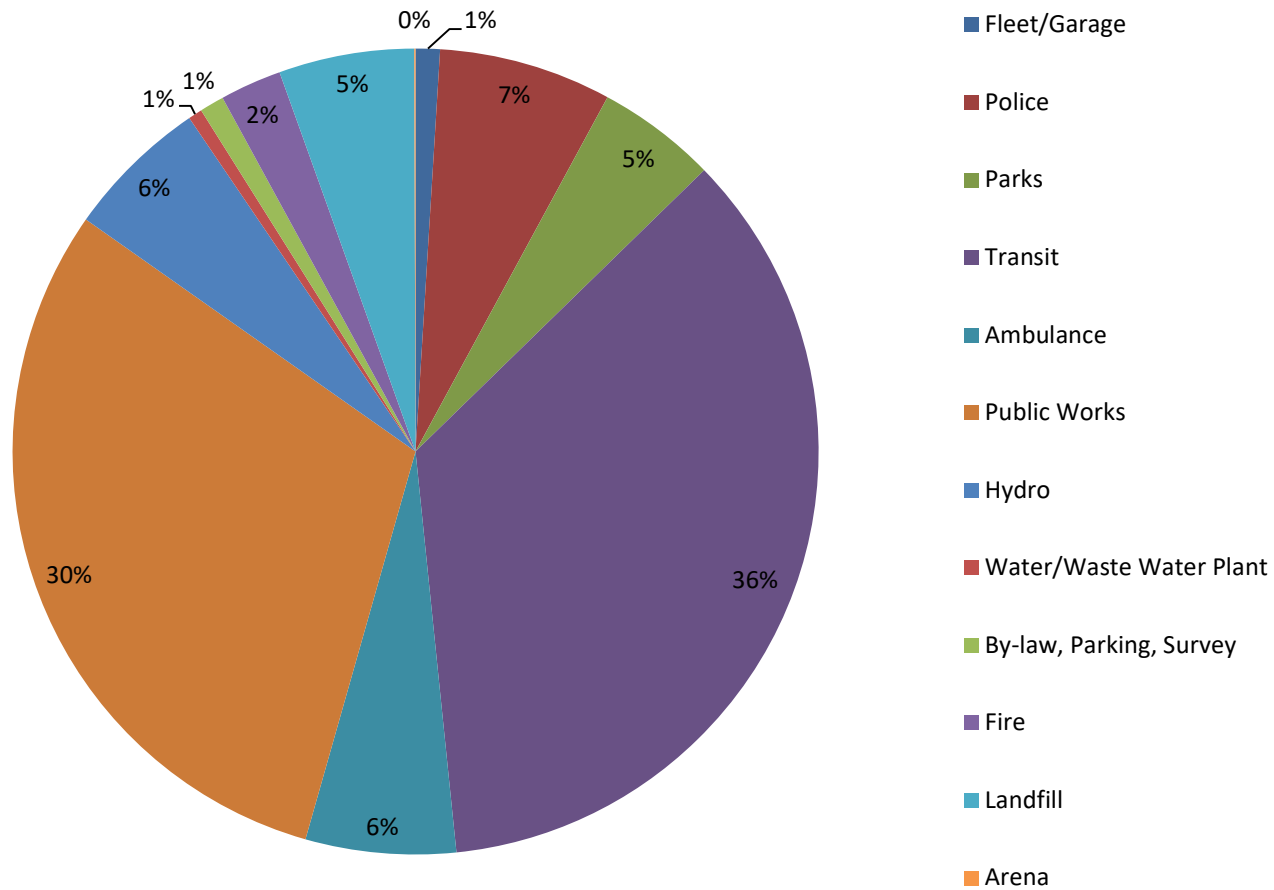


Figure 10 presents the transportation fuel used by the various functions in North Bay during 2023. Detailed annual consumption of transportation fuel data is provided in Appendix 2.3.

Figure 10: Breakdown by Function of 2023 Transportation Fuel Consumption



2.4 Isometrics

Accurately comparing energy consumption from year-to-year requires an appreciation of external factors such as weather and climatic influences. For example, hot summers drive up the demand for air conditioning, cold winters increase demand for heating, damp weather reduces water pumping but can increase pumping at sewage lift stations and at the landfill.

Heating Degree Days (days that average less than 18°C) and Cooling Degree Days (days that average greater than 18°C) can be examined to help understand energy demand at City buildings.

Tables 8, 9, and 10 show that the weather in 2023 was on average slightly cooler than it was in 2010. However, it was warmer in temperature in 2023 relative to 2022. Temperature has an impact on energy demands.

Table 8: Average Temperature at North Bay Airport

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Yearly Average |
|-------------|-------|-------|-------|------|------|------|------|------|------|------|------|-------|----------------|
| 2010 | -10.6 | -8.9 | 1.8 | 7.5 | 14.2 | 15.9 | 20.6 | 19.3 | 12.5 | 6.1 | 0.5 | -8.2 | 5.9 |
| 2011 | -8.2 | -10.5 | -5.9 | 3.2 | 12.6 | 16.6 | 20.7 | 18.9 | 14.7 | 8.5 | 2.5 | -6.2 | 5.6 |
| 2012 | -9 | -7 | 2 | 4 | 14 | 18 | 20 | 19 | 13 | 7 | -1 | -7 | 6.1 |
| 2013 | -11.6 | -11.1 | -3.9 | 1.7 | 11.7 | 15 | 18.3 | 17.2 | 12.2 | 7.2 | -3.3 | -13.3 | 3.3 |
| 2014 | -15.6 | -13.3 | -10.6 | 1.7 | 11.1 | 16.7 | 16.7 | 16.7 | 12.8 | 6.7 | -3.9 | -7.2 | 2.7 |
| 2015 | -16.4 | -19.2 | -7.9 | 3.4 | 12.1 | 14.7 | 18.5 | 18.6 | 17.1 | 5.6 | 3.3 | -0.5 | 4.1 |
| 2016 | -10.5 | -11.5 | -3.4 | -0.1 | 11.9 | 15.8 | 19.1 | 20 | 14.7 | 7.3 | 3.2 | -8.3 | 4.9 |
| 2017 | -8.7 | -6.5 | -8.3 | 5.8 | 10.3 | 15.2 | 18.4 | 16.2 | 15 | 10.2 | -2.6 | -15.7 | 4.1 |
| 2018 | -12 | -9.7 | -5.3 | -1.7 | 12.9 | 16 | 20.9 | 19.2 | 13.9 | 4.1 | -4.7 | -8.2 | 3.8 |
| 2019 | -16 | -11 | -6.8 | 1.9 | 8.7 | 15.2 | 20.1 | 17.2 | 12.9 | 6.9 | -4.6 | -7 | 3.1 |
| 2020 | -8.3 | -9.5 | -2.4 | 2.1 | 9.9 | 16.8 | 20.7 | 17.1 | 11.7 | 4.4 | 2.1 | 2.1 | 5.6 |
| 2021 | -8.9 | -10.5 | -2.8 | 6.0 | 10.8 | 17.4 | 17.9 | 19.8 | 13.2 | 10.6 | -0.6 | -6.4 | 5.5 |
| 2022 | -17.5 | -12.6 | -5 | 2.9 | 13.5 | 15.9 | 18.2 | 18.1 | 13.4 | 7.5 | 1 | -5.3 | 4.2 |
| 2023 | -8.6 | -10 | -4.7 | 4.2 | 10.9 | 17.2 | 18.9 | 16.2 | 14.9 | 7.9 | -1.8 | -3.2 | 5.16 |

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Yearly Average |
|------------------------|--------|--------|-------|------|-------|-------|-------|-------|-------|------|-------|-------|----------------|
| Monthly Average | -11.56 | -10.81 | -4.51 | 3.04 | 11.76 | 16.17 | 19.21 | 18.11 | 13.71 | 7.14 | -0.71 | -6.74 | |

Table 9: Heating Degree Days at North Bay Airport (number of degrees Celsius that the mean temperature is below 18°C)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Yearly Average |
|------------------------|--------|--------|--------|--------|--------|-------|-------|-------|--------|--------|--------|--------|----------------|
| 2010 | 789 | 670 | 429 | 390 | 335 | 88 | 47 | 18 | 85 | 254 | 402 | 596 | 341.9 |
| 2011 | 875 | 960 | 783 | 622 | 388 | 120 | 42 | 11 | 47 | 151 | 354 | 530 | 406.9 |
| 2012 | 837 | 704 | 502 | 429 | 148 | 64 | 20 | 41 | 172 | 339 | 561 | 757 | 381.2 |
| 2013 | 890 | 793 | 679 | 487 | 202 | 102 | 48 | 64 | 174 | 327 | 613 | 945 | 443.7 |
| 2014 | 1002 | 854 | 849 | 478 | 216 | 70 | 70 | 73 | 178 | 340 | 628 | 761 | 459.9 |
| 2015 | 996.4 | 1041 | 778 | 438.8 | 191.1 | 100.6 | 37.1 | 27.4 | 68.8 | 358.5 | 426.8 | 481.2 | 412.1 |
| 2016 | 854.9 | 856.7 | 663.4 | 542.1 | 201 | 85.7 | 24.1 | 9.2 | 75.6 | 213.9 | 324.8 | 473.3 | 360.4 |
| 2017 | 427.9 | 417.1 | 709 | 269.5 | 170.2 | 66.9 | 15.8 | 59 | 114.2 | 203.9 | 411.1 | 875.6 | 311.7 |
| 2018 | 928.4 | 775.9 | 720.7 | 592.2 | 173.8 | 75 | 8.9 | 16.5 | 145.5 | 415.8 | 680.3 | 813 | 445.5 |
| 2019 | 1042.2 | 811.4 | 770.3 | 483.5 | 288.4 | 92.2 | 7 | 42.7 | 154.9 | 320.9 | 677.9 | 775.3 | 455.6 |
| 2020 | 814.9 | 796.5 | 632.5 | 476.8 | 272.7 | 75.6 | 5.6 | 60.2 | 188.8 | 409.2 | 475 | 475 | 390.2 |
| 2021 | 834.7 | 797.5 | 645.4 | 361.3 | 227.3 | 49.0 | 35.6 | 18.3 | 145.7 | 230.5 | 558.9 | 756.3 | 410.4 |
| 2022 | 1099.9 | 856.9 | 712.1 | 453.4 | 159.7 | 82.9 | 28.9 | 31.3 | 141.2 | 283.9 | 510.3 | 722.1 | 423.6 |
| 2023 | 825.9 | 784.3 | 702.8 | 415.9 | 225.7 | 53.7 | 14.9 | 57.9 | 113.4 | 294.7 | 593.5 | 635.7 | 393.2 |
| Monthly Average | 872.73 | 794.16 | 684.01 | 459.96 | 228.49 | 80.40 | 28.92 | 37.82 | 127.57 | 295.88 | 515.47 | 685.46 | |

Table 10: Cooling Degree Days at North Bay Airport (number of degrees Celsius that the mean temperature is above 18°C)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Yearly Average |
|------------------------|-----|-----|------|------|-------|-------|-------|-------|-------|------|-----|-----|----------------|
| 2010 | 0 | 0 | 0 | 12 | 70 | 57 | 168 | 131 | 25 | 2 | 0 | 0 | 38.8 |
| 2011 | 0 | 0 | 0 | 1 | 37 | 73 | 171 | 113 | 50 | 14 | 0 | 0 | 38.3 |
| 2012 | 0 | 0 | 5 | 0 | 33 | 64 | 98 | 53 | 19 | 1 | 0 | 0 | 22.8 |
| 2013 | 0 | 0 | 0 | 1 | 26 | 23 | 76 | 41 | 8 | 2 | 0 | 0 | 14.8 |
| 2014 | 0 | 0 | 0 | 0 | 10 | 47 | 34 | 38 | 16 | 1 | 0 | 0 | 12.2 |
| 2015 | 0 | 0 | 0 | 0 | 8.1 | 1.6 | 52.7 | 44.9 | 43.1 | 0 | 0 | 0 | 12.5 |
| 2016 | 0 | 0 | 0 | 0 | 11.7 | 21.6 | 55.4 | 61.9 | 2.1 | 0 | 0 | 0 | 12.7 |
| 2017 | 0 | 0 | 0 | 0 | 0.7 | 1.6 | 24.8 | 11.6 | 30.4 | 0 | 0 | 0 | 5.8 |
| 2018 | 0 | 0 | 0 | 0 | 15.3 | 16 | 99.7 | 55 | 23.8 | 0 | 0 | 0 | 17.5 |
| 2019 | 0 | 0 | 0 | 0 | 0 | 7 | 73.6 | 18.3 | 1.9 | 0 | 0 | 0 | 8.4 |
| 2020 | 0 | 0 | 0 | 0 | 22.8 | 40.8 | 89.1 | 31.4 | 0.9 | 0 | 0 | 0 | 15.4 |
| 2021 | 0 | 0 | 0 | 0 | 11.2 | 30.4 | 31.3 | 72.4 | 0.5 | 2.0 | 0 | 0 | 12.3 |
| 2022 | 0 | 0 | 0 | 0 | 21.6 | 19 | 34.1 | 35.4 | 13.5 | 0 | 0 | 0 | 10.3 |
| 2023 | 0 | 0 | 0 | 0.5 | 6.9 | 31.1 | 43.9 | 8.3 | 20.3 | 2.4 | 0 | 0 | 9.45 |
| Monthly Average | 0 | 0 | 0.36 | 1.04 | 19.59 | 30.94 | 75.11 | 51.09 | 18.18 | 1.74 | 0 | 0 | |

Table 11 shows a decrease in precipitation in 2023 compared to previous years, and a decrease compared to the baseline (2011). The peak year for precipitation is 2019.

Table 11: Monthly and Annual Precipitation in millimeters

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Yearly Average |
|------------------------|-------|-------|-------|-------|-------|-------|-------|-------|--------|--------|-------|-------|----------------|
| 2010 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2011 | 62.8 | 60.6 | 73.4 | 133.4 | 51.6 | 90.2 | 62.8 | 43.2 | 79.4 | 126.8 | 106.4 | 81.4 | 81.0 |
| 2012 | 82.2 | 44 | 57 | 70 | 23.8 | 115.4 | 61.8 | 145.8 | 102 | 126 | 54.2 | 79.9 | 80.2 |
| 2013 | 72.4 | 37.6 | 32.8 | 90.2 | 57.4 | 59.2 | 82.3 | 91.7 | 68.8 | 102.9 | 63.7 | 31 | 65.8 |
| 2014 | 69.3 | 24.4 | 55.9 | 67.3 | 49.3 | 175.8 | 241.8 | 88.9 | 86.4 | 77.2 | 58.4 | 22.6 | 84.8 |
| 2015 | 0.9 | 3.8 | 20.4 | 74.2 | 79.1 | 57.4 | 53 | 92.3 | 45.2 | 85.7 | 66.5 | 69.1 | 54.0 |
| 2016 | 54.1 | 43.2 | 109 | 24.3 | 48.8 | 52.9 | 77.6 | 105.8 | 67.9 | 33.6 | 22.7 | 26.5 | 55.5 |
| 2017 | 14.2 | 36.8 | 16.1 | 106 | 92.8 | 86.1 | 71.1 | 149.4 | 70.1 | 104.9 | 59.5 | 41.3 | 70.7 |
| 2018 | 38.2 | 34.5 | 11.2 | 51.9 | 71.3 | 27.8 | 25.1 | 119.5 | 121.5 | 89.8 | 56.1 | 52.7 | 58.3 |
| 2019 | 66.9 | 70 | 60 | 144.7 | 132.1 | 107.5 | 81.4 | 45.2 | 146.2 | 156.8 | 100.4 | 53.9 | 97.1 |
| 2020 | 56.2 | 37.1 | 113.3 | 69.6 | 76 | 61.2 | 99.3 | 124 | 151.3 | 120 | 68.6 | 86.4 | 88.6 |
| 2021 | 22.9 | 46.7 | 44.8 | 48.8 | 19.4 | 142.5 | 169.6 | 73.0 | 186.4 | 127.1 | 66.4 | 94.5 | 86.8 |
| 2022 | 12.4 | 23.9 | 101.1 | 84.3 | 112.5 | 101.1 | 120 | 106.3 | 129.6 | 66.7 | 45.7 | 33.4 | 78.1 |
| 2023 | 37.2 | 47.5 | 33.6 | 119.2 | 58.7 | 150.6 | 81.9 | 66.3 | 74.6 | 105.8 | 65.5 | 26.3 | 72.27 |
| Monthly Average | 45.36 | 39.24 | 56.05 | 83.38 | 67.14 | 94.44 | 94.44 | 96.26 | 102.26 | 101.79 | 64.16 | 53.77 | |

Appendix 3: Energy Intensity per Building

Table 12 illustrates the energy intensities for the City of North Bay’s facilities in 2023 to show which facilities use the most energy per square meter.

Table 12: Energy Intensity of Facilities (2023)

| Facility | Energy Intensity (kWh/sqm) |
|------------------------|----------------------------|
| Aquatic Center | 225.46 |
| City Hall | 202.21 |
| Fire Station #1 | 173.85 |
| Fire Station #2 | 72.96 |
| Fire Station #3 | 77.82 |
| Fire Station #4 | 78.69 |
| Lee Park Building | 216.87 |
| Memorial Gardens Arena | 332.31 |
| Merrick Landfill | 1.62 |
| Parking Garage | 113.54 |
| Pete Palangio Arena | 273.47 |
| Public Library | 81.21 |
| Public Works | 84.10 |
| Sewage Plant | 195.13 |
| Transit Station | 149.36 |
| Water Treatment Plant | 366.25 |
| West Ferris Arena | 122.19 |

Appendix 4: Greenhouse Gas Emissions Reductions

Table 13: Summary of Annual Energy Consumption and GHG Emissions from 2007-2023

| 2007 | Electricity (kWh) | Natural Gas (m ³) | Transportation Fuel (L) | Annual Total | Cumulative Total |
|---------------------------------------|-------------------|-------------------------------|-------------------------|--------------|------------------|
| Total Quantity Used | 23,093,113 | 1,359,460 | 1,489,778 | | |
| Total GHG Produced (tons CO2e) | 16,326 | 2,630 | 15,166 | 34,122 | 34,122 |

| 2008 | Electricity (kWh) | Natural Gas (m ³) | Transportation Fuel (L) | Annual Total | Cumulative Total |
|---|-------------------|-------------------------------|-------------------------|--------------|------------------|
| Total Quantity Used | 22,190,198 | 1,525,287 | 1,492,901 | | |
| Total GHG Produced (tons CO2e) | 15,688 | 2935 | 15,198 | 33,821 | 67,943 |
| Reduction Quantity (From Baseline) | 902,915 | -165,827 | -3,123 | | |
| Percent Reduction (From Baseline) | 3.91% | -12.20% | -0.96% | | |
| GHG Reduction (From Baseline) | 1,493 | -294 | 148 | 1,347 | 1,347 |

| 2009 | Electricity (kWh) | Natural Gas (m ³) | Transportation Fuel (L) | Annual Total | Cumulative Total |
|---|-------------------|-------------------------------|-------------------------|--------------|------------------|
| Total Quantity Used | 21,726,052 | 1,396,585 | 1,413,296 | | |
| Total GHG Produced (tons CO2e) | 15,360 | 2,687 | 14,387 | 32,434 | 100,377 |
| Reduction Quantity (From Baseline) | 1,367,061 | -37,125 | 76,482 | | |
| Percent Reduction (From Baseline) | 5.92% | -2.73% | 5.14% | | |
| GHG Reduction (From Baseline) | 1,821 | -46 | 779 | 2,554 | 3,901 |

| 2010 | Electricity (kWh) | Natural Gas (m ³) | Transportation Fuel (L) | Annual Total | Cumulative Total |
|---|-------------------|-------------------------------|-------------------------|--------------|------------------|
| Total Quantity Used | 21,839,169 | 1,246,338 | 1,398,238 | | |
| Total GHG Produced (tons CO2e) | 15,440 | 2,398 | 14,234 | 32,072 | 132,449 |
| Reduction Quantity (From Baseline) | 1,253,944 | 113,122 | 91,540 | | |
| Percent Reduction (From Baseline) | 5.43% | 8.32% | 6.14% | | |
| GHG Reduction (From Baseline) | 1,741 | 243 | 932 | 2,916 | 6,817 |

| 2011 | Electricity (kWh) | Natural Gas (m ³) | Transportation Fuel (L) | Annual Total | Cumulative Total |
|---|-------------------|-------------------------------|-------------------------|--------------|------------------|
| Total Quantity Used | 22,491,553 | 1,427,922 | 1,381,524 | | |
| Total GHG Produced (tons CO2e) | 15,902 | 2,748 | 14,064 | 32,714 | 166,211 |
| Reduction Quantity (From Baseline) | 601,560 | -68,462 | 108,254 | | |
| Percent Reduction (From Baseline) | 2.60% | -5.00% | 7.27% | | |
| GHG Reduction (From Baseline) | 1,279 | -107 | 1,102 | 2,454 | 9,091 |

| 2012 | Electricity (kWh) | Natural Gas (m ³) | Transportation Fuel (L) | Annual Total | Cumulative Total |
|---|-------------------|-------------------------------|-------------------------|--------------|------------------|
| Total Quantity Used | 22,525,177 | 1,433,250 | 1,354,793 | | |
| Total GHG Produced (tons CO2e) | 15,925 | 2,758 | 13,792 | 32,475 | 197,638 |
| Reduction Quantity (From Baseline) | 567,936 | -73,790 | 134,985 | | |
| Percent Reduction (From Baseline) | 2.46% | -5.43% | 9.06% | | |
| GHG Reduction (From Baseline) | 1,256 | -117 | 1,374 | 2,513 | 11,604 |

| 2013 | Electricity (kWh) | Natural Gas (m ³) | Transportation Fuel (L) | Annual Total | Cumulative Total |
|---|-------------------|-------------------------------|-------------------------|--------------|------------------|
| Total Quantity Used | 19,755,591 | 1,433,045 | 1,339,073 | | |
| Total GHG Produced (tons CO2e) | 13,967 | 2,758 | 13,632 | 30,357 | 227,995 |
| Reduction Quantity (From Baseline) | 3,337,522 | -73,585 | 150,705 | | |
| Percent Reduction (From Baseline) | 14.45% | -5.40% | 10.11% | | |
| GHG Reduction (From Baseline) | 3,214 | -117 | 1,534 | 4,631 | 16,235 |

| 2014 | Electricity (kWh) | Natural Gas (m ³) | Transportation Fuel (L) | Annual Total | Cumulative Total |
|---|-------------------|-------------------------------|-------------------------|--------------|------------------|
| Total Quantity Used | 20,098,157 | 1,701,498 | 1,726,126 | | |
| Total GHG Produced (tons CO2e) | 14,209 | 3,274 | 17,572 | 35,055 | 263,050 |
| Reduction Quantity (From Baseline) | 2,994,956 | -342,038 | -236,348 | | |
| Percent Reduction (From Baseline) | 12.97% | -25.20% | -15.86% | | |
| GHG Reduction (From Baseline) | 2,972 | -633 | -2,406 | -67 | 16,168 |

| 2015 | Electricity (kWh) | Natural Gas (m ³) | Transportation Fuel (L) | Annual Total | Cumulative Total |
|---|-------------------|-------------------------------|-------------------------|--------------|------------------|
| Total Quantity Used | 20,785,245 | 1,417,109 | 1,639,765 | | |
| Total GHG Produced (tons CO2e) | 14,695 | 2,727 | 16,693 | 34,115 | 297,165 |
| Reduction Quantity (From Baseline) | 2,307,868 | -57,649 | -149,987 | | |
| Percent Reduction (From Baseline) | 9.99% | -4.20% | -10.07% | | |
| GHG Reduction (From Baseline) | 2,486 | -86 | -1,527 | 873 | 17,041 |

| 2016 | Electricity (kWh) | Natural Gas (m ³) | Transportation Fuel (L) | Annual Total | Cumulative Total |
|---|-------------------|-------------------------------|-------------------------|--------------|------------------|
| Total Quantity Used | 19,285,175 | 1,441,921 | 1,646,865 | | |
| Total GHG Produced (tons CO2e) | 13,635 | 2,775 | 16,765 | 33,175 | 330,340 |
| Reduction Quantity (From Baseline) | 3,807,938 | -82,461 | -157,087 | | |
| Percent Reduction (From Baseline) | 16.49% | -6.10% | -10.54% | | |
| GHG Reduction (From Baseline) | 3,546 | -134 | -1,599 | 1,813 | 18,854 |

| 2017 | Electricity (kWh) | Natural Gas (m ³) | Transportation Fuel (L) | Annual Total | Cumulative Total |
|---|-------------------|-------------------------------|-------------------------|--------------|------------------|
| Total Quantity Used | 18,846,553 | 1,748,034 | 1,725,667 | | |
| Total GHG Produced (tons CO2e) | 13,325 | 3,364 | 17,567 | 34,256 | 364,596 |
| Reduction Quantity (From Baseline) | 4,246,560 | -388,574 | -235,889 | | |
| Percent Reduction (From Baseline) | 18.39% | -28.60% | -15.83% | | |
| GHG Reduction (From Baseline) | 3,856 | -723 | -2,401 | 732 | 19,586 |

| 2018 | Electricity (kWh) | Natural Gas (m ³) | Transportation Fuel (L) | Annual Total | Cumulative Total |
|---|-------------------|-------------------------------|-------------------------|--------------|------------------|
| Total Quantity Used | 19,248,464 | 1,518,862 | 1,581,446 | - | - |
| Total GHG Produced (tons CO2e) | 13,609 | 2,938 | 16,099 | 32,646 | 397,242 |
| Reduction Quantity (From Baseline) | 3,843,649 | -159,402 | -91,668 | | |
| Percent Reduction (From Baseline) | 16.64% | -11.73% | -6.22% | | |
| GHG Reduction (From Baseline) | 3,572 | -308 | -933 | 2,331 | 21,917 |

| 2019 | Electricity (kWh) | Natural Gas (m ³) | Transportation Fuel (L) | Annual Total | Cumulative Total |
|---|-------------------|-------------------------------|-------------------------|--------------|------------------|
| Total Quantity Used | 19,262,416 | 1,640,764 | 1,738,683 | | |
| Total GHG Produced (tons CO2e) | 13,619 | 3,174 | 17,700 | 34,493 | 431,735 |
| Reduction Quantity (From Baseline) | 3,829,697 | -281,304 | -248,905 | | |
| Percent Reduction (From Baseline) | 16.58% | -20.69% | -16.71% | | |
| GHG Reduction (From Baseline) | 2,708 | -544 | -2,534 | -370 | 21,547 |

| 2020 | Electricity (kWh) | Natural Gas (m ³) | Transportation Fuel (L) | Annual Total | Cumulative Total |
|---|-------------------|-------------------------------|-------------------------|--------------|------------------|
| Total Quantity Used | 18,166,035 | 1,571,067 | 1,390,461 | | - |
| Total GHG Produced (tons CO2e) | 12,843 | 3,039 | 14,155 | 30,037 | 461,772 |
| Reduction Quantity (From Baseline) | 4,926,078 | -211,607 | 99,317 | | |
| Percent Reduction (From Baseline) | 21.33 | -15.57 | 6.67% | | |
| GHG Reduction (From Baseline) | 3,483 | -490 | 1,011 | 4,004 | 25,551 |

| 2021 | Electricity (kWh) | Natural Gas (m ³) | Transportation Fuel (L) | Annual Total | Cumulative Total |
|---|-------------------|-------------------------------|-------------------------|--------------|------------------|
| Total Quantity Used | 17,919,336 | 1,041,471 | 1,349,895 | | |
| Total GHG Produced (tons CO2e) | 12,669 | 2,015 | 13,742 | 28,426 | 490,198 |
| Reduction Quantity (From Baseline) | 5,172,777 | 317,989 | 139,883 | | |
| Percent Reduction (From Baseline) | 22.40% | 23.39% | 9.39% | | |
| GHG Reduction (From Baseline) | 3,657 | 615 | 1,424 | 5,696 | 31,247 |

| 2022 | Electricity (kWh) | Natural Gas (m ³) | Transportation Fuel (L) | Annual Total | Cumulative Total |
|---|-------------------|-------------------------------|-------------------------|--------------|------------------|
| Total Quantity Used | 19,315,494 | 876,021 | 1,530,554 | | |
| Total GHG Produced (tons CO2e) | 13,656 | 1,694 | 15,581 | 30,931 | 521,129 |
| Reduction Quantity (From Baseline) | 3,777,619 | 483,439 | -40,776 | | |
| Percent Reduction (From Baseline) | 16.35 | 35.56 | -2.74 | | |
| GHG Reduction (From Baseline) | 2,670 | 935 | -415 | 3,190 | 34,437 |

| 2023 | Electricity (kWh) | Natural Gas (m³) | Transportation Fuel (L) | Annual Total | Cumulative Total |
|---|------------------------------|--|------------------------------------|-------------------------|-----------------------------|
| Total Quantity Used | 19,305,833 | 879,321 | 1,638,134 | | |
| Total GHG Produced (tons CO2e) | 13,649 | 1,701 | 16,676 | 32,026 | 553,155 |
| Reduction Quantity (From Baseline) | 3,787,280 | 480,139 | -148,356 | | |
| Percent Reduction (From Baseline) | 16.40 | 35.32 | -9.96 | | |
| GHG Reduction (From Baseline) | 2,677 | 929 | -1,510 | 2,096 | 36,533 |

| 2007-2022 Cumulative | Electricity (kWh) | Natural Gas (m³) | Transportation Fuel (L) | Total |
|---------------------------------------|------------------------------|--|------------------------------------|--------------|
| Total Quantity Used | 345,853,561 | 23,657,955 | 25,837,199 | |
| Total GHG Produced (tons CO2e) | 244,517 | 45,615 | 263,023 | 553,155 |

Figure 11 illustrates the progress made in the reduction of GHG's generated by fossil fuel consumption by the City of North Bay from 2007 to 2023.

Figure 11: Annual Greenhouse Gas Emissions 2007 to 2023

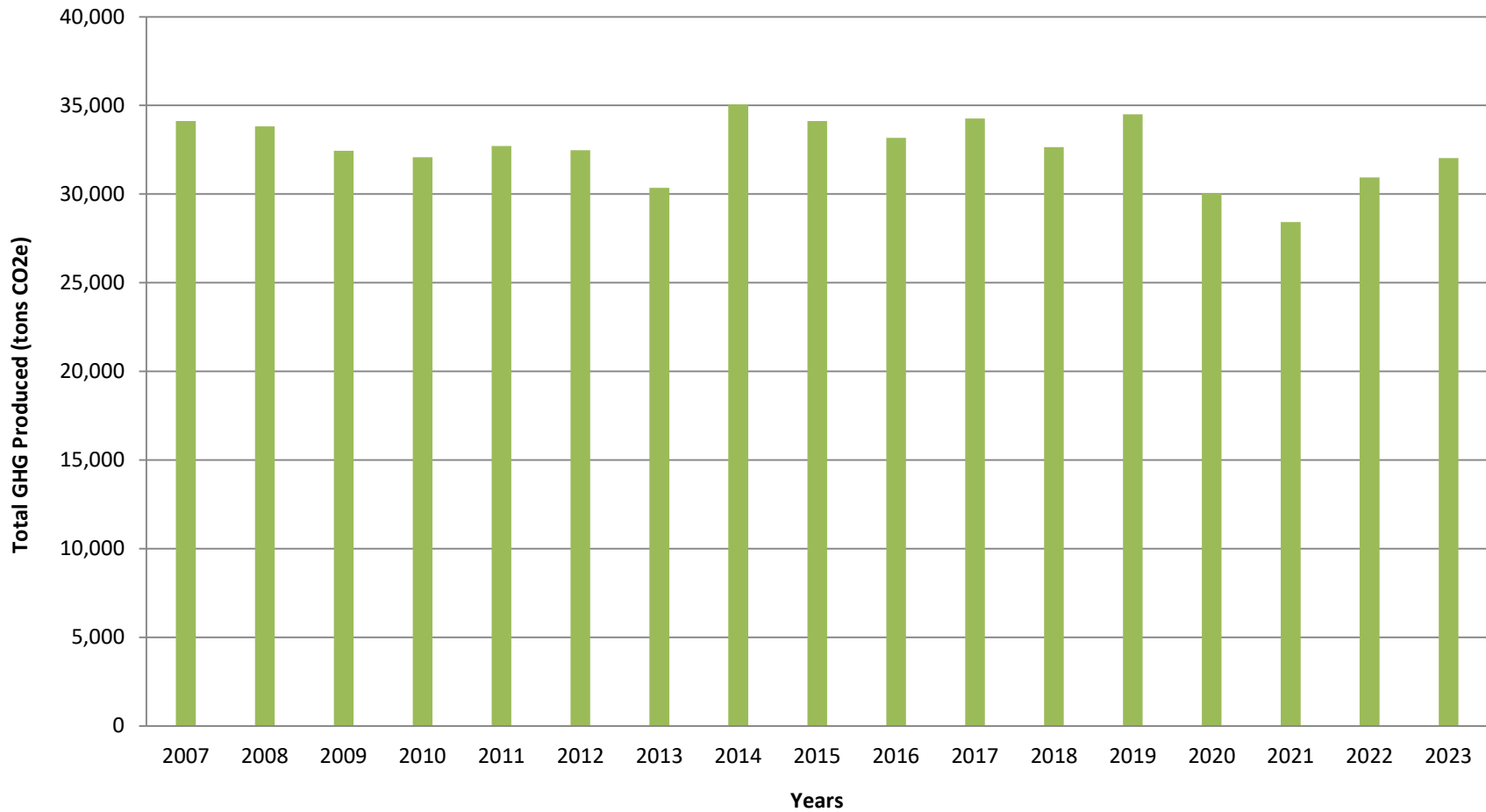
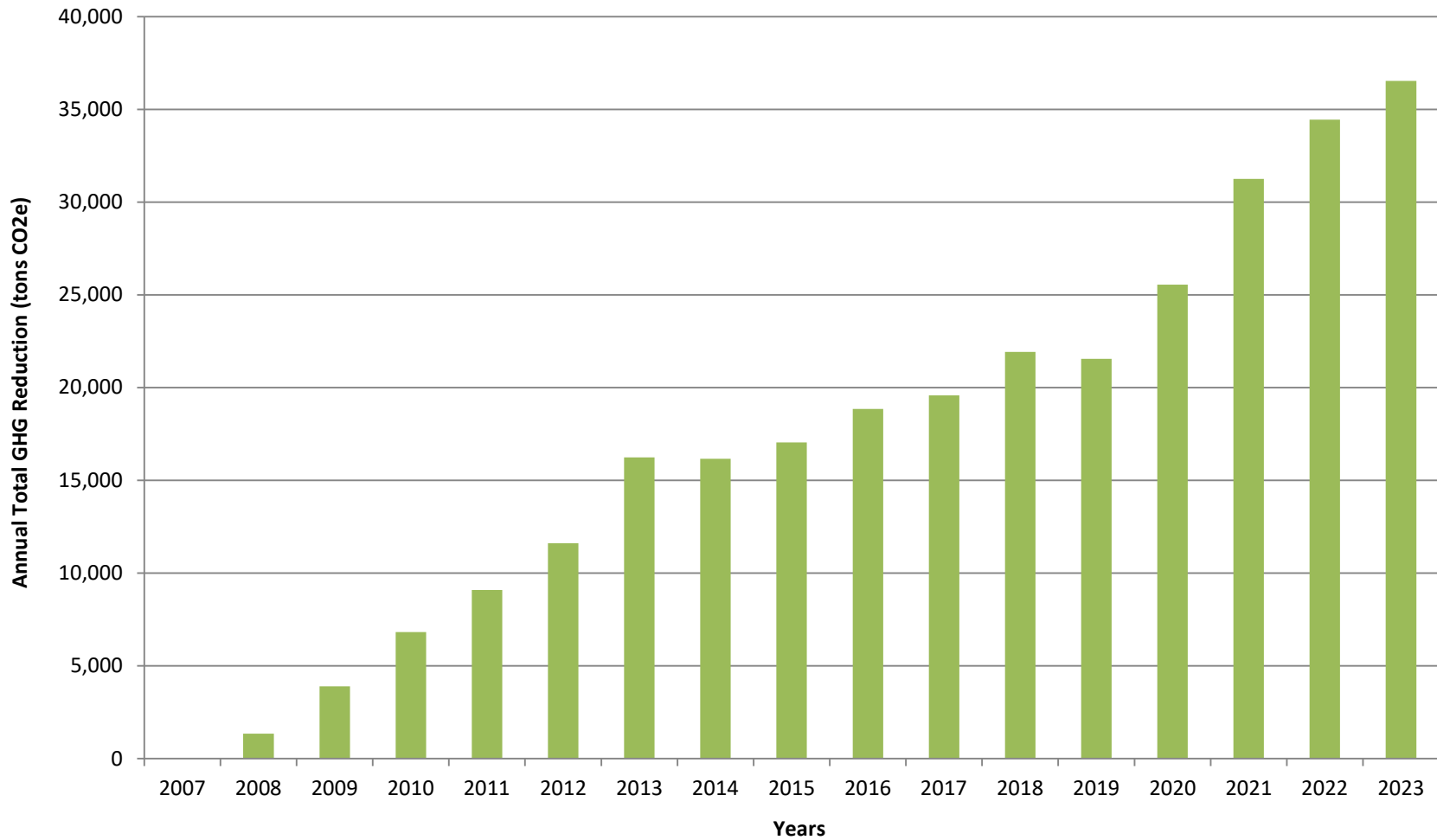


Figure 12 illustrates the cumulative annual reduction of GHG's from 2007 to 2023. By 2023, the City has decreased the amount of GHG's generated by a total of 36,533 CO_{2e} tonnes, an average of 2,283 CO_{2e} tonnes per year.

Figure 12: Cumulative Reduction of GHG's from 2007 to 2023



Appendix 5: Initiated, Completed, and Future Major Energy Projects

Table 14: The City of North Bay's Completed Major Energy Projects

| Project | Costs | Savings Realized (per year) | Est. Simple Payback |
|--|--------------|-----------------------------|---------------------|
| Replace HPS Street lights with LED Fixtures (2013) | \$2,800,800 | \$281,000 | 13 years |
| Replaced Decorative lights | \$200,000 | \$37,500 | 6 years |
| Lighting & heating upgrades at YMCA Aquatics Center | \$750,000 | \$75,000 | 10 years |
| EMP Mini-Hybrid on City Transit Buses | \$268,000 | \$151,400 | 2 years |
| Cogeneration Project at Wastewater Treatment Plant | \$3,900,000 | \$150,940 | 26 years |
| Driver Training using Smart Driver Program | \$50,000 | 30,000 L | 2 years |
| Install Residential Water Meters (bill based on use) | \$6,063,576 | 500,000 kWh | |
| Replace Ellendale pumps with high efficiency motors | \$831,109.35 | 115,480 kWh | |
| Eliminate Janey Avenue Pumping Station | | 12,650 kWh | |

Table 15: The City of North Bay's Initiated and Future Major Electricity Reduction Projects

| Projects | Potential Savings |
|--|-------------------|
| Continue with revamping/controls in City buildings | 25,000 kWh/yr. |
| *Parking lot lighting review | Being Evaluated |
| Education and Awareness Training with AMO/LAS | Being Evaluated |
| Study Sewage Plant low lift pumping system | Being Evaluated |
| Study improved use of Building automation systems | Future Evaluation |
| Study to improve water distribution system | Future Evaluation |

Table 16: The City of North Bay's Future Major Natural Gas Reduction Projects

| Projects | Potential Savings (m3) |
|--|------------------------|
| Insulate/Seal Garages at Public Works/Automatic Door Closure | 25,000 |
| Insulate Roof of City Hall | 10,000 |
| Insulate Roof at Fire Station #4 | 5,000 |

Table 17: The City of North Bay’s Initiated and Future Major Transportation Fuel Reduction Projects

| Projects | Potential Savings (per year) |
|--|-------------------------------------|
| *Reduce Idling | 35,000 L |
| *Reduce Vehicle Weight | 10,000 L |
| *Cull older inefficient vehicles/ Reduce fleet size | 7,600 L |
| *Enhance vehicle preventative maintenance | 5,000 L |
| *Emission Reduction in Fleet | Being Evaluated |
| *Improve traffic flows/automate signalization system | Being Evaluated |

Note: Projects marked with an asterisk (*) are currently ongoing.