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CORPORATE AND COMMUNITY ENERGY AND EMISSIONS REPORT (CCER)

Prepared for: Township of Cavan Monaghan
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List of Acronyms

CCAP – Climate Change Action Plan

CCER – Corporate and Community Energy and Emissions Report

CDMP – Energy Conservation and Demand Management Plan

CMCC – Cavan Monaghan Community Centre

ECMs – Energy and Carbon Conservation Measures

ekWh – Equivalent kilowatt-hour

FIT – Feed-in-tariff

GHG – Greenhouse Gas

GJ - Gigajoules

kWh – Kilowatt-hour

LED – Light emitting diode

LEED – Leadership in Energy and Environmental Design

TCM – Township of Cavan Monaghan

tCO_2e – Tonne (metric) of carbon dioxide equivalent

WWTP – Wastewater Treatment Plant

Executive Summary

The Township of Cavan Monaghan's Corporate and Community Energy and Emissions Report provides a comprehensive overview of energy consumption and greenhouse gas emissions within the community and corporate operations for the period 2020-2023, establishing a 2023 baseline for future planning. This report supports the Township's Climate Change Action Plan (CCAP) goals through data analysis, benchmarking, and actionable recommendations.

Key Findings:

- **Community Analysis**
    - The Residential sector is the largest contributor to energy use and emissions
    - Per capita energy consumption (14,432 ekWh) and GHG emissions (1.90 tCO2e) are lower than benchmarks from other reviewed sample municipalities
    - From 2011 to 2023, Community GHG emissions decreased due to measures like energy efficiency upgrades and a greener electricity grid. However, a 4,800 tCO2e reduction is still needed to meet the 2031 CCAP target
- **Corporate Analysis**:
    - Six key facilities account for 84% of Corporate energy use and 85% of emissions, led by the Cavan Monaghan Community Centre
    - Corporate GHG emissions have risen since the 2011 baseline, attributed to population growth and expanded facilities
    - Energy efficiency benchmarks show mixed performance, with some facilities underperforming compared to national standards

Completed Initiatives:

- High-efficiency lighting retrofits at several Corporate facilities
- Implementation of Leadership in Energy and Environmental Design Silver standards for new constructions
- Installation of solar tracking units on municipal properties

Proposed Actions:

1. **Community Initiatives**
    - Expand home energy audits and LED lighting programs
    - Promote solar adoption and heat pump installations
    - Encourage higher green building standards
2. **Corporate Initiatives**
    - Implement a Decarbonization Framework enabled by a strong GHG reduction commitment and supporting policies. Within the framework:
        1. Conduct energy audits for key facilities
        2. Retrofit facilities with advanced lighting controls, high-efficiency HVAC systems, building envelope improvements
        3. Fuel-switch heating systems to low-carbon alternatives upon replacement
        4. Pursue on-site renewable energy generation where feasible and power purchase agreements otherwise
        5. Ensure new facilities are Net-Zero or Net-Zero ready

The Township has made meaningful progress in reducing energy consumption and emissions, demonstrating its commitment to climate action. However, meeting the CCAP's ambitious 2031 GHG reduction goals will require continued focus on targeted initiatives, particularly in areas such as natural gas reduction and renewable energy adoption. Building on its successes, TCM can address remaining challenges through sustained efforts in benchmarking, monitoring, and engaging the community. These actions will be critical to achieving the Township's objectives and maintaining its path toward long-term sustainability.

Introduction/Project Scope

The Township of Cavan Monaghan (TCM) engaged Aladaco Consulting to develop this Corporate and Community Energy and Emissions Report (CCER) alongside an Energy Monitoring and Reporting Tool for TCM's own use. The study period for this report is 2020-2023, with 2023 effectively establishing a new energy and emissions baseline for TCM.

The CCER provides insights around TCM's energy consumption and resultant emissions both from Corporate operations (including buildings and streetlighting) as well as from various Community sectors (MURB/Commercial, Industrial and Residential). It also provides highlights of reduction mechanisms that TCM has already employed in the Corporate and Community sectors and provides recommendations for future initiatives to further decrease energy and emissions in alignment with TCM's Climate Change Action Plan (CCAP) goals.

Energy consumption described within this report is split into two[1] categories – electricity and natural gas. Electricity consumption is measured in kilowatt-hours (kWh) and natural gas consumption is measured in cubic metres (m^3). Equivalent kilowatt-hours (ekWh) or gigajoules (GJ) are used for the combination of electricity and natural gas consumption in a common unit of energy. All energy data was provided to Aladaco by TCM.

Emissions are measured in tonnes of carbon dioxide equivalent (tCO2e).

Below is a brief overview of the contents of this document:

Data Sources and Assumptions: Provides a high-level overview of the data sources, assumptions and factors that Aladaco employed in the development of this report and the associated tool.

Community Energy and Emissions Analysis: Provides Community Energy and Emissions analysis results in table and graph formats. Provides insights for TCM to:

- better understand where energy is being consumed throughout the Township
- gauge overall performance against similar municipalities

[1] Note that there are some areas within TCM's municipal boundaries that use propane and other combustible heating fuels, primarily due to lack of natural gas access. Data for these non-natural gas heating fuels was found to be unreliable and, as such, the CCER considers only electricity and natural gas energy consumption.

- review Community energy and emissions trends
- pinpoint opportunities for energy and emissions reductions

Corporate Energy and Emissions Analysis: Provides Corporate Energy and Emissions analysis results in table and graph formats. Provides insights for TCM to:

- better understand which facilities are the largest contributors to TCM's Corporate energy and emissions profile
- benchmark facilities against each other as well as industry standards
- pinpoint opportunities for energy and emissions reductions

Data Sources and Assumptions

Data Sources

Table 1 - Data Sources

Data Type	Source and Description

Corporate and Community Energy Data	• Provided to Aladaco by TCM
	  ○ Electricity data sourced from Hydro One
	  ○ Natural gas data sourced from Enbridge Gas

TCM past Inventory Results, Targets	• Corporate and Community emissions results and reduction targets were sourced from TCM's 2015 Climate Change Action Plan, developed by LURA and ICLEI and in collaboration with the Greater Peterborough Area
Emissions Factors	• Electricity and natural gas emissions factors were sourced from the relevant year's National Inventory Report[2] as well as from The Atmospheric Fund's Ontario Electricity Emissions Factors and Guidelines[3]
Benchmarking	• Energy intensity benchmarks were sourced from Energy Star Portfolio Manager Technical Reference (Canadian Energy Use Intensity by Property Type)[4]

[2] https://publications.gc.ca/site/eng/9.506002/publication.html
[3] https://taf.ca/publications/ontario-electricity-emissions-factors-2024/
[4] https://portfoliomanager.energystar.gov/pdf/reference/Canadian%20National%20Median%20Table.pdf

Additional data sources and references used are provided in footnotes where relevant throughout this document.

Assumptions and Factors

All assumptions and factors used throughout this report can be found in the "Conversions and Factors" tab in the Energy Monitoring and Reporting Tool.

Community Energy and Emissions Analysis

2023 Energy and Emissions by Sector

Figures 1 and 2 below provide an overview of TCM's 2023 Community energy consumption and GHG emissions (respectively) by sector.

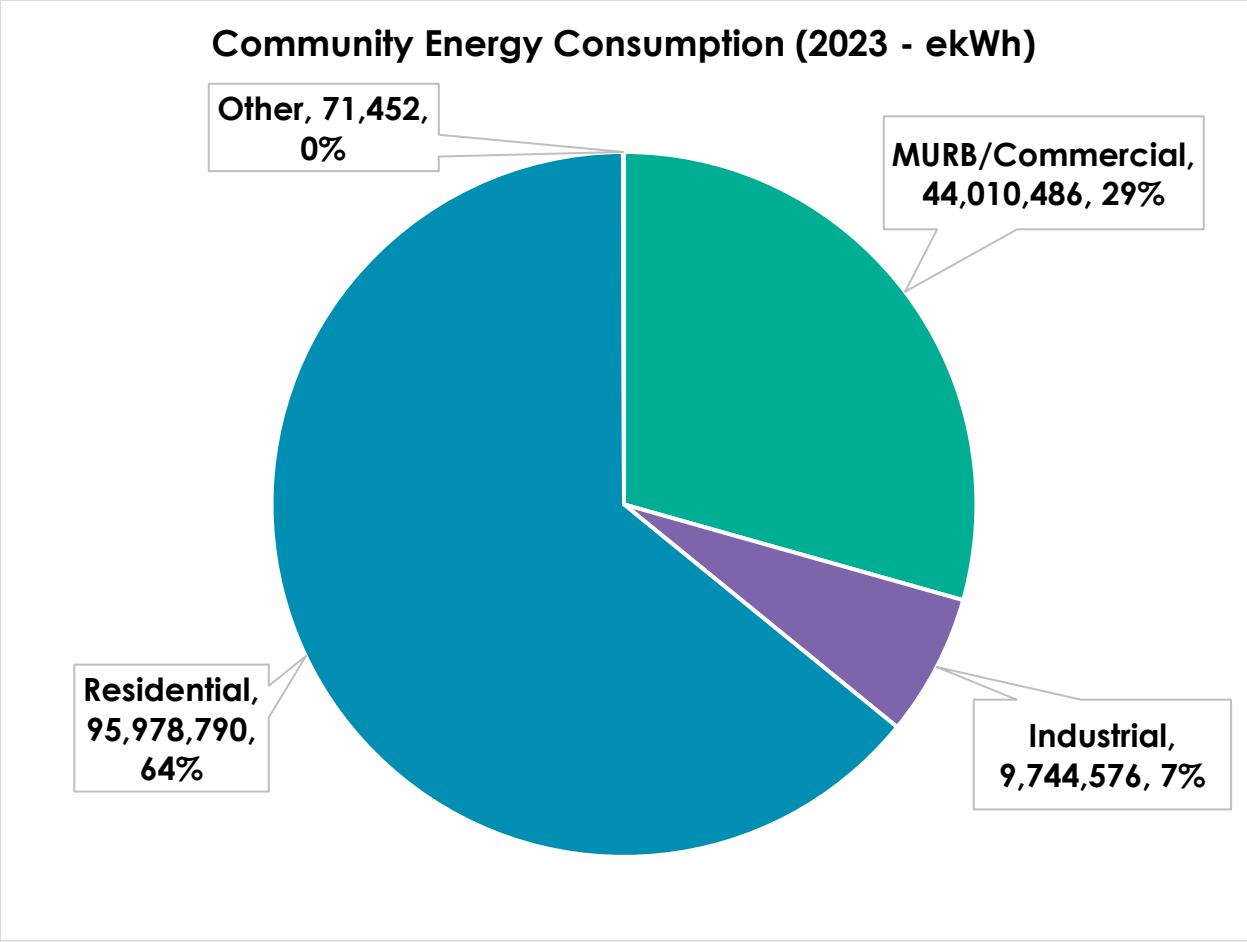

Figure 1 - Community Energy Consumption by Sector (2023)

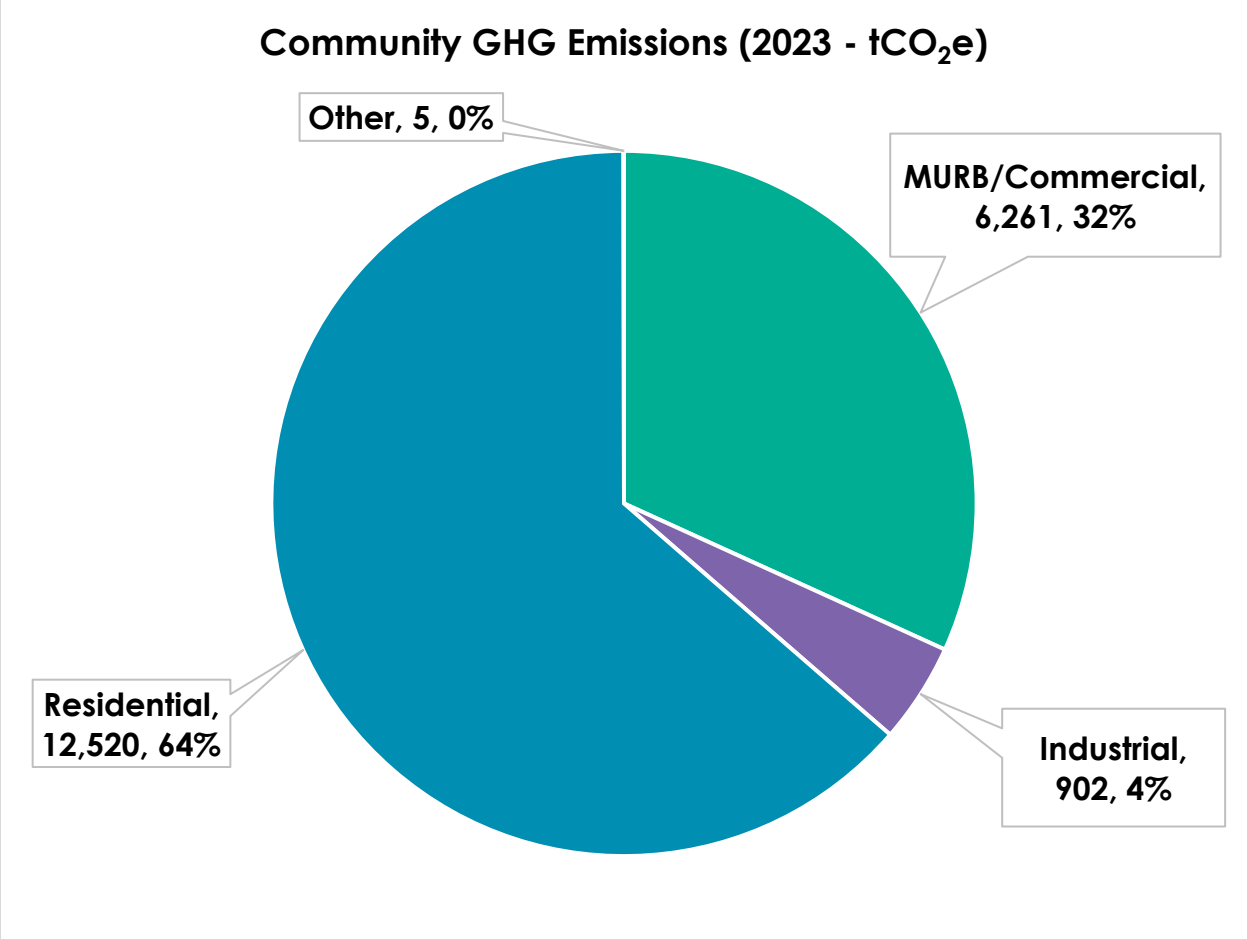

Figure 2 - Community GHG Emissions by Sector (2023)

The Residential sector is the largest contributor to TCM's Community energy and GHG emissions, followed by the Multi-unit Residential (MURB)/Commercial sector. The Other sector includes electricity consumption from street lighting, sentinel lighting, distributed generation, and other unmetered loads.

Benchmarking

Benchmarking energy and GHG emissions against other municipalities that share similarities with TCM (e.g. climate, size, demographics or other) is a useful way to gauge TCM's overall performance. Municipalities typically provide these types of metrics in Local or Community Energy Plans as well as GHG Inventories.

Note that in many cases the metrics provided in these publications include additional sources of energy and GHG emissions, such as transportation fuels. Additionally, metrics are often provided in different formats (e.g. energy consumption by sector as opposed to by source of electricity, natural gas). For these reasons, it is challenging to locate a large sample of public resources to

make accurate comparisons with TCM given the limited scope (electricity and natural gas) of this CCER.

Table 2 below provides a comparison of TCM's Community energy consumption and GHG emissions metrics against several other municipalities (or Regional municipalities) in southern Ontario. Note that these per capita values were calculated by Aladaco based on energy and GHG data provided in the respective reports (provided in footnotes) related to electricity and natural gas consumption alone.

Table 2 - Community Energy and GHG Emissions Benchmarking

Metric	TCM (2023)	Durham Region (2016)[5]	Town of Newmarket (2017)[6]	City of London (2023)[7]
Energy Consumption (ekWh) per capita	14,432	18,056	18,140	23,353
GHG Emissions (tCO_2e) per capita	1.90	2.75	2.49	3.52

Per Table 2, TCM is performing well with both lower energy consumption and GHG emissions metrics relative to the other three study areas. However, note that these comparisons can be imperfect due to other variables such as population density and level of industry in the area.

TCM is encouraged to complete an updated GHG Inventory which will provide the necessary information for more streamlined comparisons against a larger set of its peers. An updated GHG Inventory would include all relevant emissions sources as well as provide TCM a more comprehensive picture of where they currently stand with respect to their 2031 reduction targets.

Study Period Trends and Comparison with Goals

Figures 3 and 4 below provide an overview of TCM's Community energy consumption and GHG emissions (respectively) by year throughout the study period (2020-2023). The GHG emissions plot also includes TCM's 2011 Baseline and 2031 Emissions Goal (both related to Electricity and Natural Gas contributions

[5] 20190424 Durham Community Energy Plan Presentation to Regional Council
[6] Community Energy Plan (Updated 07.31.2019).pdf
[7] 2023 Community Energy Use and Greenhouse Gas Emissions Inventory

only) per TCM's section of the Greater Peterborough Area's CCAP (published in 2015-2016)

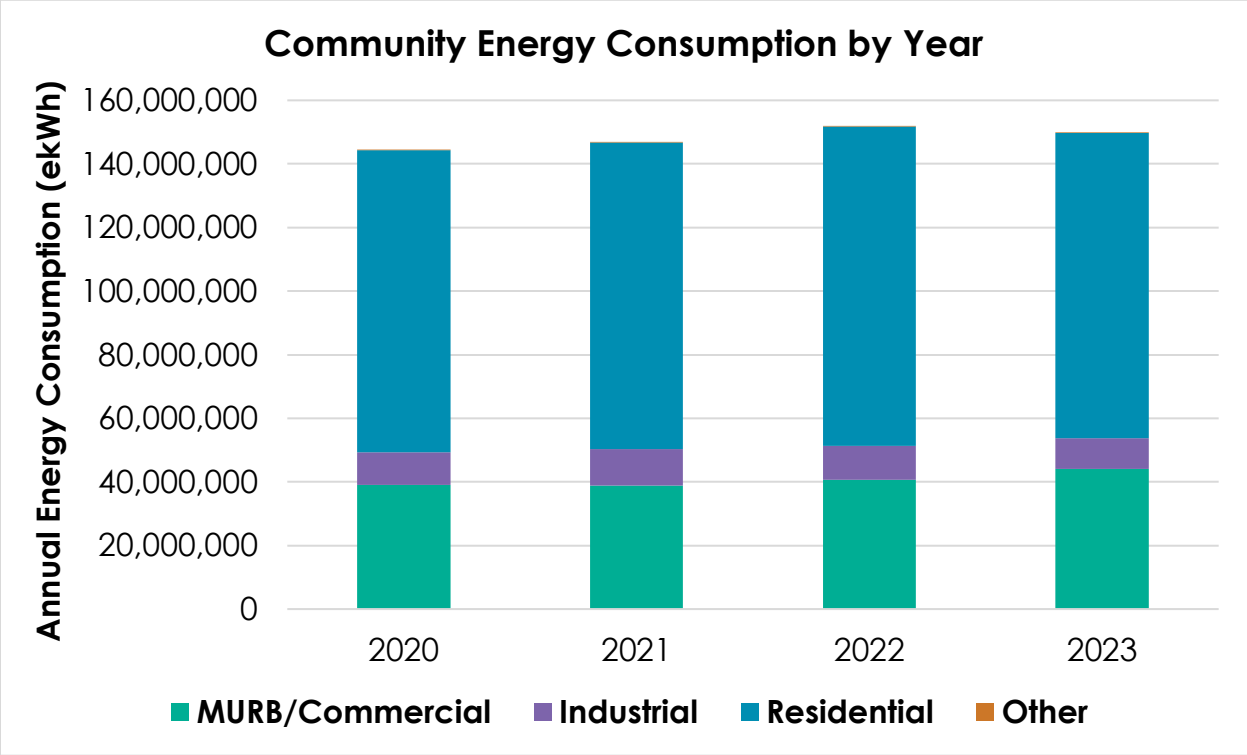

Figure 3 - Community Energy Consumption by Year

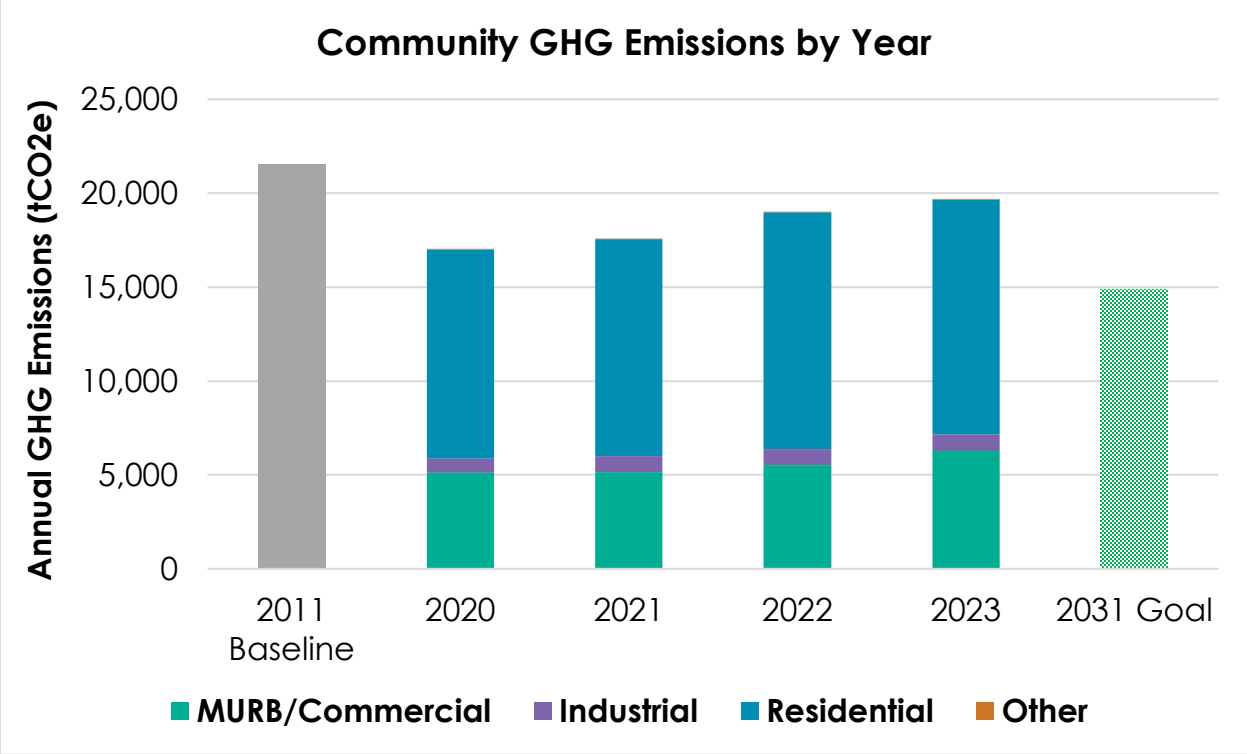

Figure 4 - Community GHG Emissions by Year

Between 2020-2023 there was a rise in both energy consumption and resultant GHG emissions. This trend is similar to what Aladaco has observed in other municipalities. The impacts of the COVID-19 pandemic were felt heavily in 2020 and 2021 which caused decreases in energy consumption and resultant emissions. By late 2022, much of the impact of the pandemic had ended and the day-to-day operation of facilities and individuals within the Community returned to normal. For this reason, we recommend that TCM treats the 2020-2022 period as an anomaly and consider 2023 as representative of relatively normal Community energy and GHG emissions.

TCM's Community GHG emissions have decreased notably since 2011. This is likely due to a combination of implemented reduction measures as well as the benefit of the greening of the Ontario electricity grid. Further reductions of roughly 4,800tCO_2e are required to meet the 2031 GHG emissions goal from the CCAP. Achievement of this goal will be heavily impacted by the electricity emissions factor[3] as well as population and business growth in the area.

Energy and Emissions Reduction Mechanisms

Completed Initiatives

To encourage high-efficiency buildings in the TCM community, TCM implemented a policy (Section 3.13 of TCM's Official Plan) to encourage new construction (including industrial, institutional, commercial and multi-unit residential buildings) to be built to Leadership in Energy and Environmental Design (LEED) Canada Version 1.0 certification level "Silver" or equivalent.

All major renovation projects requiring Planning Act approvals and resulting in a total gross floor area of 600 square metres or more for industrial, commercial, institutional and medium density residential buildings occurring after January 2012 shall meet this standard. LEED consists of an explicit set of performance criteria organized into six performance criteria including sustainable sites, water efficiency, energy and atmosphere, materials and resources, indoor environmental quality and innovation and design.

Proposed Initiatives

Below is a high-level list of Community energy and GHG emissions reduction measures that TCM could consider employing. Some of these measures are targeted at specific sectors, however some can apply relatively broadly across all sectors.

Table 3 - Proposed Community Energy and Emissions Reduction Measures

Initiative	Description	Sector Targeted	GHG Reduction Impact	Energy Reduction Impact	Cost Implications
Community LED Lighting Program	Promote light emitting diode (LED) lighting adoption through incentives and community bulk-buy programs.	MURB/Commercial	MEDIUM	HIGH	LOW-MEDIUM
Home Energy Audit Program	Subsidize home energy audits to identify and implement energy efficiency improvements.	Residential	HIGH	HIGH	LOW
Solar Panel Group Purchase	Support group purchasing for solar installations to reduce reliance on grid electricity.	Residential, Commercial	HIGH	HIGH	HIGH
Energy Efficiency Rebates	Offer rebates for energy-efficient appliances and heating systems upgrades.	Residential, Commercial	MEDIUM	HIGH	MEDIUM
Green Building Incentives and Policies	Generally incentivize energy-efficient building practices in new constructions and renovations, as well as increase the requirement for new building design from the current LEED Silver to LEED Gold or Platinum.	MURB/Commercial	MEDIUM	MEDIUM	MEDIUM-HIGH
Community Solar Projects	Develop shared solar resources to supplement community electricity needs.	Community-wide	HIGH	HIGH	HIGH

Initiative	Description	Sector Targeted	GHG Reduction Impact	Energy Reduction Impact	Cost Implications
Heat Pump Incentive Program	Promote the adoption of efficient heat pumps over traditional heating systems.	Residential, Commercial	HIGH	MEDIUM	LOW-MEDIUM
Renewable Energy Workshops	Conduct workshops to educate on renewable energy options and energy-saving practices.	Community-wide	LOW	MEDIUM	LOW
Insulation and Weatherization Upgrades	Support upgrades to insulation and weather-sealing to reduce heating needs and natural gas use.	Residential, Commercial	HIGH	HIGH	MEDIUM
Industrial Energy Education Program	Provide education to industrial sector to leverage existing Enbridge Gas and IESO Save On Energy incentive funding for energy projects.	Industrial	MEDIUM	MEDIUM	LOW

Corporate Energy and Emissions Analysis

2023 Energy and Emissions by Asset

Figures 5 and 6 below provide an overview of TCM's 2023 Corporate energy consumption and GHG emissions (respectively) by asset. For visual convenience, only the large contributors include data labels in these plots.

These large contributors (six in total) account for 84% of total Corporate energy consumption and 85% of total Corporate GHG emissions. The remaining sixteen assets, which include aggregates for sentinel and streetlighting, account for only 16% of total Corporate energy consumption and 15% of total Corporate GHG emissions.

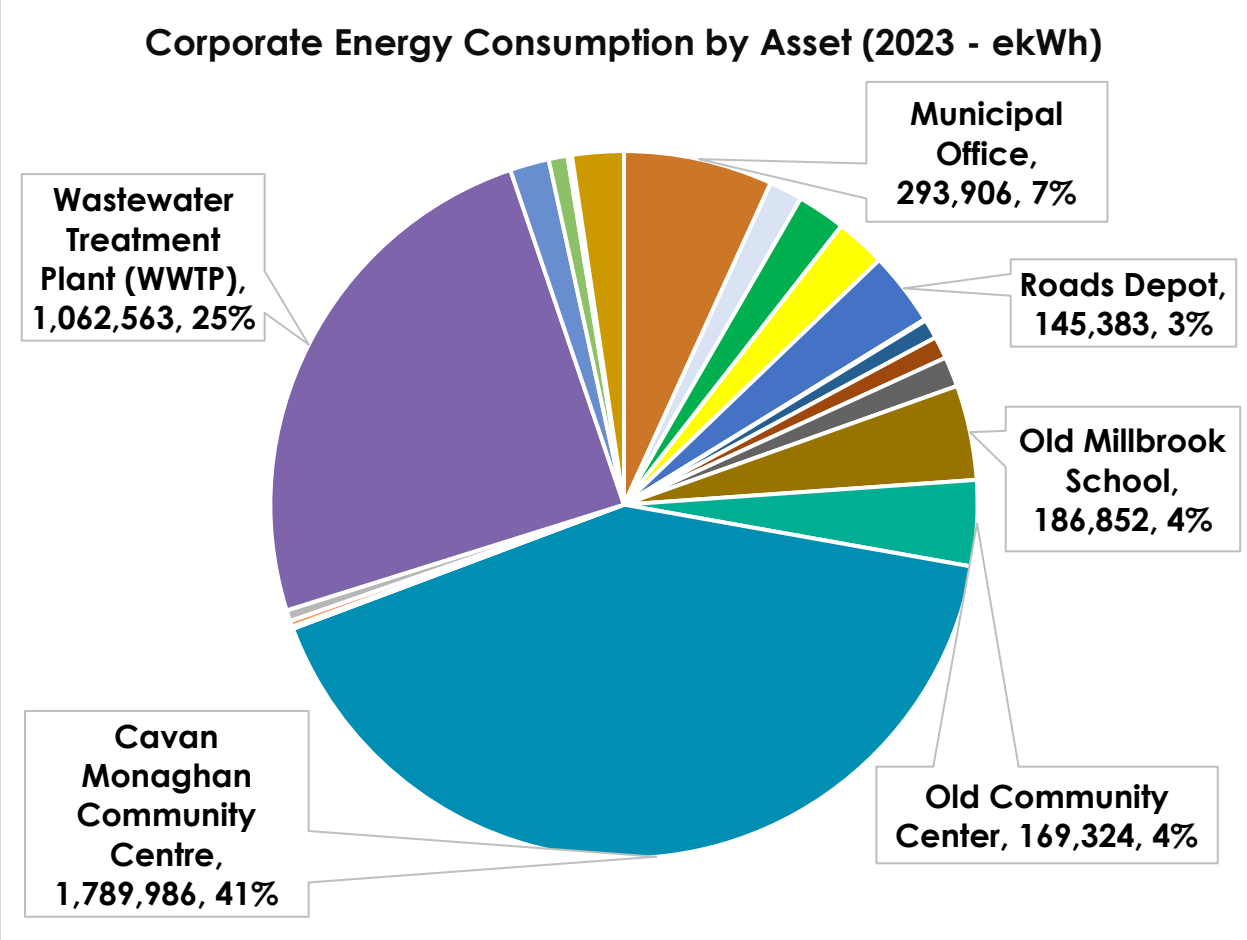

Figure 5 - Corporate Energy Consumption by Asset (2023)

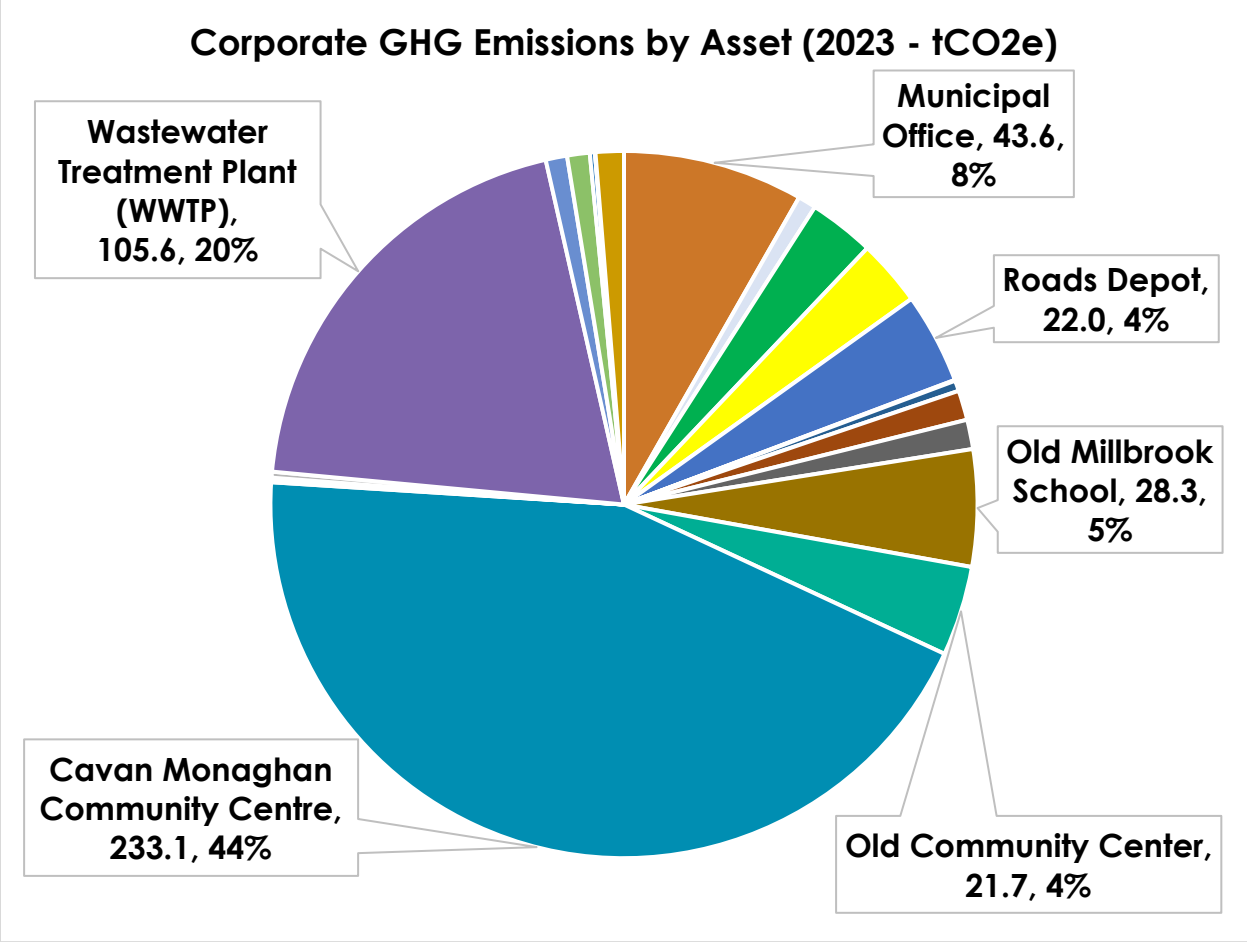

Figure 6 - Corporate GHG Emissions by Asset (2023)

Benchmarking

Benchmarking energy performance of Corporate facilities against industry standards offers valuable insights into operational efficiency. By comparing energy use intensity to similar buildings across Canada, TCM can assess its performance, identify areas for improvement, and ensure alignment with broader industry practices.

Figure 7 below compares energy use intensity for TCM's Corporate facilities against industry standards provided in Energy Star Portfolio Manager's Technical Reference - Canadian Energy Use Intensity by Property Type[4]. Note that not all facilities were included in the benchmarking analysis. Most energy benchmarks are designed for commercial buildings and calculate energy use intensity on a per-unit-area basis. The energy consumption at these facilities is primarily driven by weather factors. However, energy consumption at facilities such as water and wastewater assets as well as parks are influenced by different operational factors, making direct comparisons less applicable.

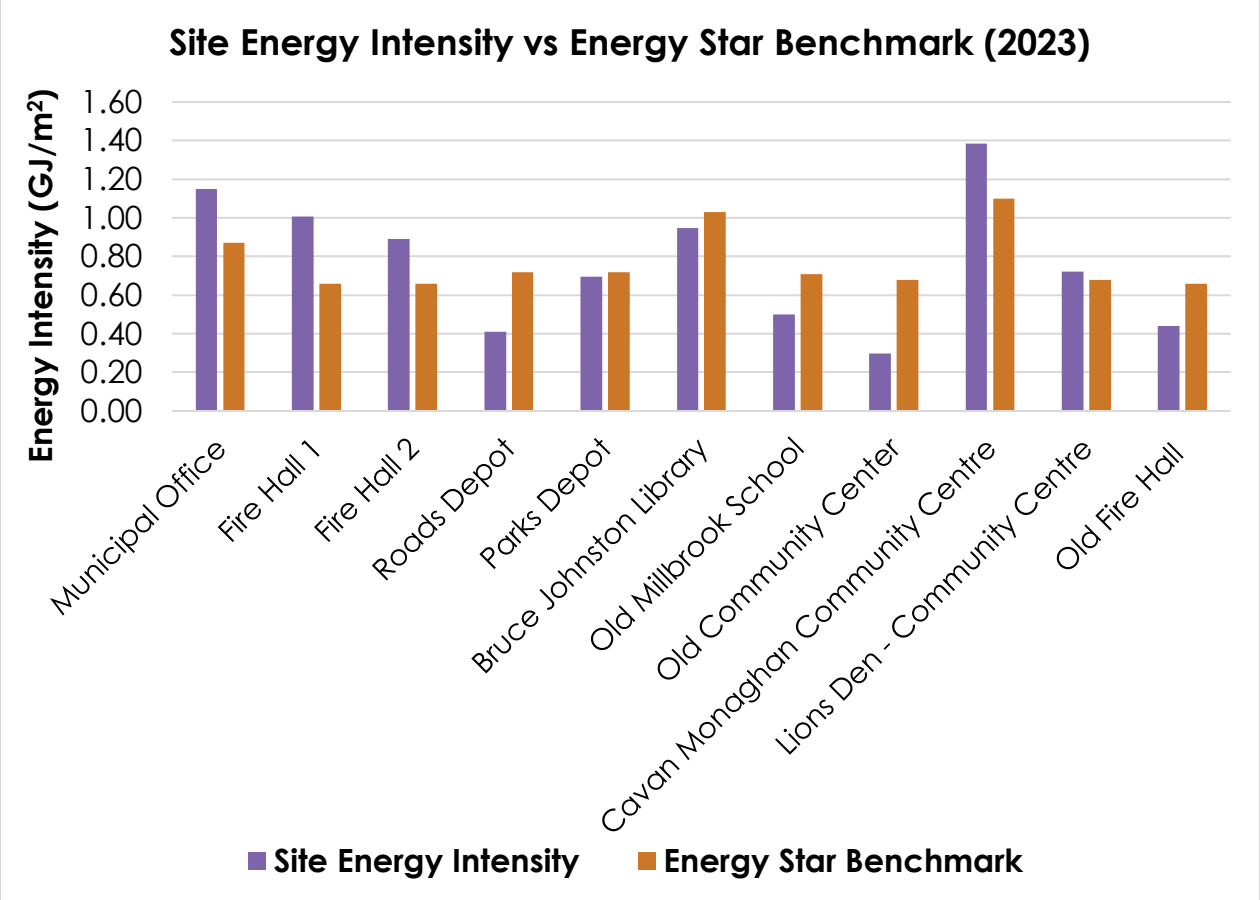

Figure 7 - Site Energy Intensity vs. Energy Star Benchmark (2023)

The benchmarking exercise identified that six of the eleven sites met or exceeded the Energy Star benchmark (i.e. their energy use intensity was at or below benchmark value). However, five sites that did not meet the benchmark are:

- Municipal Office
- Fire Hall 1
- Fire Hall 2
- Cavan Monaghan Community Centre (CMCC)
- Lions Den – Community Centre

Study Period Trends and Comparison with Goals

Figures 8 and 9 below provide an overview of TCM's Corporate energy consumption and GHG emissions (respectively) by year throughout the study period (2020-2023). The GHG emissions plot also includes TCM's 2011 Baseline and 2031 Emissions Goal (both related to Electricity and Natural Gas contributions only) per TCM's section of the Greater Peterborough Area's CCAP (published in 2015-2016).

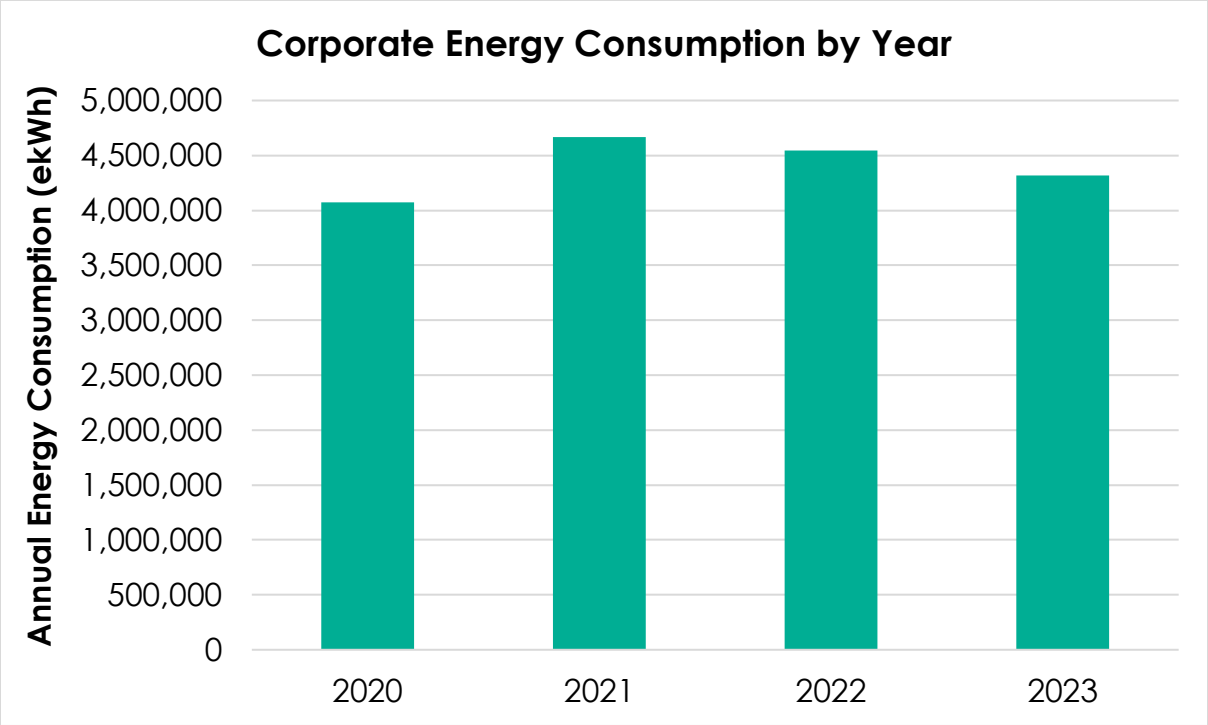

Figure 8 - Corporate Energy Consumption by Year

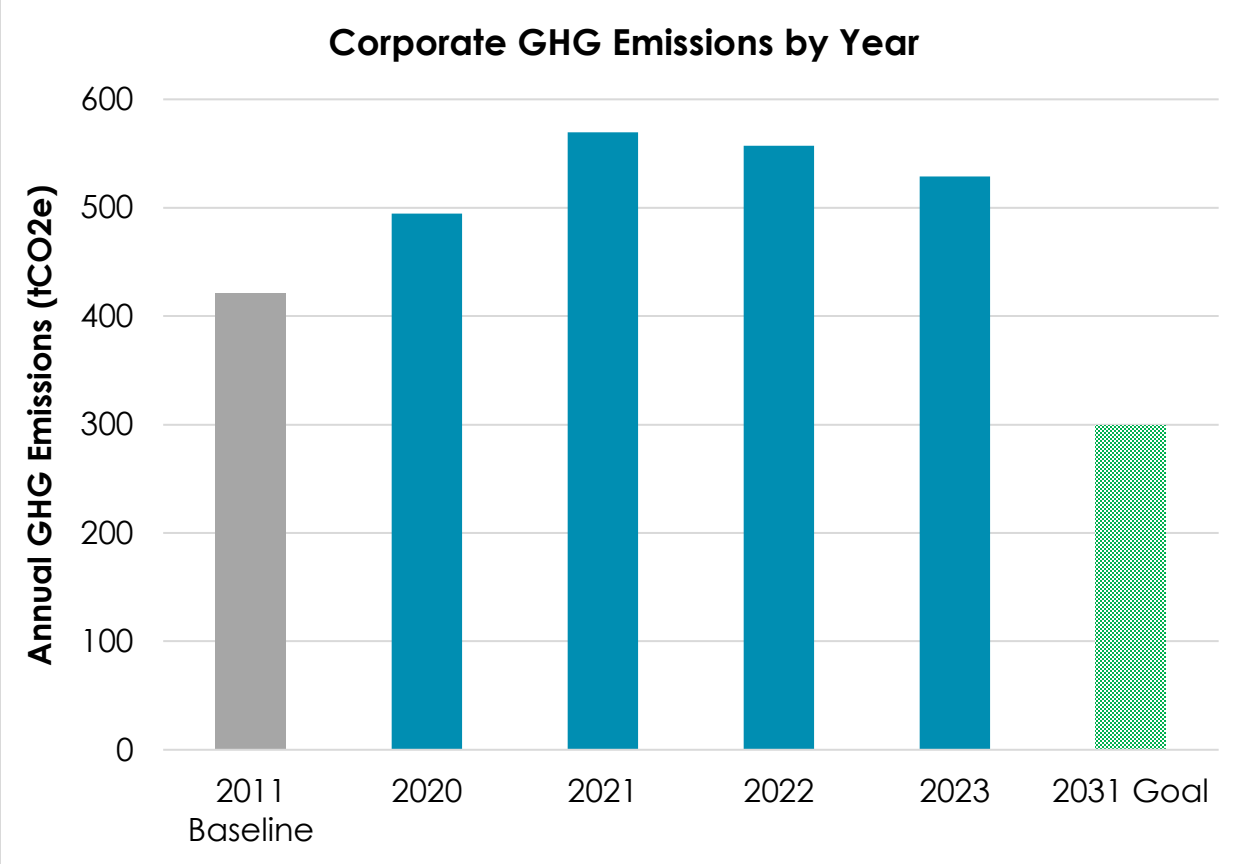

Figure 9 - Corporate GHG Emissions by Year

COVID impacts to Corporate operations in 2020 are the probable reason for lower GHG emissions in that year. In the years since (2021 to 2023) Corporate energy consumption and GHG emissions have been trending downwards. Based on Aladaco's data analysis, this appears to be primarily driven by reduced energy consumption at several sites including the Old Community Center and CMCC.

However, over the longer term, TCM's Corporate GHG emissions have increased since the baseline established in 2011. This is likely due to population growth requiring the addition of services and recreation facilities. Notably, the CMCC was brought online in 2019. As previously described, this facility is the largest contributor to TCM's Corporate energy consumption and GHG emissions and alone contributed approximately 233tCO_2e to TCM's 2023 emissions. For scale, TCM's 2023 GHG emissions are currently 230tCO_2e higher than the 2031 CCAP goal. This demonstrates the carbon footprint impact of adding new facilities and underscores the need for implementation of low-carbon solutions (such as heat pump heating systems), ideally Net-Zero facilities, in order to achieve the 2031 goal.

Energy and Emissions Reduction Mechanisms

Completed Initiatives

Below is a list of Corporate energy and emissions reduction initiatives that TCM has completed to date, in alignment with recommendations from TCM's CCAP:

Table 4 - Completed Corporate Energy and Emissions Reduction Measures

Initiative	Description
LEED Policy	• Implemented a policy (Section 3.13 of TCM's Official Plan) to encourage new construction (including industrial, institutional, commercial and multi-unit residential buildings) to be built to Leadership in Energy and Environmental Design (LEED) Canada Version 1.0 certification level "Silver" or equivalent • All major renovation projects requiring Planning Act approvals and resulting in a total gross floor area of 600 square metres or more for industrial, commercial, institutional and medium density residential buildings occurring after January 2012 shall meet this standard. LEED consists of an explicit set of performance criteria organized into six performance criteria including sustainable sites, water efficiency, energy and atmosphere, materials and resources, indoor environmental quality and innovation and design
Facility General Energy Efficiency Upgrades	• Retrofitted existing Works Yard building for storage and built a new energy efficient depot • Replacement of the double doors at the Community Centre to a higher U-Value • Replaced windows at the Old Millbrook School to more efficient units
Lighting Upgrades	• Replacement of entire streetlight inventory from high pressure sodium to efficient LED technologies • Retrofit of existing lighting to LED in 4 TCM facilities
Green Energy	• Completed 8 installations of solar tracking units (MicroFIT) on various TCM properties

Proposed Initiatives

Implementation of a Decarbonization Framework

To best inform energy and GHG reduction initiatives, a review of existing building energy audits and condition assessments is typically conducted. As these documents were unavailable, Aladaco is providing a high-level, 5-step Decarbonization Framework (Figure 10) which will be essential in reducing Corporate, energy-related emissions if TCM wishes to pursue achievement of the 2031 CCAP goal.

See next page

Conduct Energy Audits for Key Facilities

- Conduct energy audits at TCM's largest energy consuming facilities (CMCC, WWTP) as well as facilities that TCM identifies as high value for investigation (e.g. Old Millbrook School).
- Aladaco recommends audits equivalent to ASHRAE Level 2 standards.
- Identify energy inefficiencies, upgrade opportunities, and strategies for integrating low-carbon technologies.

Implement Energy Efficiency Measures

- Upgrade lighting, insulation, windows, and HVAC systems for improved energy performance.
- Install advanced building controls and sensors to optimize energy use across facilities.
- Prioritize low-cost, high-impact improvements with short payback periods.

Retrofit Heating Systems to Low-Carbon Alternatives

- Transition from natural gas heating to low-carbon options (e.g., heat pumps, electric or bioenergy-based systems) during system replacements.
- Incrementally replace systems as they reach the end of their lifecycle to minimize initial capital costs.

Pursue Renewable Generation

- Explore installing on-site renewable energy systems (e.g., solar) at high-demand facilities like CMCC and WWTP.
- Investigate power purchase agreements (PPAs) with renewable energy providers.

Leverage Reductions in Other Sectors

- Consider leveraging emissions reductions in other sectors (e.g. transportation, waste management) to help bridge the overall GHG emissions gap to target.
- E.g. reducing emissions from TCM's fleet (through electrification or fuel-efficient vehicles) may offer more immediate and cost-effective reductions.

Figure 10 - 5-Step Decarbonization Framework

Following the above framework will help set TCM up for success in their energy conservation and decarbonization journey.

To execute on this framework, a GHG reduction commitment and supporting policies, such as a low-carbon procurement policy, are essential.

Energy efficiency measures typically yield both cost savings and GHG reductions. By contrast, decarbonization measures (like electrification projects) often involve higher upfront capital and, in some cases, higher operating costs, making them less appealing from a strictly economic standpoint. Nonetheless, these projects are crucial for achieving TCM's longer-term GHG reduction targets.

Where available, incentive funding programs can help offset incremental capital costs, and some low-carbon solutions may provide operational benefits that strengthen the business case over time. In general, however, these initiatives require a revised approach to evaluating capital investments—one that accounts for each project's contribution to meeting TCM's broader GHG reduction goals, rather than focusing solely on short-term financial returns.

As a general goal, TCM should strive to build all new Corporate facilities to be Net-Zero or Net-Zero ready. New facilities built to conventional standards (e.g. using natural gas heating equipment) will make it nearly impossible to meet the CCAP's decarbonization targets.

Appendix A includes a list of common Energy and Carbon Conservation Measures (ECMs) that TCM may consider implementing at their Corporate facilities. Note that this information is high-level and does not replace more detailed information that would result from energy audits. Notably, measures that reduce natural gas consumption will generally have the largest GHG Reduction Impact as natural gas has a significantly higher emissions factor than electricity in Ontario.

Appendices

Appendix A - Common ECM List

Table 5 - Common ECMs for Corporate Energy and Emissions Reductions

Description of Measure	GHG Reduction Impact	Energy Reduction Impact	Cost Implications
LED Lighting Retrofits (Interior/Exterior)	LOW	MEDIUM	LOW
Building Insulation Upgrades	LOW	MEDIUM	HIGH
High-Efficiency HVAC Systems	MEDIUM	HIGH	HIGH
Solar Photovoltaic Panel Installation	MEDIUM	HIGH	HIGH
Energy Management Systems	MEDIUM	MEDIUM	MEDIUM
Advanced Lighting Controls	LOW	MEDIUM	LOW
Window Upgrades for Improved Insulation	MEDIUM	MEDIUM	MEDIUM
Natural Gas Space Heating to Electric Heat Pump Conversions	HIGH	MEDIUM	HIGH
Natural Gas Hot Water Heating to Electric Heat Pump Conversions	HIGH	MEDIUM	HIGH
Waste Heat Recovery Systems	HIGH	HIGH	HIGH
Variable Frequency Drives for HVAC and Pumps	MEDIUM	HIGH	MEDIUM
High-Efficiency Boilers	MEDIUM	MEDIUM	MEDIUM
Building Automation and Control Systems	MEDIUM	MEDIUM	HIGH
Smart Metering and Energy Use Monitoring	LOW	MEDIUM	MEDIUM
Re-insulating Thermal Distribution Piping	LOW	LOW	LOW
Demand-Controlled Ventilation	MEDIUM	MEDIUM	MEDIUM

Disclaimer

This document was exclusively prepared by Aladaco for the Township of Cavan Monaghan and is intended solely for their use. Other parties should not rely on this report in whole or in part. The information contained herein is based on data available during preparation and is subject to limitations, assumptions, and qualifications stated herein.

Aladaco applied professional judgment in developing this report concerning estimates and opinions on costs, schedules, and technical matters based on its experience and the information available during report preparation. Aladaco cannot guarantee the accuracy of such estimates or opinions due to potential changes in market conditions or other factors outside of its control. Reliance on these estimates is at the reader's own risk.

By accepting this report, the Township of Cavan Monaghan acknowledges these limitations and confirms that it satisfies the scope of work requirements.