Appendix A

OAKVILLE

Town-Owned Buildings Energy and Carbon Plan

2025-2029

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1.0 Executive summary

As a growing lakeside community of 234,000 in Southern Ontario's Greater Golden Horseshoe, the Town of Oakville has a demonstrated longstanding commitment to sustainability. The wise use of energy resources and a commitment to reduce greenhouse gas emissions is consistently supported by Council and Senior Leadership.

In 2019, Town Council passed the **Climate Emergency Declaration** resolution and set forth commitments to continue, and increase, efforts to mitigate and adapt to the impacts of climate change. Council has reinforced this commitment by including Environmental Sustainability as a Strategic Priority of the **Town of Oakville Council Strategic Plan (2023-2026)**. This Priority specifically highlights the need to reduce greenhouse gas (GHG) emissions and conserve energy across municipal facilities and operations.

This Energy and Carbon Plan has been created using the input of various reports created for staff by external consultants including a Low Carbon Roadmap, a Renewable Energy Strategy, and several Deep Energy Retrofit reports, among others. Ideas generated from these third-party experts, along with internal stakeholders, has led to the proposed direction for the next five years of energy and carbon management at Oakville.

The **Town-Owned Buildings Energy and Carbon Plan (2025-2029)** was prepared in compliance with *O. Reg. 25/23: Broader Public Sector: Energy Reporting and Conservation and Demand Management Plans.* It is the third iteration of provincially regulated requirements to create energy management plans on a five-year renewal timeline. The nomenclature for the plan is referred to in regulation as the Conservation and Demand Management (CDM) Plan and is sometimes referred to as such in this document.

The 2025-2029 Plan:

- Provides a framework for energy and carbon reduction at town facilities for the next five years.
- Provides data on energy use and carbon emissions.
- Summarizes the current state and highlights exemplary projects undertaken in the last five-year CDM period.

2.0 Oakville's Commitment and Legislative Requirements

2.1 Oakville's Commitment to Environmental Sustainability

The Town's strong commitments to the environment and climate change is longstanding and is supported by publicly available documents and the Town's memberships in various initiatives.

These include:

- Livable Oakville - Official Plan
- Vision 2057 - Sustainable Community Framework
- Council's Strategic Plan (2023-2026)
- Climate Emergency Declaration (2019)
- Conservation and Demand Management Plans (2014 and 2019)
- Climate Change Strategy (2014)
- International Council for Local Environmental Initiatives (ICLEI) Local Governments for Sustainability
- Future Energy Oakville
- Sustainable Design Guidelines
- Sustainable Building Design Procedure
- Sustainable Green Fleet Procedure
- Sustainable Purchasing Procedure

2.2 Vision for 2050

Town Council adopted the following short and long-term GHG emissions targets for town-owned buildings:

- **Short-Term:** Reduce GHG emissions by 30 per cent and energy use by 20 per cent below 2015 levels by 2030
- **Long-Term:** Net Zero GHG emissions by 2050

2.3 Provincial Legislation and Oakville's Compliance

The Town of Oakville has reported its annual energy consumption and GHG emissions to the Ministry of Energy, Northern Development and Mines since 2014, as per O.Reg. 507/18 under the *Electricity Act 1998*. Ontario Regulation 25/23 (O. Reg. 25/23) replaced O. Reg 507/18 in 2023. All previous reports, as well as this year's report and the 2014 and 2019 CDM Plan, are posted to the Town of Oakville's website.

In accordance with O. Reg 25/23, the Town of Oakville has developed and published a plan to implement energy conservation and demand management initiatives over a five-year period. Including:

1. *A summary of annual greenhouse gas emissions for each of the public agency's prescribed operations, which shall be included in the summary of the public agency's annual energy consumption required under paragraph 1 of subsection 25.35.2 (3) of the Act.*
2. *A description of the results of previous activities and measures to conserve the energy consumed by the public agency's prescribed operations and to otherwise reduce the amount of energy consumed by the public agency, including by employing such energy conservation and demand management methods as may be prescribed.*
3. *The cost and saving estimates for the public agency's current and proposed activities and measures referred to in paragraph 2 of subsection 25.35.2 (3) of the Act.*
4. *A description of any renewable energy generation facility operated by the public agency and the amount of energy produced on an annual basis by the facility.*
5. *A description of,*
    i. *the ground source energy utilized, if any, by ground source heat pump technology operated by the public agency,*
    ii. *the solar energy utilized, if any, by thermal air technology or thermal water technology operated by the public agency, and*
    iii. *the proposed plan, if any, to operate heat pump technology, thermal air technology or thermal water technology in the future.*
6. *The estimated length of time the public agency's current and proposed activities and measures referred to in paragraph 2 of subsection 25.35.2 (3) of the Act will be in place.*
7. *A confirmation that the energy conservation and demand management plan has been approved by the public agency's senior management.*

3.0 Energy and Carbon Data

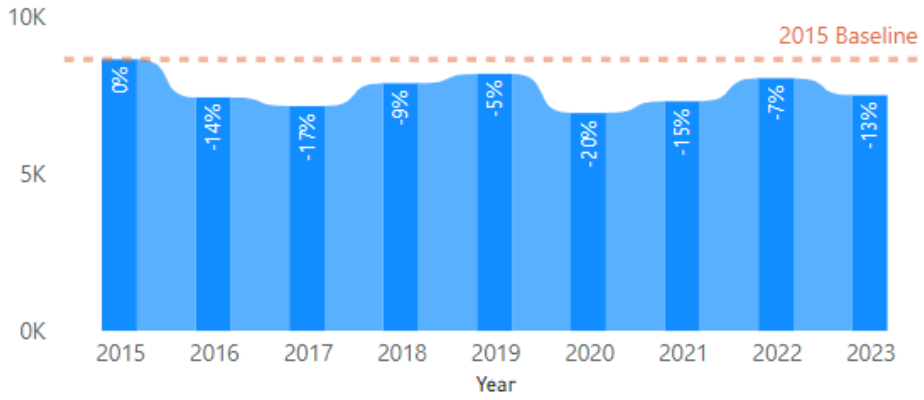
Ontario Regulation 25/23 requires all Broader Public Sector institutions to report on their energy use annually. The graphs and tables presented in this section provide information on the Town's energy use, costs and GHG emissions in the most recent reporting year energy information was reported to the Ministry.

As of 2024, the town operated 122 buildings totaling 2.3M square feet. The town also operated 16,500 streetlights, 16 splash pads, 38 parks with a range of amenities (including seasonal parks buildings), parking meters and other outdoor infrastructure. In 2023, the town spent $6.8M in utilities and had scope one and two emissions of 7.5M tonnes of carbon dioxide equivalent (tCO_2e).

Figure 1 presents the annual greenhouse gas emissions (GHGs) trend from all town sources since baseline year 2015[1]. Overall, GHG emissions decreased and then remained stable with a significant dip in 2021 attributed to the COVID-19 pandemic.

The trend shows that more aggressive actions are still required to achieve to the town's short term carbon reduction goal of 30% reduction by 2030. In budget years 2022 and 2023, Council approved funding for initiatives (geothermal, recommissioning, sustainable design standards, etc.) that will result in decrease of GHG emissions. However, the impact of these initiatives will not be visible in the overall emissions data for a few years.

Figure 1: Annual Greenhouse Gas Emissions Baseline Year to Present



[1] Baseline year shifted from 2014 to 2015 since last CDM Plan. The rationale was that 2015 is more reflective of standard operating conditions since it was the first year when all coal-powered generating facilities on the Ontario grid were fully offline. The higher grid emissions factor including coal generating plants confuses a decreases in GHGs resulting from Town operations alone.

Figure 2: Annual Energy Use Baseline Year to Present

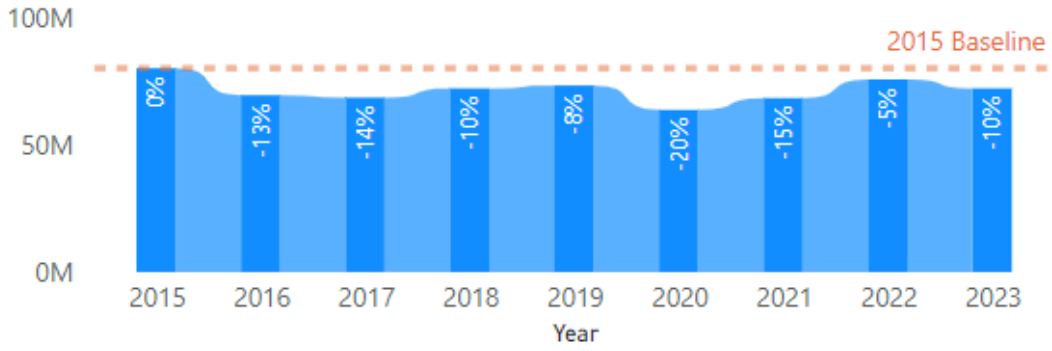
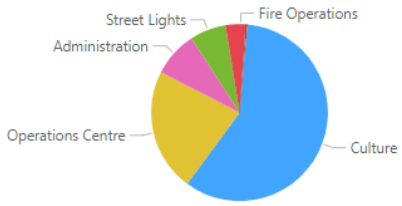


Figure 3 illustrates the distribution of energy consumption, utility costs and greenhouse gas emissions for each category of facility types.

The below charts show that Culture facilities – including community centres, arenas, museums, art galleries, parks, etc. – are the major driver of both cost and GHG emissions. Electricity-only loads, such as streetlights, are high in cost but low in GHG emissions. This showcases a key challenge in decarbonizing, that electricity is low in carbon impact in Ontario but higher in cost.

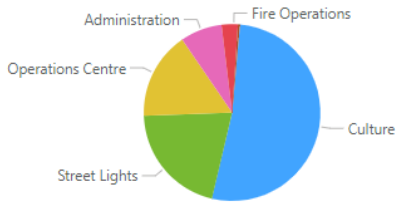
Figure 3: Energy, Cost and Greenhouse Gas Emissions by Category 2023

Energy (ekWh)



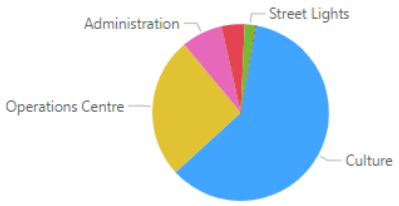
Facility Type	Energy (ekWh)
Administration	5,435,341
Culture	38,464,712
Fire Operations	2,407,280
Operations Centre	14,710,434
Parking Garages	170,687
Street Lights	4,332,451
Total	**65,520,905**

Cost ($)



Facility Type	Cost
Administration	$500,349
Culture	$3,428,495
Fire Operations	$194,612
Operations Centre	$1,049,823
Parking Garages	$22,819
Street Lights	$1,359,623
Total	**$6,555,721**

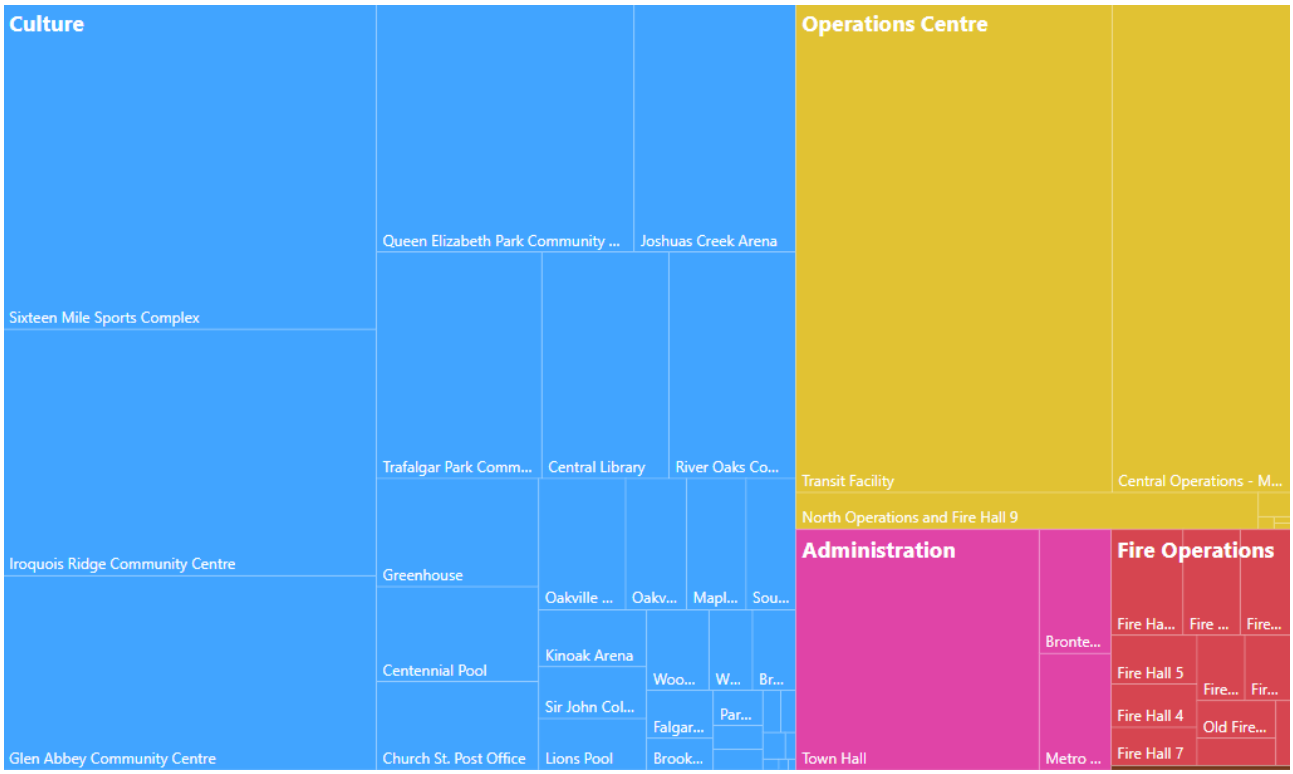
GHGs (tCO2e)



Facility Type	GHGs
Administration	491.35
Culture	3,943.60
Fire Operations	274.99
Operations Centre	1,681.25
Parking Garages	5.12
Street Lights	129.97
Total	**6,526.29**

Figure 3 breaks out the specific buildings in the Town's portfolio that drive the majority of GHG emissions. The major emitters are large-sized community centres with pools and arenas. These systems require significant natural gas and electricity to heat water, cool ice and dehumidify specialized use spaces. Other large emitting facilities include Operations Centres, where high levels of air exchange are required to maintain air quality when vehicles are operated indoors.

Figure 4: Greenhouse Gas Emissions by Facility



4.0 Current State and Activities from 2020-2024

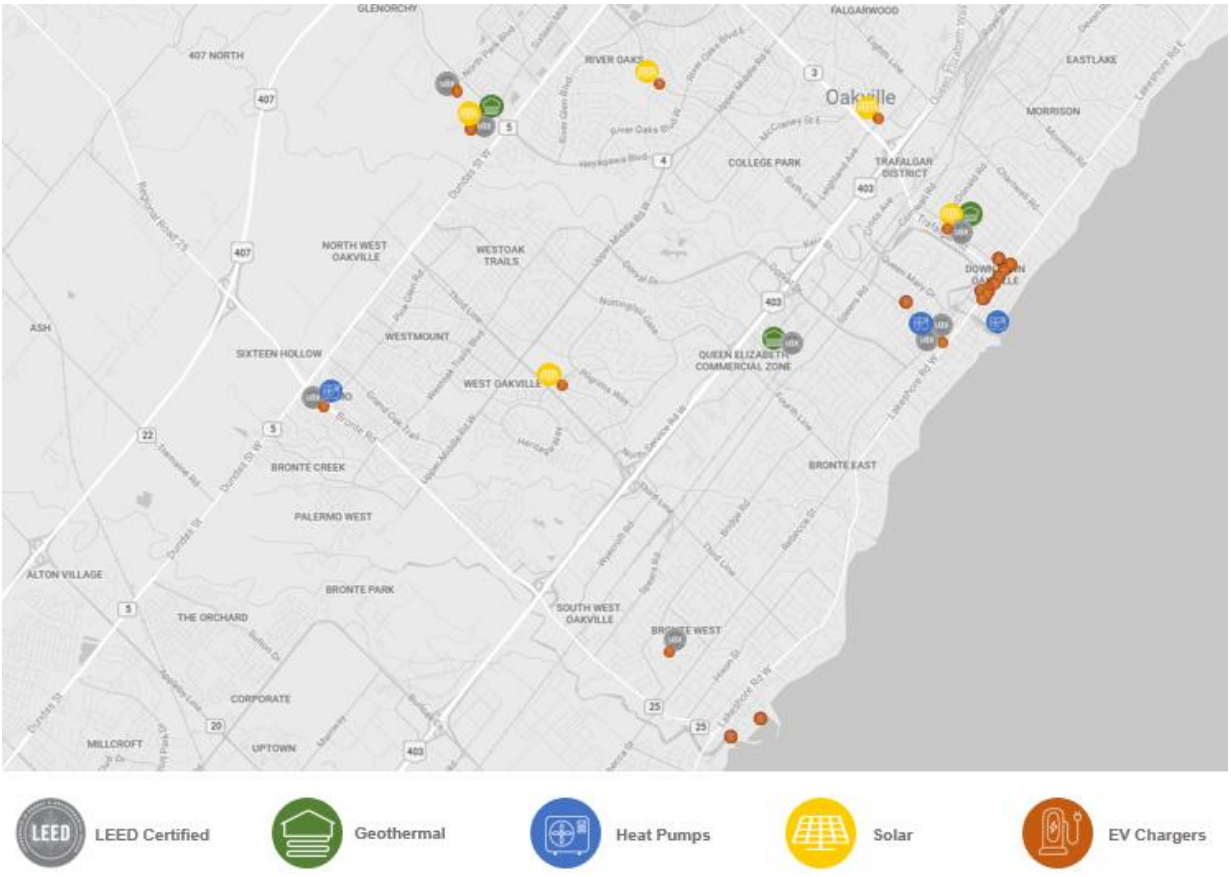
4.1 Current State

The Town has been striving to be a leader in energy efficiency and low-carbon solutions for some time and has achieved many successes. Key infrastructure includes:

- 6 LEED® Silver Certified facilities
- 2 LEED® Gold Certified facilities
- 3 Geothermal Heating/Cooling Systems
- 4 Air-Source Heat Pump Heating/Cooling Systems
- 5 Sites with Solar Panels (1 town-owned, 4 town-hosted)
- 20 EV Charger Locations supplying a total of 62 Charging Ports

Figure 4 shows a map of key infrastructure related to energy management and decarbonization.

Figure 5: Map of Key Sustainability Projects



4.2 Overview of Progress Over the Last 5 years

The timeframe of the last CDM Plan (2020-2024) represents a substantial change in strategy for the Town of Oakville. There is a transition from a focus on projects prioritizing a quick financial payback to initiatives that make a larger, long-term impact on GHG reductions. Since the Town is committed to owning and operating facilities for the long-term, quick paybacks are not the only determining factor. Larger investments often return larger savings over the long-term, even if the break-even timeline is not as short. Therefore, the financial benefit to the Town can be just as good if not better.

Consistent with industry best-practices from over the last twenty years, activities previously were focused on conserving initiatives that saved electricity (LEDs, VFDs) or tweaked energy use by optimizing building controls. Electricity-saving projects can provide great paybacks, but offer little in GHG emissions reductions, since Ontario's electricity grid is already so clean[2]. Optimization of building controls are more wholistically beneficial because they save on both cost and carbon, but to be effective requires dedicated staff time dedicated to catching areas of waste and quickly fixing them.

Over the last 5 years, following from Council's Declaration of Climate Emergency in 2019, the Town has grown the Energy Management team by adding a BAS Specialist and an Energy Data Analyst. These dedicated staff resources plus a greater commitment to funding capital projects are expected to result in the most significant decrease in GHG emissions the Town has experienced to date.

4.3 Key Successes 2020-2024

The Town of Oakville has been a leader in piloting new energy management technologies and, when found to be successful, deploying them more widely as part of standard operations.

The following section will describe key energy efficient and low-carbon technology deployments at the Town:

4.3.1 Geothermal

Sixteen Mile Sports Complex (expected completion 2025)
Set to be the flagship recreational facility for the Town of Oakville, this existing 155,000 sq ft 4-pad arena is being coupled with an 88,000 ft^2 full-service community. The facility

[2] IESO: Ontario's Electricity Grid, Supply Mix and Generation - https://www.ieso.ca/Learn/Ontario-Electricity-Grid/Supply-Mix-and-Generation

addition will include a pool, a library, a gymnasium, and community spaces. The geothermal borehole field is already completed and is expected to be able to meet the energy needs of the new addition plus a partial load of the existing facility.

Oakville Trafalgar Community Centre

The first facility built by the Town where the HVAC system was entirely supplied by a ground-source heat pump (geothermal). The GHG emissions are 90% lower when compared with a similar gas heated facility in the Town's portfolio. Using the ground as a source of heat exchange creates such a high level of energy efficiency (~60%) that even with the higher cost of electricity, compared to gas, overall utility bill savings are still being achieved.

Transit

Oakville Transit's main operations centre has a geothermal field sized for partial load of the building. The system has been operating since 2016 with no major issues.

4.3.2 Solar

Town-owned

The Town completed its first outright purchase of a solar system array on top of the Oakville Trafalgar Community Centre. Covering both the community centre roof and adjacent parking structure, over 1,300 panels offset 43% of the facility's energy requirements and reduce GHG emissions by 19.9 tonnes.

Roof-leased

In partnership with the town-owned electric utility (Oakville Electric Company) the town is host to solar PV systems on rooftops at five of our facilities: Glen Abbey Community Centre, River Oaks Community Centre, Sixteen Mile Sports Complex, Town Hall, and Oakville Hydro. Together, these systems have a total generating capacity of 1,500 MWh which, reduces GHG emissions by 45 tonnes.

Solar-ready

To continue to enable future adoption of clean energy, new facilities currently in the design phase, will include the infrastructure to allow for solar PV to be added in the future. This includes structural and electrical capacity that, if not added at the time of construction, would make the addition of future solar cost prohibitive. Sixteen Mile Sports Complex and Firehall 9 are planned to be solar-ready to allow the Town to add solar when it becomes most appropriate.

4.3.3 Heat Pumps

Oakville Museum

The Town has been operating air-source heat pumps at the 6,600 sq ft Oakville Museum site since the 2012. The site is a designated Heritage building and gas service was not an option. Town staff have been able to gain experience with air-source heat pump technology to solve any issues that have arisen. The site was added to the Building Automation System (BAS) network in 2023, which will allow us to improve efficiency and monitor any issues as the heat pump units age.

Firehall 3 & 8

The two newest fire stations achieved LEED Silver certification. A Variable Refrigerant Flow (VRF) heat pump system is used with natural gas backup for colder days.

Feasibility Studies

Feasibility studies are currently being undertaken for Glen Abbey Community Centre, Iroquois Ridge Community Centre, and Gairloch Galleries to evaluate the use of heat pumps. Natural gas will still be considered for lower temperatures, to ensure no disruption to operations in case of extreme cold and to be cost effective with respect to utility costs.

4.3.4 LEED Certified Buildings

The town has integrated sustainable building design characteristics into several of our facilities by mandating a minimum requirement of LEED® Silver certification for all new buildings. Certified buildings to date include:

- North Operations Depot (LEED® Silver)
- Oakville Fire Station 3 (LEED® Silver)
- Oakville Fire Station 8 (LEED® Silver)
- Oakville Trafalgar Community Centre (LEED® Gold)
- Oakville Transit (LEED® Silver)
- Queen Elizabeth Cultural and Community Centre (LEED® Silver)
- Sixteen Mile Sports Complex (LEED® Gold)
- Trafalgar Park Community Centre (LEED® Silver)

LEED design goes beyond conserving energy to include best-practice design for indoor environmental quality, embodied carbon, water, waste, and more.

4.3.5 Rink Water Treatment

Oakville trialled an ice rink water treatment system at Sixteen Mile Sports Complex in 2020 and found success in lowering the ice resurfacer water temperatures without any impact to

ice quality. The project was then replicated across the five other rink facilities the Town owns and operates.

Energy and cost savings were realized from both the natural gas used to heat up the water and a reduction in rink compressor electricity from not having to cool the ice as much when hot water is applied. The estimated payback for this system was less than two years.

4.3.6 LED Lighting and Other Energy Efficiency Projects

The town has been consistently upgrading all lighting to LED as equipment reaches end of life. At this point, 62% of interior spaces owned and operated by the Town is converted to LED. Other projects include BAS upgrades, HVAC unit replacements with more efficient equipment, and more. Figure 5 shows estimated annual savings from such projects.

Figure 6: Other Energy Efficiency Project Savings

Year	Project Name	Energy Savings (ekWh/yr.)	Cost Savings ($/yr.)	GHG Reductions (tCO2e/yr.)
2019	Glen Abbey CC Rink Lighting	21,360	3,204	0.6
2019	Iroquois Ridge CC Library and Gym Lighting	58,417	8,763	1.8
2019	Oakville Transit Facility RTU Upgrade	275,600	8,580	49.4
2019	Queen Elizabeth Park CC Theatre Lighting	2,673	401	0.1
2019	Town Hall BAS Upgrade	465,472	30,063	63.9
2019	Town Hall Lighting	59	9	0.0
2020	Rink Water Treatment (3 sites)	494,633	46,508	49.6
2021	Cornwall Road Salt & Sand Lighting	10,121	1,518	0.3
2021	Glen Abbey CC Gymnasium Lighting	67,708	10,156	2.0
2021	Iroquois Ridge CC Library Lighting	58,417	8,763	1.8
2021	Kinoak Arena Lighting	40,427	6,064	1.2
2022	Central Operations Centre Office Lighting	110,148	16,522	3.3
2023	Central Operations Centre Exterior Lighting	35,044	5,257	1.1
2023	Rink Water Treatment (2 sites)	240,459	23,040	23.6
2023	Maplegrove CC Lighting	39,106	5,866	1.2
2023	River Oaks CC Refrigeration Plant	141,120	21,168	4.2
2023	Town Hall Server Replacement	142,108	21,316	4.3
2024	Iroquois Ridge CC Interior Lighting	115,154	17,273	3.5
2024	Transit Facility Lighting	477,271	71,591	14.3
		2,795,296	**306,061**	**226**

4.3.7 Submetering

Collecting data on large energy-consuming equipment is essential for understanding where savings can be achieved before deciding to implement a project and how much savings are achieved once a project is implemented. Submetering needs to be done

sooner rather than later in the energy management journey, as it is impossible to go back in time and understand data if you have not collected it in the first place.

The Town has implemented submetering at several facilities and is committed to continuing to do so.

Figure 7: Progress toward energy submetering at Town facilities

Oakville Trafalgar CC	Iroquois Ridge CC	River Oaks CC	Town Hall	Transit	Glen Abbey CC	Queen Elizabeth Park CC	Trafalgar Park CC	Sixteen Mile Sports Complex	Joshua's Creek Arenas
Fire Hall 2	Iroquois Ridge Branch	White Oaks Branch	Central Library	Central Operations	Glen Abbey Branch	Sir John Colborne	TP Outdoor Rink	Sixteen Mile Branch	Maplegrove Arena
Gairloch Gardens	Fire Hall 7	Oakville Centre for the Performing Arts	Former Fire Hall 3	Fire Training Campus	Oakville Gymnastics	Fire Hall 1	Woodside Branch	North Ops	Kinoak Arena
South -East Depot	Clearview Branch	Uptown Core	Church St. Post Office	Fire Prevention	Palermo School House	Bronte Convention Centre	Museum Buildings	Centennial Pool	Brookdale Pool
Greenhouse	White Oaks Pool	Hydro	Parking Garage	Fire Hall 5	Fire Hall 8	Bronte Heritage Park	Fire Hall 3	Bronte Beach Park	Wedgewood Pool
Former OT High School	Melvin House		Fire Hall 4	Bronte GO Trailer	Fire Hall 6	Bronte Tennis Club	TOWARF Harbours	Bronte Athletic Park	Falgarwood Pool
Cornwall Road Sports Park	Lafrentz Road		Oakville Scout Shop	Third Line Pump Stn	Oakville Soccer Club	Sovereign House	Lawn Bowling Club House	Tannery Park	Bronte Pool
Wallace Park	Whitehall Homes			1094 Third Line House		Bronte Outer Harbour Marina Office	Thomas House	Coronation Park Stonehouse	Lions Pool

4.3.8 Strategic Initiatives

In addition to retrofitting equipment, many measures were taken to enable staff to implement future energy and carbon projects. This work, from the last CDM plan period, will continue to underpin the success of initiatives over the next 5 years. This includes:

- Hiring a BAS Specialist to ensure ongoing optimum performance.
- Procuring a BAS Preventative Maintenance contract for annual PM site visits.
- Procuring BAS integrated monitoring and analytics platform.
- Creating internal standards for lighting levels and thermal comfort.
- Installing submetering at various sites (see Figure 7).
- Requiring for minimum certification of LEED Silver for all new buildings.
- Applying a mandatory consideration of using a Climate Lens when creating SOPs.
- Retro-commissioning studies completed at 6 major facilities.
- Air balancing projects completed for energy efficiency, indoor environmental quality, and thermal comfort.
- Commissioning a *Low Carbon Pathway Report* and *Deep Energy Retrofit Studies* to influence future design.
- BAS training provided to operators.
- Collaborating with the Town's Climate Committee.
- Working with Operations Staff to identify energy opportunities.

- Releasing Climate Primer document to the public when the Climate Emergency Declaration was made by Council.

4.4 Notes on Operational Impacts 2020-2024

COVID-19

As with all organizations, the COVID-19 pandemic was a major disruptive event to operations. The majority of Culture facilities were closed from March 13, 2020 until late-2021 and only partially opened at that time. Much of the energy management staff efforts were put on hold and staff resources redirected to supporting pandemic management.

Air quality in building spaces became a key requirement and impacted energy through adding load for treating more fresh air. Filtration mediums were increased to prevent viral spread, increasing resistance to airflow and putting further energy requirements on fan loads. Even with these greater HVAC requirements, the Town was still able to achieve significant reductions in 2021 by re-programming HVAC to shifting operating schedules.

Infrastructure and Operational Growth

As with other municipalities in the Golden Horseshoe region, Oakville is undergoing population growth and requires growth in services to continue to uphold a high standard of community infrastructure. To meet this requirement, the Town's managed footprint grew by 9% from 2015-2022. On top of this, facilities have been required to provide longer use hours to keep up with demand. Infrastructure growth adds a greater challenge to reducing energy and carbon reduction on whole. The Town's focus on ensuring new buildings are getting as close to possible to net zero emissions is a key mitigation strategy.

4.5 Lessons Learned from Last CDM Period

The Town strives for continuous improvement in all aspects of operations. To improve we must reflect on key lessons-learned at each planning renewal milestone.

Time to move from generalized energy studies to detailed planning: While the numerous energy studies carried out have been extremely insightful in generating ideas for energy efficiency and decarbonisation, it is time to move more aggressively to implementation. This means using lessons from these studies and integrating with asset renewal cycles. Instead of commissioning energy audits to generate ideas, the Energy Management team will focus on Feasibility Studies (Pre-Design Phase Studies) to identify exactly which technologies and design will be utilized for the Detailed Design Phase.

Focus on asset management renewal alignment: When renewing buildings or equipment, the lifespan of the new assets is expected to last out to or beyond the 2050 timeframe, which governments broadly have set as the target to achieve net zero carbon emissions. It is vital that new assets are considering designs that either achieve net zero carbon emissions or allow for future low-cost conversion to net zero.

Solar is not a silver bullet: While renewable electricity from solar provides relatively good payback and is a visible indication to residents of the Town's commitment to sustainability, Ontario's extremely low-carbon electricity grid means that the carbon impact of offsetting grid electricity is relatively low. Higher impact reductions are found in converting from using natural gas for heating to electricity for heating.

Operational energy efficiency needs rigorous data feedback to sustain savings: The operators at the Town have adopted many strategies to curb energy waste through management of BAS schedules and monitoring for inefficient programming. The hiring of an in-house BAS Specialist has drastically reduced temperature and humidity issues in the spaces and caught many energy waste issues at their root. To improve even further, data feedback loops are necessary to inform operators of how their sites are performing. Numerous options are being explored, including the use of AI and machine learning to regularly scheduling in-house BAS recommissioning.

5.0 What We Are Planning 2025-2029

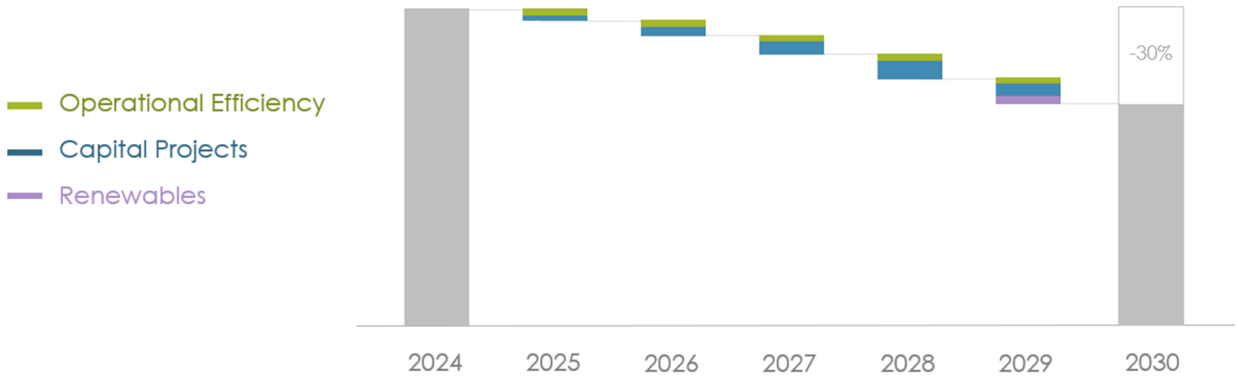
The 2025-2029 CDM will build on the work of the previous two CDM periods. Much of the underlying capacity building work has been completed with some finishing touches to be completed in the next few years.

The work will be divided into two main pillars: (A) Operational Optimization, and (B) Capital Upgrades. This aligns with the Town's departmental structure, which has an Operations team that oversees day-to-day facilities management and a Project Management team that implements capital upgrades for larger retrofits and new builds. A contribution from Renewable Energy (primarily solar PV), acquired by the town, will be used to make up any gap towards achieving the target of 30% GHG reduction by 2030.

Over the past several years, a restructuring has taken place within the town to aggregate all facility management and project managers into one department, so coordination on implementing new technologies has become more streamlined. The Energy Management team is situated directly within this new Facility Services department, working side-by-side both the Operations and Project Management teams.

A target of 2% annual reduction from Operational Efficiency will mean a 10% reduction over the five-year period. Capital Projects are expected to make a larger impact, as there are several significant equipment renewals due in the next five years. Capital Projects are targeted to contribute 15-20%. Cost-effective financing for Renewables will be explored with a target of 0-5%, depending on the impact of Operational and Capital initiatives.

Figure 8: Potential Pathway to 30% GHG Reduction by 2030



5.1 Operational Optimization

Reducing energy and carbon emissions through incremental low-cost initiatives will be led by the Operations team in partnership with the Energy Management Team. The types of projects fall into three categories: (A) HVAC Controls Optimization, (B) Efficiency Improvements, and (C) Recommissioning of Select Systems. The strategies below are targeted to achieve 2% GHG reductions per year.

5.1.1 HVAC Optimization

Ensuring the HVAC systems across the Town portfolio perform at optimal levels to meet comfort, humidity and fresh air requirements is a large task. Reducing time spent by operators responding to occupant comfort issues will improve facility management efficiency overall. Dehumidification in rinks and pools is vital to preventing window fogging and mold growth. The importance of good indoor air quality has been brought into sharper focus after the COVID-19 pandemic.

These elements of day-to-day facility management can be improved along with reducing energy and carbon by creating a strong Building Automation System (BAS) program. The Town's onboarding of a BAS Specialist has already made great steps in reducing the number of HVAC-related issues. Next steps include further optimizing for energy performance and adding more facilities to the BAS network.

Top projects identified or already started include:

- ***Schedule optimization***
- ***Air balancing***
- ***Improved BAS fault diagnostics***
- ***Sensor-based HVAC control***
- ***Identification and response protocol for high energy use***
- ***Additional sites added to the BAS network***

5.1.2 Efficiency Improvements

In partnership with the Operations team and departments occupying the spaces, there are many projects that get at the "root cause" of energy waste. For example, a project that uses new technologies to refine the accuracy of chemical dosing in pools will improve the experience for swimmers, save costs of chemicals purchased by the Town, while also reducing the outside air required to achieve indoor air quality and therefore save energy.

Top projects identified or already started include:

- ***Pool filtration and chemical dosing efficiency***
- ***Rink ice laser-level system***
- ***Space use optimization***

- ***Conversion to electric Zambonis and ice edgers***
- ***Small building HVAC renewals with heat pumps or hybrid systems***

5.1.3 Recommissioning of Select Systems

The experience of the town has shown that recommissioning is most effective when considering specific high-value building systems rather than trying to 'cast too wide a net'. With a limited budget for such studies, town staff are usually able to narrow down which, systems are having issues and which, are consuming the most energy. A recommissioning study can help reduce regular maintenance issues that operators are dealing with in addition to optimizing for energy efficiency.

Top projects identified or already started include:

- ***Heat recovery wheels***
- ***Rink and pool dehumidification systems***
- ***Chiller and boiler plants***

5.2 Capital Projects

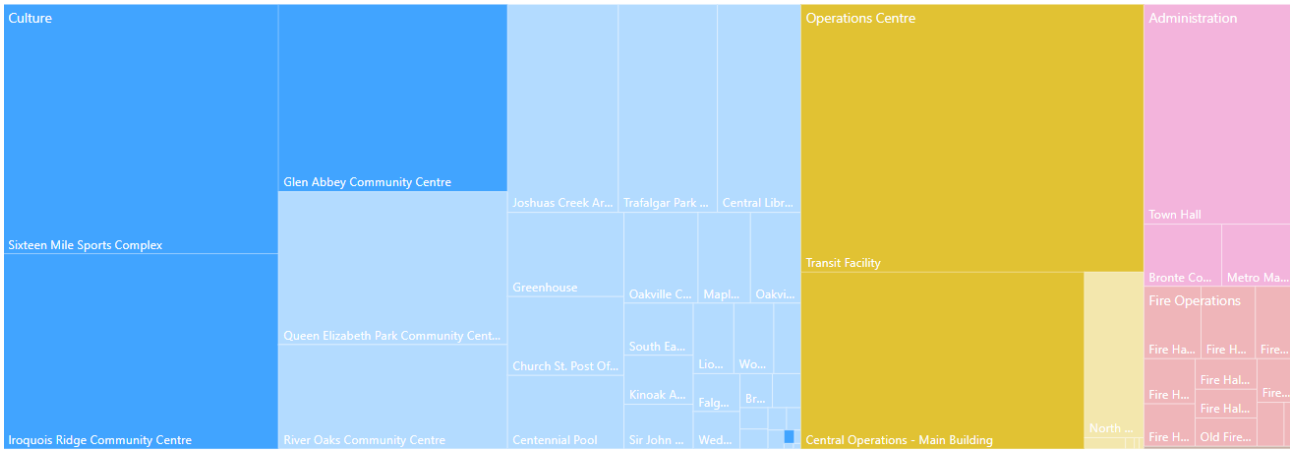
As equipment and entire buildings reach end of life, it is vital that the town chooses design options that will ensure the lowest energy and carbon emissions within reasonable budget constraints. This new building equipment and materials will last up to or beyond the timeline of the town's 2050 carbon targets. Therefore, it is most cost-effective to implement these changes now rather than later when equipment will still be within the period of their useful lifecycle.

5.2.1 Retrofits

Looking ahead at the next 5 years of the Town's Asset Management plan there will be retrofits relevant to energy management at the five top-emissions sites. Planning these renewals to be the most energy efficient and as low carbon as possible could be the most impactful action the Town can take to reduce our impact on the environment.

Figure 9 shows the facilities at which these planned renewals are taking place make up 53% of the entire GHG emissions from all town buildings. If we can reduce emissions by half, through these retrofit projects, we will be able to nearly reach the Town's 2040 target of 30% through this activity alone.

Figure 9: GHG Emissions from Facilities Planned for Relevant Equipment Renewals



Top initiatives identified or already started include:

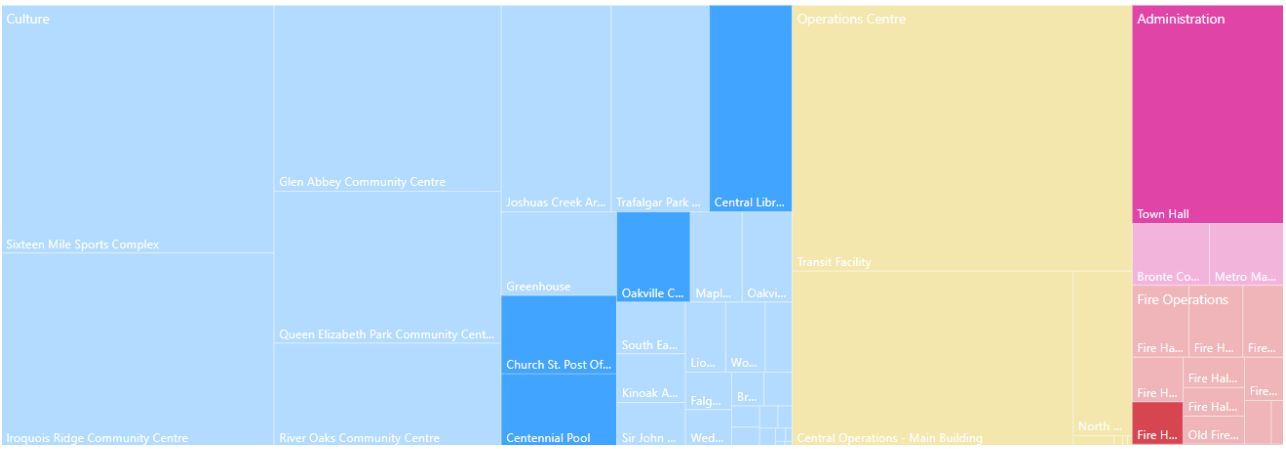
- ***Aligning with Asset Renewal Planning, focusing on HVAC and envelope***
- ***Feasibility Studies in advance of Detailed Design***
- ***Requesting more sustainable options from consultants during Design Phase***
- ***Continued conversion to LEDs***

5.2.2 New Buildings

The buildings currently scheduled for, or under consideration for, replacement make up 13% of the Town's GHG emissions. Considering that the emissions for Oakville Trafalgar Community Centre (one of the Town's most aggressively sustainable new buildings) achieved a 90% reduction in GHG emissions as compared to similar buildings in the town's portfolio, this provides a very promising indicator for the positive impact that new building construction could have on lowering the town's GHG emissions. If we can achieve the same results with future new builds, the town could see an over 10% reduction in GHG emissions (providing a significant contribution towards the town's 30% reduction target).

In addition, efforts to keep newly constructed building emissions as low as possible is even more important (when considering the town's future growth needs) since overall growth in the number of facilities that the town operates, will add to our overall GHG footprint. This will require further conservation efforts to mitigate against the impact of this growth. Each additional facility must add as little carbon as possible to the Town's emissions if we are to reach the stated targets.

Figure 10: GHG Emissions from Facilities Planned or Considered for Replacement



Top initiatives identified or already started include:

- ***Updating Sustainable Design Standards***
- ***Evaluating feasibility of using CaGBC's Zero Carbon Building Standard as a minimum requirement***
- ***Prioritizing high performance envelopes***
- ***Designing for gas to be used for heating only below -10C***
- ***Evaluating embodied carbon impacts of new builds***

5.3 Renewable Energy Generation

The primary renewable energy generation source available for the Town is solar photovoltaic (PV) systems. The Town has experience with such systems, the prime example being the system at OTCC which utilizes both the main community centre building and the neighbouring parkade structure rooftop to achieve 42% electricity reduction. While this is significant, grid electricity is already very low carbon in Ontario, so the overall impact of replacing grid electricity with solar is minimal.

The Town will continue to explore solar while prioritizing the cost-benefit analysis of potential solar PV projects. Dependent on market conditions, there could be a substantial financial incentive to these projects, while contributing somewhat to GHG reduction targets. To this end, new buildings will be built with the electrical and structural capacity to add solar PV when the time is right. Innovative financing structures could also enable further deployment. Solar hot water applications will be explored in more depth, as this offsets natural gas used for heating and could potentially lead to significant GHG reductions.

Top initiatives identified or already started include:

- ***Solar-ready new buildings***
- ***Explore solar parking lot applications***
- ***Explore building integrated solar applications for new buildings***
- ***Explore solar hot water applications***
- ***Explore financing options.***

5.4 Creating a Sustainable Mindset

The value of building capacity for a wide range of staff roles to drive energy efficiency and low-carbon projects forwards cannot be understated. As more staff understand the types of projects that make sense from a cost-efficiency point of view, to reduce energy and carbon, the more they will be able to identify and carry out such projects as standard practice. In addition, benefits to operations will be identified as energy and carbon projects are implemented, allowing them to be more accepted and more easily replicated.

Top initiatives identified or already started include:

- ***Grow the Energy Team with operators and building occupant departments***
- ***Align reporting and KPIs with the Town's Climate Committee and Council Dashboard***
- ***Create operator and management energy and carbon dashboards***
- ***Continue to install submetering***
- ***Identify relevant benchmarks for facilities***
- ***Continued operator BAS training***
- ***Education and awareness initiatives for general staff.***

5.5 Explore New Funding Opportunities

The Town will continue to participate in funding programs offered by Federal and Provincial governments to accelerate toward achieving set targets. Other opportunities will be explored such securing preferred financing for ESG (Environmental, Social, Governance) projects through private capital markets or participating in carbon credit programs.

- ***Participate in Government grant programs***
- ***Evaluate other opportunities like ESG financing and carbon credit programs***

Appendix A: Planned Projects and Initiatives