City of Kingston
Report to Council
Report Number 24-010

To:	**Mayor and Members of Council**
From:	**Paige Agnew, Commissioner, Growth & Development Services**
Resource Staff:	**Julie Salter-Keane, Manager, Climate Leadership**
Date of Meeting:	**January 23, 2023**
Subject:	**Progress Update on Impact and Options to increase the corporate carbon target of 30% by 2030 to 40-50% by 2030**

Council Strategic Plan Alignment:

Theme: 2. Lead Environmental Stewardship and Climate Action

Goal: 2.1 Reduce carbon footprint of City operations.

Executive Summary:

Council's 2023-2026 Strategic Plan includes a commitment to report on the impact and options to increase the current corporate carbon budget of 30% by 2030 to 40-50% by 2030. This report discusses the challenges, impacts, and available options for pursuing more ambitious GHG reduction goals and provides recommendations on next steps.

In 2018, the City's corporate operations produced over 22,000 tonnes of emissions, marking a 12% decrease from 2011. The City's 2018-2022 Strategic Plan set more ambitious targets: a 15% reduction from 2018 levels by 2022, 30% by 2030, and achieving carbon neutrality by 2040. In Q1 2024, staff reported on the 2022 Corporate GHG Emissions Inventory (Report Number 24-008), showing an 8% reduction in 2022 from 2018 base year emissions, falling short of the 15% target. This shortfall underscores the substantial efforts and challenges that lie ahead to meet the City's GHG reduction goals from 2022 to 2040.

To support City staff in responding to Council's directive, Greenscale Inc. was retained to research and report on the challenges, impacts, and available options for pursuing more

ambitious GHG reduction goals. The report – Feasibility Assessment of a Corporate Carbon Budget of 40-50% by 2030, is attached as Exhibit A to this report.

To understand the implications of establishing a more aggressive mid-term target, the overarching question addressed in the Greenscale Inc. report is: what is the feasibility of meeting and/or exceeding the original 2030 reduction target within the 2023 - 2030 timeframe? This review is addressed through these main objectives:

a) Re-assess the current business-as-planned pathway with regard to the status of the initiatives the City is already in the process of implementing in terms of the likelihood of reaching the existing 2030 reduction target. ("Business-as-planned" (BAP) is a reference to the City's Climate Leadership Plan (Report Number 22-022 Climate Leadership Plan) which incorporates already approved actions that are in progress but not yet fully accounted for in terms of their impact within City's Corporate annual GHG emissions inventories.).

b) Identify any current projects or new initiatives where implementation could potentially be accelerated faster than the BAP pathway.

c) Examine some of the potential challenges or barriers that already exist for initiatives in progress, as well as impediments associated with an expedited implementation of current or new projects that could potentially lead to achieving deeper GHG reductions within the current decade.

d) Quantify the financial implications for the City if purchasing carbon offsets are required to meet more aggressive 2030 reduction targets if an accelerated GHG reduction pathway is not successfully carried out over the next 7 years.

The analysis and findings presented in the Greenscale Inc. report considers several ongoing initiatives, such as in-depth assessments of Facilities, Transit, and other Municipal Fleet categories, that are likely to provide valuable cost estimates and other information that will help to evaluate the potential to achieve more aggressive reduction strategies. Given the expected completion of these studies in 2024, staff suggests that a more effective time for reassessing aggressive reduction targets would be in 2025, instead of as soon as early 2024. This would give each sector the ability to use the information from the studies to understand the actual costs and operational impacts to achieve current targets as well as to evaluate potential scenarios for more aggressive reduction goals. Staff are also gathering more information on regional electrical transmission capacity which could impact the City's ability to achieve its electrification goals.

The Greenscale Inc. report also performed carbon price modelling and showed that committing to both carbon offset purchases and larger reduction targets can be expensive when targets are missed. Comparing the carbon offset costs of missing the 30% by 2030 target by 5% with a more ambitious 50% target missed by 15% revealed a cost difference of nearly $1.3 million. Therefore, in addition to operational costs and other challenges to meet a more aggressive target, the carbon price modelling suggested there is added financial risk as well. Based on

findings in the Greenscale Inc. report, staff are recommending that the existing target of 30% by 2030 be retained and that a re-assessment of mid and long-term GHG reduction targets for municipal operations be delayed until some time in 2025 when departments have had time to undertake detailed sector assessments. There is already work underway that, when completed, will provide important information to assess how aggressive the corporate targets can be, and which could be used to inform commitments to update targets in 2025.

There are four key takeaways and associated recommendations that staff have made, based on the findings in the Greenscale Inc. report:

1. Wait for in-depth Transportation/Transit, Municipal Fleet, and Facilities studies

The in-depth assessments being completed in 2024 for Transportation & Transit, Corporate Asset Management & Fleet, and Facilities Management & Construction Services (FMCS) will not only provide detailed analysis of GHG emitting operations, but they will be able to provide the most realistic level of corporate emissions attainable by 2030, subject to available resources.

2. Adopt federal carbon pricing to understand implications of not reaching imposed reduction targets

Missed ambitious targets can be expensive. While there are planned budgets and technologies available that should help FMCS meet their mid-term reduction target, the Fleet and Transit sectors need a lot of help from a number of different resources such as funding, infrastructure, policy, resourcing, technology, and supply chains. A clearer understanding of carbon pricing's impact on budgets will better aid in setting realistic targets and fully grasping the financial consequences of not achieving them.

3. Consider re-investment strategies using federal carbon pricing

The total value of the carbon cost to the City in each year that it falls short of emission reduction targets has the potential to be significant, as outlined in the carbon modelling within the Greenscale Inc. report. However, using carbon price forecasting can be a valuable tool to understand what the trade-offs would be if, rather than purchasing carbon offsets, the funds could be directed to a new ***internal*** carbon reduction fund. This fund could be used to further support corporate initiatives that could accelerate corporate GHG reductions faster over time than if those funds were used to pay for annual carbon offsets.

4. Consider aligning future mid- and long-term targets to a 2018 baseline year

Currently there are two sets of targets: those set in 2011 and those set in 2018. Some sectors are setting targets almost exclusively from the more recent 2018 levels and this can sometimes create confusion in documents about which baseline targets are referring to.

Recommendation:

That Council receive the Feasibility Assessment of a Corporate Carbon Budget of 40-50% by 2030 Report by Greenscale Inc., attached as Exhibit A to Report Number 24-010; and

That Council direct staff to report back no later than Q2 2025 on the feasibility of increasing the carbon budget to 40-50% by 2030 upon the completion of the reports by Facilities Management & Construction Services, Corporate Asset Management & Fleet, Transportation & Transit; and

That Council direct staff to implement the practice of using the federal carbon pricing across all sectors and budget accordingly in the future to be accountable for self-imposed greenhouse gas (GHG) reduction targets; and

That Council direct staff to evaluate, using the federal carbon pricing approach, the practice of purchasing carbon off-sets versus a proposed practice of investing in local greenhouse gas reduction and renewable energy projects to determine which practice would accelerate greenhouse gas reductions faster and to report to Council the results of the evaluation no later than Q2 2025; and

That Council direct staff to base all new mid- and long-term greenhouse gas emissions targets on the 2018 baseline year, ensuring consistency in climate action planning.

Authorizing Signatures:

ORIGINAL SIGNED BY COMMISSIONER

Paige Agnew, Commissioner,
Growth & Development Services

ORIGINAL SIGNED BY CHIEF

ADMINISTRATIVE OFFICER

Lanie Hurdle, Chief
Administrative Officer

Consultation with the following Members of the Corporate Management Team:

Jennifer Campbell, Commissioner, Community Services	Not required
Neil Carbone, Commissioner, Corporate Services	
David Fell, President & CEO, Utilities Kingston	
Peter Huigenbos, Commissioner, Major Projects & Strategic Initiatives	Not required
Brad Joyce, Commissioner, Infrastructure, Transportation	
& Emergency Services	
Desirée Kennedy, Chief Financial Officer & City Treasurer	

Options/Discussion:

As part of the City of Kingston's ongoing commitment to advance climate change leadership, City Council's Strategic Plan 2023-2026 priority to Lead Environmental Stewardship and Climate Action includes the action requesting staff to report on the impact and options to increase the current corporate carbon budget of 30% by 2030 to 40-50% by 2030. Specifically, staff were asked to report back on the feasibility of the City considering an increase of this mid-term target from 30% below 2011 levels to 40% - 50% by 2030. To support City staff in responding to Council's directive, Greenscale Inc. was retained to report on the challenges, impacts, and available options for pursuing more ambitious GHG reduction goals.

To help the City understand the implications of establishing a more aggressive mid-term target, the overarching question addressed in the Greenscale Inc. report is: what is the feasibility of meeting and/or exceeding the original 2030 reduction target within the 2023 - 2030 timeframe? Within this question is the need to recognize what the most promising options are available to the City to reach those levels, and what are the potential implications operationally and financially for trying to engage in a higher reduction pathway. These questions are addressed through these main objectives:

a) Re-assess the current business-as-planned (BAP) pathway with regard to the status of the initiatives the City is already in the process of implementing in terms of the likelihood of reaching their existing 2030 reduction target.
b) Identify any current projects or new initiatives where implementation could potentially be accelerated faster than the BAP pathway.
c) Examine some of the potential challenges or barriers that already exist for initiatives in progress, as well as impediments associated with an expedited implementation of current or new projects that could potentially lead to achieving deeper GHG reductions within the current decade.
d) Quantify the financial implications for the City if purchasing carbon offsets are required to meet more aggressive 2030 reduction targets if an accelerated GHG reduction pathway is not successfully carried out over the next 7 years.

The findings and recommendations within the report were developed through the following steps:

a) Understand the current BAP timelines, strategies and expected changes.
b) Conduct interviews and surveys with City staff to establish several important areas of understanding including: current and potentially new GHG reduction strategies and projects, existing initiatives staff are engaged in to identify potential reduction opportunities, and challenges they are likely to face in the coming years to achieve more aggressive mid-term targets by 2030.
c) Review up-to-date external data and carbon pricing models for Ontario and Canada.

Direct consultations with City staff were a crucial methodological component of the Greenscale Inc. report. These discussions aimed to understand their current work and assess their ability to

achieve GHG reduction targets beyond the existing 2030 goal. Based on annual corporate GHG inventory reporting, there are six sectors where corporate inventory emissions are accounted for: facilities, transportation, transit, wastewater, water, and waste. To capture opinions and details about each sector, staff responsible for overseeing and implementing emission reduction strategies in those sectors were consulted.

Interviews with 11 individuals from facilities, transit, transportation, waste divisions and Utilities Kingston (wastewater and water) were conducted.

Report Findings

GHG Reduction Targets and the Climate Action Pathway to 2030

For context, the City of Kingston currently has short-term, mid-term and long-term GHG emission reduction targets:

- **Short-term** - **15%** reduction of 2018 emissions by 2022;
- **Mid-term** - **30%** reduction below 2011 emissions by 2030; and
- **Long-term** - carbon neutrality by the year 2040 or earlier.

It is the mid-term 2030 target that Council directed staff to re-assess for a potentially more aggressive reduction percentage from the approved Climate Leadership Plan.

The Climate Leadership Plan included modelling for three scenarios:

1. **BAP** - already approved actions that are in progress, but not yet fully accounted for within the City's GHG emissions inventories.

2. **Moderate** - moderate implementation of different additional initiatives either identified within the Strategic Plan for 2018 - 2022 or from consultation, that which did not yet have all the necessary approvals to advance.

3. **Aggressive** - expedited or ramped up implementation of all actions to optimize GHG reductions within the prescribed timeframe.

The BAP trajectory, representing the City's short-term strategy, aims for a 15% reduction in emissions by 2022, compared to 2018 levels, based on initiatives planned from 2018 to 2022. The City's suite of timeline-based targets from 2018-2030, as described in the Climate Leadership Plan, is shown in Figure 1. Of the targeted 15% reduction from 2018 levels, the strategy anticipated 3% from municipal building retrofits and 7% from transitioning to electric transit and light-duty fleet vehicles. The Council-approved 2018-2022 Corporate Strategic Plan accounts for the remaining 5% through carbon offset purchases. FMCS is also targeting a 19% emission reduction for 2026, which has an overall corporate reduction of approximately 6.3%.

Figure 1 also demonstrates that while long-term targets can be closely associated with total GHG reduction targets at the larger corporate scale, sector specific targets work on shorter time scales that are more iterative and linked with approved capital budgets. For example, the City

had to significantly re-adjust their overall operational and capital budgets due to the increased expenses and decreased revenues from operations during 2020 and 2021 as a result of the financial impact from the Covid-19 pandemic. For the Fleet sector, achieving the 7% GHG reduction largely depended on procuring 12 EV transit buses by 2022, but only 2 are currently in service. The adjusted plan will now see 5 electric buses approved for purchase in 2024 through capital budget, with an expected delivery time of Q3, 2025. This adjustment will decelerate the transition to electrified transit by 2030, contingent on funding acquisition for expedited EV procurement and the availability of electric buses.

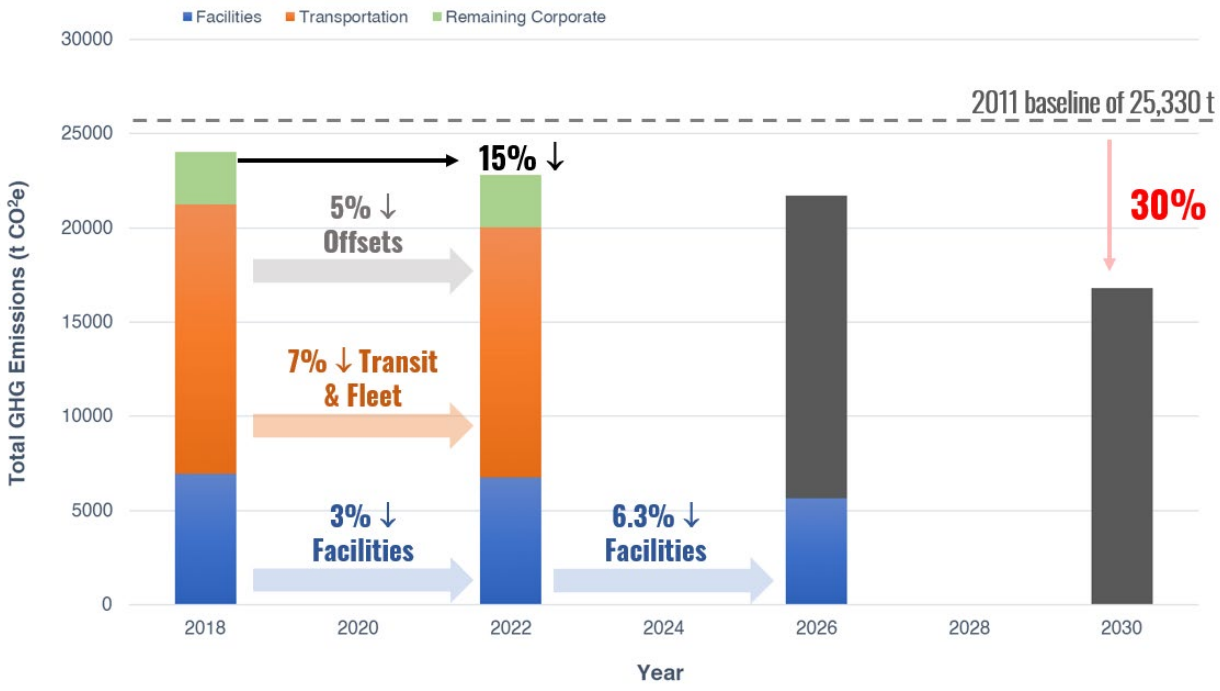

Figure 1. Illustration of the City's timeline-based targets as outlined in the CLP, including a 15% reduction by 2022 from 2018 levels, and 30% reduction by 2030 from the 2011 levels. The grey shaded areas in 2026 and 2030 signal sectors with less specific or fully funded reduction plans, showing progression beyond short-term targets.

The modeling for the Climate Leadership Plan (CLP) completed by WSP of both the BAP and Moderate pathways projected increased total corporate emissions for 2030 and 2040. This rise is attributed to the anticipated growth in demand for municipal services, such as transit and new facilities, and a projected increase in the carbon intensity of Ontario's electricity grid, outweighing the reductions from planned actions. This is why additional actions and more aggressive implementation was considered. Of the three scenarios examined by WSP, corporate actions planned in the most aggressive pathway were estimated to result in a GHG decline of 74% by 2040 when compared to 2011 emission levels, prior to the procurement of offsets. As this translates to a GHG reduction of approximately 35 - 40% reduction by 2030, the emissions modelled within the CLP were short of complete carbon neutrality in 2040 but potentially surpassing the reduction goal for 2030. Key corporate initiatives from the CLP, which

were instrumental in modeling these emission pathways, are detailed in Appendix B of the "Feasibility Assessment of a corporate carbon budget of 40-50% by 2030" report. Significant initiatives for corporate operations, as highlighted in this report, include:

- Advocate for provincial support and policy for virtual and community-level net metering arrangements.
- Install photovoltaics on all new municipal buildings where feasible and explore options for solar photovoltaics during roof replacements or other major renovations of municipal facilities.
- Retrofit City facilities to reduce emissions 19% by 2026 from 2018 levels.
- Prioritize the transition of municipal facilities to net-zero energy by 2040 by incorporating relevant expenditures into the approved 15-year capital budget forecast.
- Prioritize electrification of the City's bus fleet and Solid Waste Collection fleet, aiming for complete transition by 2040.
- As commercial electric vehicles become more widely available, explore group procurement for multiple commercial partners.

The CLP illustrated that in the year 2018, more than 98% of the City's GHGs from Corporate operations came from a combination of its buildings (including energy used within water and wastewater facilities) and fleet vehicles (including transit) (Table 1). The 2022 Corporate GHG Inventory Report (Report 24-008) illustrates that more than 98% of the City's GHGs' from Corporate operations came from a combination of its facilities and fleet vehicles and the remaining balance of corporate emissions came from streetlights and waste. Consequently, this report primarily focuses on the City's fleet vehicles and buildings, including water and wastewater facilities managed by Utilities Kingston.

Understanding the types of energy used within City operations can help inform development of GHG reduction strategies like fuel switching and renewable energy generation projects. Based on the 2018 Corporate GHG Inventory, the breakdown of energy used by each of the sectors is shown in Table 2. The primary energy sources of these emissions, combustion of diesel in fleet accounted for more than 49% of emissions and natural gas 32% in the year 2018. Gasoline consumed within the corporate (non-transit) fleet represented the more than 11% of corporate GHGs whereas electricity accounted for les than 7.5% of emissions (Heating oil and propane were relatively nominal sources of GHGs at <0.5%). Consequently, actions that effectively move the City towards its deep carbon reduction goals will need to dramatically lower the use of these fossil fuels within building and fleet operations over the coming years - particularly diesel in heavy-duty vehicles and natural gas used for space and water heating.

Important to consider for future emissions from electricity consumption, the GHG intensity of Ontario's electricity grid is expected to significantly increase out to 2030. During this period, major refurbishment and retirement of a few key nuclear reactors will be replaced by gas fired

generation plants and it is expected there will be a tripling of electricity emission factors (IESO 2020; 2021). Therefore, the associated increases in electricity consumption from the City's planned electrification of facilities and fleet over time will increasingly dampen the expected emission benefit between now and 2040 as a result of the more carbon intensive power grid. Even with the tripling of emission factors, the burning of natural gas for heat is still far more GHG emission intensive than switching to electric.

Table 1: Summary of sector emission results from the 2018 GHG Inventory; used as the baseline for the City's short- and long-term reduction targets and strategies.

Operations Sector	% of Emissions	GHG Emissions (tonnes CO_2e)
Facilities	28.99	6,968
Transportation	23.06	5,542
Transit	36.30	8,724
Streetlights	0.45	109
Wastewater	7.30	1,754
Water	2.34	562
Waste	1.57	377
TOTALS	**100.0%**	**24,037**

Table 2: Summary of emission results from Energy Use Sectors in the 2018 GHG Inventory; used as baseline for City's short- and long-term reduction targets.

Energy Use Sector	% of Emissions	GHG Emissions (tonnes CO_2e)
Electricity	7.27	1,720
Natural Gas	32.04	7,580
Gasoline	11.18	2,644
Diesel	49.12	11,622
Heating Oil	0.28	66
Propane	0.12	27
TOTALS	**100.0%**	**24,037**

Enhanced 2030 Targets – Required Reductions & Timelines

Figure 2 provides a summary of the timeline used within the current analysis. The important baseline years associated with short- and mid-term targets are described. The total tonnes of CO_2e required to achieve business-as-usual and more aggressive emissions reductions by 2030 based on previous inventory levels are summarized in Table 3. The business-as-usual 2030 30% target requires approximately 7600 tonnes of CO_2e to be reduced from 2011 levels, and a 6,257-tonne reduction from more recent 2018 levels. According to the City's most recent corporate GHG inventory, there were 1,909 less tonnes of CO_2e emitted in 2022 than in 2018, a reduction of 8%.

To achieve the 30% reduction target by 2030 will require another 4,348 tonnes to be reduced from 2022 levels. To attain a 40% reduction by 2030, 6,881 tonnes of GHGs must be cut from the 2022 levels. For a 50% reduction, the reduction rises to nearly 9,415 tonnes. Based on total

operational sector emissions summarized from 2018 earlier, the 50% reduction target would require a reduction nearly equal to the entire fleet sector emissions, in addition to the planned emissions reductions to reach 30% reduction emissions.

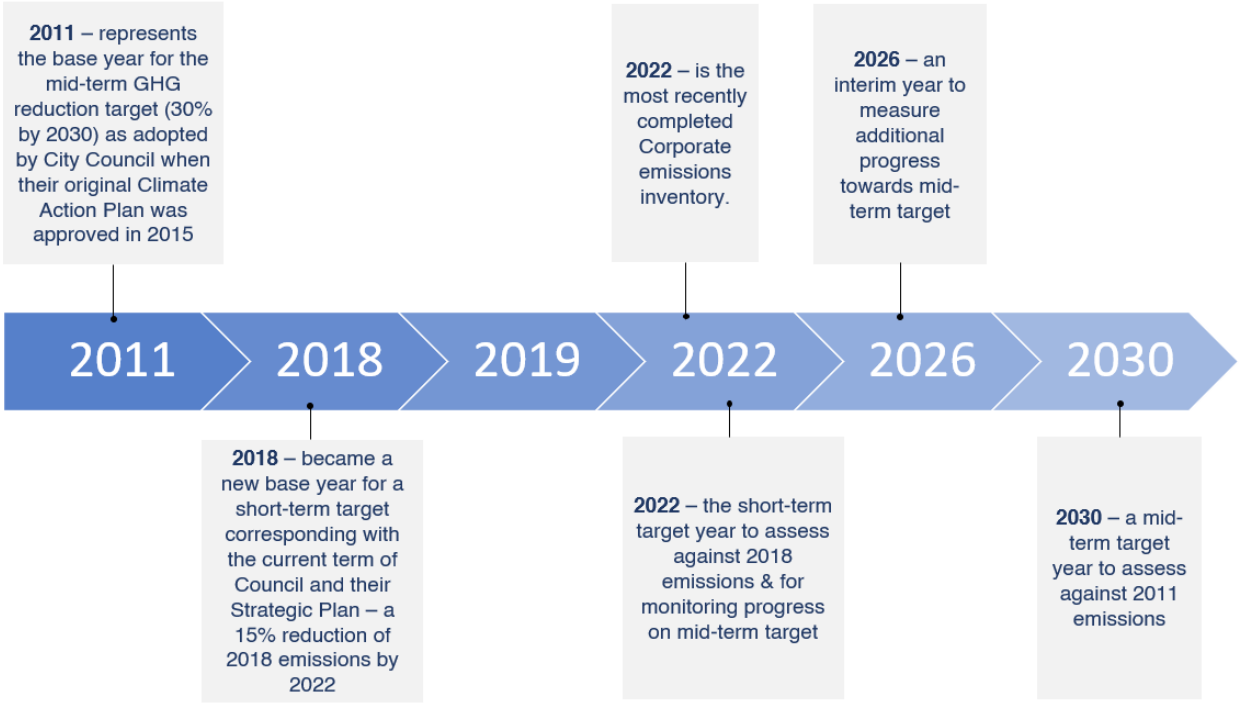

Figure 2. Timeline used within the current analysis of a business as planned emission trajectory as well as the potential for an accelerated GHG reduction pathway.

Table 3. Reference data for base year emissions for existing 30% reduction target of 2011 levels by 2030 and values for a 40%, 45% and 50% reduction.

Past Emissions (tonnes CO_2e)			Target GHG Emissions (tonnes CO_2e) a.k.a Carbon budget for 2030			
2011	2018	2022	30%	40%	45%	50%
25,330	23,988	22,079	17,731	15,198	13,931	12,665
Emissions to be reduced --->			***7,599***	***10,132***	***11,399***	***12,665***

Current Initiatives & Projects

Based on the interviews conducted with key City staff, along with documents reviewed from the major corporate emissions sectors, numerous initiatives are underway to support the BAP trajectory and the pursuit of the original 2030 reduction target. Given the large corporate emission footprint of Facilities and Transportation (Fleet and Transit), the most significant current projects and reduction pathways from those sectors are focused on within this section. City initiatives underway from the CLP and Strategic Plan, to support the pursuit of the original 2030 reduction target, include:

Facilities

The Facilities Energy and Asset Management Plan is a multi-stage program which aims to reduce energy consumption while also establishing a potential framework to transition municipal facilities to net-zero energy by 2040. The stages of the program include:

Stage 1 – Recommissioning (RCx): Optimizing existing buildings to ensure equipment and systems are running efficiently (as designed) to meet occupant needs. The fine tuning completed at this stage can lead directly to operational efficiencies, energy savings and GHG reductions.

Stage 2 – Deep Carbon/Energy Audits: Detailed review, energy modeling, and analysis of building systems to understand deeper energy conservation measures and retrofit scenarios that can significantly reduce facility GHG emissions (80% minimum).

Stage 3 – Net-Zero Transition Plan: Review of various GHG reduction scenarios within the context of applicable spending levels for renewals along with detailed electrification demand modelling for all facility locations. This scope of work will be used to establish potential costs of meeting facility related GHG reduction targets identified in the CLP. Various scenarios will be assessed and findings will also be reviewed with Utilities Kingston to understand the full impacts of electrification for long-term planning.

To date, Stages 1 and 2 have been completed for the City's most energy intensive facilities, and work is currently underway for remaining locations. In general, significant GHG reductions will

result from energy efficiency retrofits, regular recommissioning to sustain optimum performance, and heating system electrification (fuel switching) where technically feasible. The most cost-effective approach will be to implement upgrades as equipment reaches the end its useful life, accelerating decarbonization as much as funding will allow. The pace of this ongoing transition will be impacted by available levels of funding, the required timing for renewals, as well as electrical capacity constraints within the existing grid. Along with the Stage 3 work currently underway, the extent of electrical servicing upgrades will be reviewed to provide more accurate cost projections for potential scenarios to transition municipal facilities to net-zero energy as identified in the CLP.

Transportation

The major projects and timelines for the Fleet and Transit BAP approach include the incremental electrification of light-duty vehicles (LDV), transit buses, refuse trucks, and some specialty vehicles. This plan includes telematics deployment for LDV utilization assessment and the Council's 2023-2026 approved Strategic Priorities to purchase of 18 electric buses (replacing diesel buses) by the end of 2026. The first five (5) are expected to be received in Q3, 2025, supported by $18.3M from the Canada Infrastructure Program (ICIP), confirmed in August 2023.

More than half of the LDVs could be electric by 2030 with adequate funding, improved supply chain conditions, increased market competition, OEM model availability, and enhanced electric vehicle production capacity. Similar to Facilities, upcoming studies due by the end of 2023 will create a roadmap for electrifying the transit bus fleet by 2040, focusing on vehicle charging requirements and an expanded municipal fleet electrification model. These studies will inform the City's GHG reduction strategies.

There are also anticipated incremental costs associated with future capital budget forecasts for transit bus electrification which have been included in the 2024, 15-Year Capital Plan to be presented by the Mayor in January 2024. Combining the results of the 2023 report with these updated budget forecasts will help establish a framework that can be used to create a detailed reduction plan that will need to be funded through approved capital budgets. This type of plan is likely to model the Facilities plan that uses an iterative process to enhance regular renewals identified in the capital plan and accelerate decarbonization of operations as much as funding will allow. It is expected that the 2023 reports to be completed by the end of the year on fleet and transit electrification will be crucial for deciding the best strategies to achieve at least a 30% reduction in the City's transportation emissions.

Water & Wastewater

Although not the largest portion of the Corporate emissions portfolio, Water and Wastewater sectors can help reduce the reduction burdens needed for other more intensive sectors. Some current projects include changeover to more efficient pumping locations, building envelope improvements, and various other facility upgrades improving energy efficiency. Solar PV for net metering is also being explored. Similar to both Facilities and Transportation sectors, a major

strategic initiative is being developed by Utilities Kingston that will result in a Climate Action Leadership Plan, to define the organization's climate goals and strategies and evaluate the technical and financial feasibility of achieving carbon neutral operations for its multi-utility management of water and wastewater, as well as natural gas, water heater rental services, and fleet. The financial resources required to meet the Climate Action Leadership Plan will be outlined in the Utilities Kingston 2025-2027 capital and operation budgets for City of Kingston Council approval in 2024.

Accelerated GHG Reduction Potential – New & Existing Projects

In addition to existing initiatives, several areas offer potential for deeper GHG reductions for the City. These areas, contingent on insights from the ongoing studies referenced earlier in this report, play a vital role in achieving the City's current reduction target timelines. An overview of a few of these opportunities within the largest energy using sectors at the corporate scale (buildings and transportation) are summarized below.

Facilities (Buildings)

FMCS is currently projecting to meet the existing 2030 (mid-term) GHG reduction target for facility related emissions based on current funding levels. The GHG emission intensity (footprint) for buildings managed by FMCS in 2022 (2.76 kg CO_2e/ft^2) is currently 13.8% lower than 2018 levels (3.2 kg CO_2e/ft^2). The pending decarbonization studies expected to be completed by 2024 will identify the most feasible additional actions that would further reduce emissions for the 2025 – 2030 period. In addition, Facilities is also engaged in a number of other activities and projects that will help inform the planning of further emission reduction initiatives in the near future.

The link between decarbonization and capital planning is well understood within Facilities, and it is recognized that 2025 is likely the last year a fossil-fuel based heating system, such as a natural gas furnace, can be installed based on the current life expectancy of these types of assets. Based on work currently underway as outlined above, Facilities will be developing an updated framework in 2024 that will also be reflected in subsequent 15-year capital budget forecasts. This is an iterative process to enhance regular renewals identified in the capital plan and to accelerate/optimize decarbonization of facilities as much as funding will allow.

Advancing photovoltaic (PV) net metering projects and other on-site power generation opportunities (e.g., energy storage) will be critical going forward as the carbon intensity of the provincial power grid is expected to increase threefold over the time horizon of this report in comparison to 2018 electricity emission factors for Ontario. These PV projects typically require substantial upfront capital resources and have a longer payback compared to some retrofit projects. However, they also have the ability to offset some of the expected operating costs associated with switching from less expensive natural gas to more expensive grid electricity (i.e., on the basis of $ per gigajoule (GJ) of purchased energy). Furthermore, switching to air source heat pumps for example provides much higher energy efficiency levels than even the highest efficiency natural gas heating equipment (specifically the coefficient of performance of

the equipment in delivering the required energy service). Higher energy efficiency levels of equipment will also help reduce operating costs as well as lower emissions.

Water and Wastewater initiatives

Previously, no water or wastewater initiatives were incorporated into the emissions modelling conducted for the CLP. These facilities are subject to Ontario Regulation 507/18 which requires annual reporting of public sector energy consumption and submission of energy conservation and demand management plans (ECDMP) every five years. The most recent ECDMP for these process facilities was developed in 2019. Approximately 2,200 MWh of electricity savings were achieved in 2020 and 2021, with an additional 1,600 MWh and 6,500 m3 of natural gas savings anticipated in 2024. Additional actions will be evaluated through the development of the Climate Action Leadership Plan being prepared by Utilities Kingston, which will have added value when combined with their next ECDMP when both are completed in 2024. Current initiatives include: a municipal class environmental assessment to examine the feasibility of constructing a regional biosolids/biogas facility, as well as retro-commissioning and deep energy/carbon audits of the King Street and Point Pleasant Water Treatment Plants.

Transportation (Fleet)

Accelerating the transition to electric transit and other fleet vehicles will have a significant impact on corporate GHG emissions from diesel fuel and gasoline consumption, which combined, account for nearly 57% of the City's 2022 carbon footprint. In the past, the City has been able to more rapidly replace and or accelerate their expansion plans for transit vehicles when supplementary federal or provincial funding is available. For example, in 2012 and 2017, procurement was more than double the usual annual replacement units.

Following the release of the electrification report by the end of 2023 for the City's transportation sectors, there will need to be enhancements to the City's vehicle and transit procurement budget in order to achieve carbon neutrality by 2040. The process from budget approval to procurement can take two years or longer, depending on vehicle type or model. Therefore, reduction measures being achieved through budget planning need to happen quickly and early in order to help facilitate reductions within the planned target timeframe. The CLP identified use of biofuels, specifically biodiesel, in heavy duty diesel fleet where the bulk of consumption occurs in transit vehicles. However, fuel supply is not always available (see challenges and barriers). Despite supply chain and technological constraints restricting usage beyond B20, staff are continuously exploring advancements in manufacturing and fuel production to meet this CLP objective.

Challenges & Barriers

This current analysis did not include the detailed cost benefit analysis expected from the pending studies outlined earlier in this section. It's anticipated that significantly increased budget support will be necessary to hasten the City's ambitious climate actions already underway in facilities and fleet operations. Accelerating existing actions or advancing new initiatives will

require substantially enhanced budgets and human resources in order for them to be implemented.

A closer look at the scale of fleet changes required provides an example of the magnitude of impact. Accelerating the current transit bus replacement schedule would necessitate adding millions to the capital budget from 2022 to 2030. Under the current replacement schedule of 12-15 years, between 30 and 60 busses are slated for replacement by 2030 and EV busses are currently at a 55% cost premium. There are also 138 light-duty fleet vehicles that could potentially be replaced with EVs by 2030 which represents 85% of the non-transit corporate fleet. Although these vehicles have a lower relative cost premium (20% - 30%) and applicable federal rebates, there are more of these gasoline vehicles to replace. For some vehicles such as EV pick-up trucks, supply chain issues for existing orders are currently an issue, suggesting any current acceleration in procurement will be limited by issues of supply and demand beyond the significant financial resources required for the premium vehicles and associated EV charging stations. Similarly, in the context of Facilities, any opportunity to reduce emissions beyond current projects and initiatives will in large part be dependent on securing additional budget support required to implement the recommendations from the decarbonization studies.

Beyond financial hurdles, numerous technical and logistical challenges must be addressed to meet the existing 2030 GHG reduction target, even under current initiatives. Therefore, in addition to financial resources, the following are the challenges and barriers that City staff are faced with in meeting Council's existing GHG reduction targets, in order of magnitude:

- **Limited electricity service capacity** at some City facilities which currently would not support both fuel switching to electric heating and substantial EV charging expected from fleet/transit in the near future. There are also provincial electrical transmission limitations that will be considered.

- **Continued population/community growth and increased demand** on municipal services (e.g., transit, new facilities, more water supply and WW treatment).

- **Supply chain delays** – HVAC equipment, biodiesel availability, renewable natural gas.

- **Contractor availability and other labor shortages** (e.g., new skilled staff to support accelerated implementation).

Carbon Pricing and Procurement of Offsets

Carbon Shadow Price as a Reduction Strategy

Using a carbon price to evaluate energy and emission reduction initiatives is increasingly recognized as a best practice. This approach highlights the financial consequences, or alternate costs, of not meeting GHG targets compared to the cost of implementing effective reduction initiatives. The City's Facilities division already does this when assessing their energy and emissions management projects using the Federal carbon pricing regime as summarized (in $ per Tonne of CO_2e) in Table 6.

Table 6. Federal Governments Carbon Pricing in $ per Tonne of CO_2e (2018 - 2030).

YEAR	2018	2022	2023	2024	2025	2026	2027	2028	2029	2030
Carbon Price ($)	20	50	65	80	95	110	125	140	155	170

Within the CLP plan, it was estimated that to meet the City's Carbon Neutrality target in 2040, the equivalent of 30% of base year emissions would need to be purchased as carbon offsets. This shortfall was modelled assuming fairly significant implementation of actions. The emission reductions target for 2030 will need to reduce emissions by nearly 7600 tonnes in order to reach its 30% reduction target as previously indicated within Table 5.

Carbon Offset Costs of Missed Reduction Targets

To provide sufficient context to examine the role of carbon offsets, this report examined three different emission scenarios (all before purchase of offsets), based on the information collected, against three different reduction target values for the year 2030 as listed in Table 7. The first GHG reduction scenario, the **most** likely scenario, modelled what missing the 30% target by 5% would look like in 2030 in terms of GHG emissions and total carbon offset costs. The **less** likely scenario calculated carbon price scenarios where the 40% target would be missed by 10%, and the **least** likely scenario looked at a 50% target that was missed by 15% in 2030.

Table 7. GHG reduction scenarios and the expected total % reductions modelled for each scenario.

GHG Reduction Scenario	% Reduction in 2022	% Reduction in 2026	% Reduction in 2030
Most Likely	7.5*	15	25
Less Likely	10	18	30
Least Likely	15	25	35

*The updated actual % reduction measured for 2022 was 8%.

The assumptions for the most likely scenario were based on the barriers to planned implementation as derived from the interviews with staff and documents reviewed. For instance, achieving a 30% reduction in the transportation sector would require tripling the number of EV transit buses initially planned for procurement by 2026 to be operational by 2030. Even if the funds were available for this rapid procurement of EV transit vehicles, the obstacle of ensuring sufficient electricity service for all the new charging equipment required, still remains a major challenge on top of the same challenge in electrifying municipal facilities. In addition, although Facilities will likely meet a 30% reduction for their sector by 2030, this reduction accounts for less than 9% of the total corporate emissions using 2018 values. The moderate and aggressive reduction scenarios, similar to those in the CLP, use more stringent 2030 targets for to meet this report's objectives. The higher percentage target reductions were used in the more aggressive scenarios in comparison to the lower, more likely reduction scenario because it is assumed that if these more aggressive targets were established, an increase in the magnitude of action implementation would also be stimulated internally.

The shortfall of emissions projected in Table 7 were compared and a detailed description of all three scenarios (including annual and cumulative dollar values of required carbon offset purchases) are provided in Appendix C of the Greenscale report. Based on the **most** likely scenario, there was 6,200 tonnes of CO_2e that would need to be purchased as offsets.

Conversely, the **less** likely and **least** likely scenario shortfalls from the larger 40% and 50% reduction targets resulted in 8,700 and 11,300 tonnes of needed offsets respectively. When these GHG gaps are compared against future carbon pricing models, there is more than $1.3 million in cumulative cost difference between the most likely and least likely scenarios (Figure 5). Falling short of the 30% the 2030 target by 5% would cumulatively cost $1,168,324 from 2022 – 2030. In contrast, the less and least likely reduction scenarios could lead to higher cumulative costs of $2,178,511 and $2,406,444 respectively. This carbon price modeling

illustrates that ambitious targets without a clear implementation plan could lead to substantial annual and cumulative financial risks.

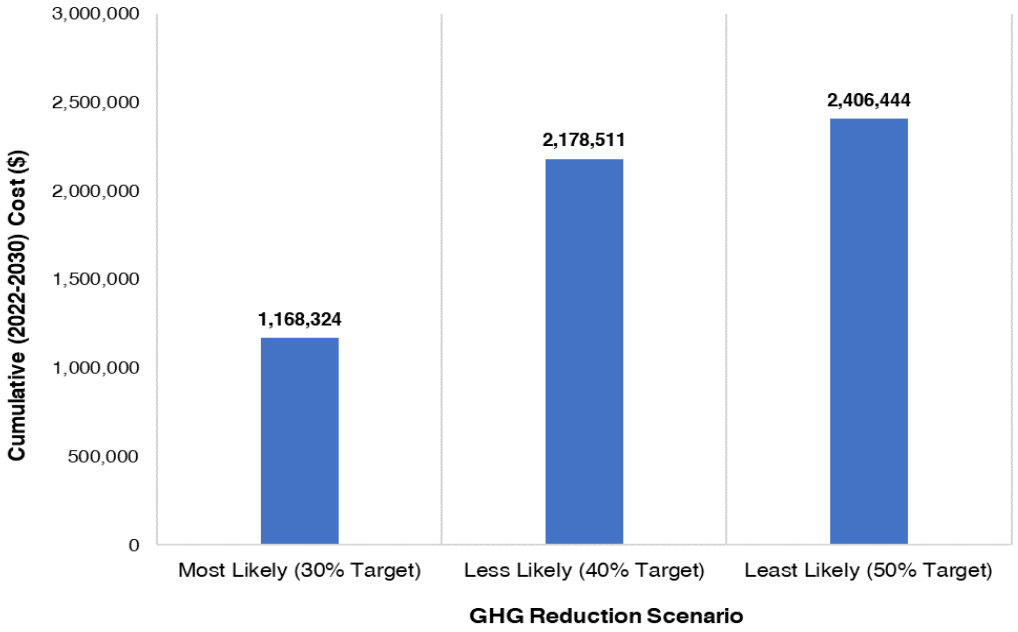

Figure 5. Cumulative cost ($) of potential carbon offsets when larger reduction targets are missed. Reduction gaps are based on values summarized on Table 7.

Takeaways and Summary

The three key takeaways and recommendations based on the findings of the Feasibility Assessment of a Corporate Budget of 40-50% by 2030 are:

1. Wait for in-depth Transportation, Fleet and Facilities studies

The in-depth assessments being completed for Transportation (2024) and Facilities (2024) will not only provide detailed analysis of GHG emitting operations, but they will be able to provide the most realistic level of corporate emissions attainable by 2030, subject to available resources. The outcomes of these technical studies will be crucial in shaping long-term targets and determining the practicality of achieving the existing mid-term 2030 reduction targets.

2. Adopt federal carbon pricing to understand implications of imposed reduction targets

Missed ambitious targets can be expensive. While there are planned budgets and technologies available that should help FMCS meet their reduction targets, the Fleet and Transit sectors need a lot of help from a number of different resources such as funding, infrastructure, policy, technology, and supply chains. A clearer understanding of carbon pricing's impact on budgets better will aid in setting realistic targets and fully grasping the financial consequences of not achieving them.

3. Consider re-investment strategies using federal carbon pricing

The total value of the carbon cost for the City in each year it falls short of the targeted emission reduction value has the potential to be significant, as outlined in the carbon modelling within this report. However, using carbon price forecasting can be a valuable tool to understand what the trade-offs would be if, rather than purchasing carbon offsets, the funds could be directed to a new **internal** carbon reduction fund. This fund could be used to further support corporate initiatives that could actually accelerate corporate reductions faster over time than if those funds were used to pay for annual carbon offsets. This strategic internal carbon funding strategy could augment the overall business case of corporate climate action by adding to the expected operating and maintenance cost benefits of many GHG reduction initiatives being incrementally implemented and further explored by City staff. These funds can also be used as matching funding when pursuing external grants from federal and provincial funding opportunities as they arise, creating a more resilient and adaptive approach to carbon reduction.

Existing Policy/By-Law:

Climate Leadership Plan, 2021

Notice Provisions:

None

Accessibility Considerations:

None

Financial Considerations:

None

Contacts:

Julie Salter-Keane, Manager, Climate Leadership, 613-546-4291 extension 1163

Other City of Kingston Staff Consulted:

Soren Christianson, Project Manager, Climate Leadership

Lana Foulds, Director, Financial Services

Brent Fowler, Director, Corporate Asset Management & Fleet Services

Speros Kanellos, Director, Facilities Management & Construction Services

Dan Korneluk, Manager, Energy & Asset Management, Facilities Management & Construction Services

Russell Horne, Supervisor, Energy & Asset Management, Facilities Management & Construction Services

Paul MacLatchy, Environment Director, Business, Real Estate & Environment

Ian Semple, Director, Transportation and Transit Services

Hugh McLaren, Energy Analyst, Water and Wastewater Treatment Operations, Utilities Kingston

Heather Roberts, Director, Water, Wastewater, Utilities Kingston

Exhibits Attached:

Exhibit A Feasibility Assessment of a corporate carbon budget of 40-50% by 2030

Feasibility assessment of a corporate carbon budget of 40-50% by 2030

November 14, 2023

Prepared For:

City of Kingston
Julie Salter-Keane, Manager, Climate Leadership

Prepared By:

Greenscale Inc.
Nathan C. Manion
David Roewade

Table of Contents

Abbreviations

BAP – business-as-planned

CHP – combined heat and power

CLP – Climate Leadership Plan

EAMP – energy and asset management plan

ECDMP – energy conservation and demand management plan

EV – electric vehicle

GHG – greenhouse gas

GJ – gigajoule

IESO – Independent Electricity System Operator

LDV – light duty vehicle

PV - photovoltaic

Executive Summary

As part of the City of Kingston's ongoing commitment to advance their climate change leadership, the City Council's 2023-2026 Strategic Plan prioritizes Environmental Stewardship and Climate Action. This includes requesting staff to explore the impact and feasibility of increasing the corporate carbon budget from 30% to 40-50% by 2030.

Greenscale Inc. prepared this report to assist City staff by offering insights into the challenges, impacts, and available options for pursuing more aggressive GHG reduction pathways. As part of the consultation process, eleven different staff members were surveyed and interviewed and dozens of internal and external documents were reviewed. This report primarily focuses on assessing the feasibility of achieving, or surpassing, the original 30% reduction target by 2030, along with the operational and financial implications of pursuing a more ambitious reduction pathway.

The findings in this report identified several ongoing initiatives, such as in-depth assessments of the Facilities, Transit, and Fleet sectors, that are likely to provide valuable information on how to achieve more aggressive reduction strategies. Given the expected completion of these studies in 2024, it suggests that a more effective time for reassessing aggressive reduction targets would be in 2025/2026, instead of as soon as the end of 2023. This longer time period would give each sector the ability to use the information from the studies to make informed target reduction goals.

This report also performed carbon price modelling and showed that committing to both carbon offset purchases and larger reduction targets can be expensive when targets are missed. Comparing the carbon offset costs of missing the 30% 2030 target by 5% with a more ambitious 50% target by 15% revealed a cost difference of nearly $1.3 million. In addition to operational challenges to a more aggressive target, the carbon modelling suggested there is added financial risk as well. Based on findings in this report, it is not recommended to set more aggressive corporate targets presently. A better time for re-evaluating mid- and long-term targets would be after the completion and evaluation of the in-depth sector assessments. There is already work underway that when completed will provide important information to assess how aggressive the corporate targets can be, and which could be used to inform commitments to update targets in 2025.

1. Introduction

1.1. Background

In March 2019, the City of Kingston became the first Ontario city to declare a climate emergency, recognizing the severity of the climate crisis and making a commitment to finding climate change solutions. Following the declaration, the City participated in an extensive, community-wide consultation facilitated by WSP Canada Inc. that engaged more than 990 community members, local experts, businesses, and City staff. This broad stakeholder engagement was used to inform the development of a Climate Leadership Plan (CLP) which built on the City's inaugural climate action plan approved in 2015, and established their target of 30% below 2011 emissions by 2030. Kingston City Council formally adopted the CLP in December 2021 as a means to update the previous action plan, and to integrate climate related actions at both the community-wide and internal corporate scales.

In addition to greenhouse gas (GHG) reductions, the CLP aims to help the City influence the development of more climate resilient and healthy communities, which incorporated the feedback and suggestions from the community members that the City consulted with during the preparation of the CLP. Engagement with City staff on the CLP was valuable for finding ways to broaden climate-action community-wide, and in identifying strategies to lower GHG emissions for municipal operations.

In 2018, the City's corporate operations produced over 22,000 tonnes of emissions, marking a 12% decrease from 2011. The City's 2018-2022 Strategic Plan set more ambitious goals: a 15% reduction from 2018 levels by 2022 and achieving carbon neutrality by 2040. However, recent data from 2022 shows a corporate GHG emission reduction of 8%, falling short of the 15% target. This shortfall underscores the substantial efforts and challenges that lie ahead to meet the City's GHG reduction goals from 2022 to 2040.

1.2. Objectives

As part of the City of Kingston's ongoing commitment to advance their climate change leadership, City Council's Strategic Plan 2023-2026 priority to Lead Environmental Stewardship and Climate Action includes the action requesting staff to report on the impact and options to increase the current corporate carbon budget of 30% by 2030 to 40-50% by 2030. Specifically, staff were asked to report back on the feasibility of the City considering an increase of this mid-term target from 30% below 2011 levels to 40% - 50% by 2030. To support City staff in responding to Council's directive, Greenscale Inc. was retained to report on the challenges, impacts, and available options for pursuing more ambitious GHG reduction goals.

To help the City understand the implications of establishing a more aggressive mid-term target, the overarching question addressed in this report is what is the feasibility of meeting and/or exceeding the original 2030 reduction target within the 2023 - 2030 timeframe? Within this question is the need to recognize what are the most promising options available to the City to reach those levels, and what are the potential implications operationally and financially for trying to engage in a higher reduction pathway. These questions are addressed through these main objectives:

a) Re-assess the current business-as-planned[1] (BAP) pathway with regard to the status of the initiatives the City is already in the process of implementing in terms of the likelihood of reaching their existing 2030 reduction target.

b) Identify any current projects or new initiatives where implementation could potentially be accelerated faster than the BAP pathway.

c) Examine some of the potential challenges or barriers that already exist for initiatives in progress, as well as impediments associated with an expedited implementation of current or new projects that could potentially lead to achieving deeper GHG reductions within the current decade.

d) Quantify the financial implications for the City if purchasing carbon offsets are required to meet more aggressive 2030 reduction targets if an accelerated GHG reduction pathway is not successfully carried out over the next 7 years.

[1] "Business-as-planned" is a reference to the City's CLP which incorporates already approved actions that are in progress but not yet fully accounted for in terms of their impact within City's annual GHG emissions inventories.

2. Methods

This report draws on various information sources to achieve the outlined objectives. Key sources and associated tasks include:

1. Review the City's previous climate change mitigation reports and projects, such as the WSP CLP documentation, to understand the current BAP timelines, strategies, and expected changes.

2. Conduct interviews and surveys with City staff to establish several important areas of understanding including: current and potentially new GHG reduction strategies and projects, existing initiatives staff are engaged in to identify potential reduction opportunities, and challenges they are likely to face in the coming years to achieve more aggressive mid-term targets by 2030.

3. Review up-to-date external data and carbon pricing models for Ontario and Canada. This involves analyzing how recent changes in these models influence both the planned business pathway and potential accelerated emission reduction strategies. This secondary literature review was used to help verify and/or address any gaps resulting from the previous two areas of inquiry.

The following sections detail the specific methods used to engage the three areas of data and information acquisition.

2.1. Literature Review: City Documents

A number of important and relevant documents were consulted and reviewed for this report. Some of the documents reviewed are available online publicly, such as the Climate Leadership Plan and motions passed by Council. There were a few other internal documents that were reviewed that are less publicly available. Table 1 lists some of the key city-specific documents reviewed that were relevant to the report outcomes and what each document type was.

Table 1. City of Kingston documents reviewed along with each document type.

Documents Reviewed	Document Type
2022 Capital Budget By-Law. By-Law Number 2022 - 24	City of Kingston Report/ Document (Public)
2022 Capital Budget Summary	City of Kingston Report/ Document (Internal)
Report to Environment, Infrastructure & Transportation Policies Committee. June 14, 2022. Report # EITP 22-007	City of Kingston Report/ Document (Public)
Climate Leadership Plan – Appendix A – Mitigation Technical Report. Dec. 13, 2021. City of Kingston.	City of Kingston Report/ Document (Public)
Climate Leadership Plan Summary Report – Nov 2021.	City of Kingston Report/ Document (Public)
Climate Leadership Plan – Dec 13, 2021. City of Kingston	City of Kingston Report/ Document (Public)
"City of Kingston Mitigation Team Meeting – Meeting Minutes" – 2021. Prepared by WSP.	City of Kingston Report/ Document (Internal)
Kingston's Strategic Plan 2019 -2022. City of Kingston	City of Kingston Report/ Document (Public)
Kingston's Strategic Plan 2021 -2025. City of Kingston	City of Kingston Report/ Document (Public)
"City of Kingston Mitigation Check-In" – Sept. 29, 2020. Presented by WSP.	Presentation
"City of Kingston Climate Leadership Plan – Mitigation Team Meeting 3" – May 19, 2021. Presented by Carolyn Johanson of WSP.	Presentation
"Climate Leadership Plan Development. CMT Presentation" – June 29, 2021. Presented by City of Kingston and WSP	Presentation
2017 Community Greenhouse Gas Inventory. December 2018. Prepared by the Sustainability Solutions Group.	City of Kingston Report/ Document (Public)
City of Kingston Corporate Greenhouse Gas Inventory 2018 update. 2020. Prepared by Triedge & Associates	City of Kingston Report/ Document (Public)
Kingston Community Greenhouse Gas Inventory update. 2018. Prepared by Triedge & Associates	City of Kingston Report/ Document (Public)
ECM Project List – 2022. From Utilities Kingston	Excel File
Corporate Energy & Asset Management Plan V6. 2022. From City of Kingston	Excel File
List of EV potential by equipment class for planning – 2021. From City of Kingston.	Excel File
Transit Bus – Fleet List. 2022. From City of Kingston	Excel File

2.2. City Staff Consultations

Direct consultations with City staff were a crucial methodological component of this report. These discussions aimed to understand their current work and assess their ability to achieve GHG reduction targets beyond the existing 2030 goal. Based on annual corporate GHG inventory reporting, there are six sectors where corporate inventory emissions are accounted for: facilities, transportation, transit, wastewater, water, and waste. In order to capture opinions and details about each sector, staff responsible for overseeing and implementing emission reduction strategies in those sectors were consulted.

Interviews with 11 different individuals from facilities, transit, transportation, waste divisions and Utilities Kingston (wastewater and water) were conducted (Table 2). In each interview, there were questions asked of staff members within each appropriate sector. There were four predetermined questions asked of every sector, and then a number of supplementary questions asked that were sector-specific; the full set of questions are listed in Appendix A. To ensure information captured was accurate, the questions and responses from the interview were summarized and given back to staff for comment. This enabled staff to provide additional details or make corrections to their recorded responses to the questions including any supplementary material or documents containing relevant data.

Table 2. Summary of sectors surveyed and/or interviewed and the staff able to participate on behalf of each sector.

Sector	Interviewees
Transit, Corporate Asset Management & Fleet	Brent Fowler, Jeremy DaCosta
Facilities	Russell Horne, Dan Korneluk, Speros Kanellos
Utilities Kingston	Heather Roberts, Hugh McLaren, Julie Runions, Randy Murphy, Jason Hollett, Karen Santucci

2.3. Literature Review: Carbon and Energy Modeling

The review also included literature beyond City-provided resources, focusing on potential short- and long-term changes in external factors that may impact the City's GHG reduction targets. These include factors such as changes in carbon pricing over time, changes to electricity and other energy emission factors, changes in legislation, or changes related to energy demand forecasting. The specific pieces of literature used are listed and described in the results as they become relevant to the report.

3. Report Findings

3.1. Review of 'Business-as-Planned'

3.1.1. GHG Reduction Targets and the Climate Action Pathway to 2030

For context, the City of Kingston currently has short-term, mid-term and long-term GHG emission reduction targets:

- **Short-term** - **15%** reduction of 2018 emissions by 2022;
- **Mid-term** - **30%** reduction below 2011 emissions by 2030; and,
- **Long-term** - carbon neutrality by the year 2040 or earlier.

The City's long-term target is beyond the scope of this analysis. It is the mid-term 2030 target that Council directed staff to re-assess for a potentially more aggressive reduction percentage when they approved the CLP last year and is the primary focus of this report. The CLP included modelling for three scenarios:

1. **BAP** - already approved actions that are in progress, but not yet fully accounted for within the City's GHG emissions inventories
2. **Moderate** - moderate implementation of different additional initiatives either identified within the Strategic Plan for 2018 - 2022 or from consultation, that which did not yet have all the necessary approvals to advance.
3. **Aggressive** - expedited or ramped up implementation of all actions to optimize GHG reductions within the prescribed timeframe.

The BAP trajectory, representing the City's short-term strategy, aims for a 15% reduction in emissions by 2022, compared to 2018 levels, based on initiatives planned from 2018 to 2022. The City's suite of timeline-based targets from 2018-2030, as described in the CLP, is shown in Figure 1. Of the targeted 15% reduction from 2018 levels, the strategy anticipated 3% from municipal building retrofits and 7% from transitioning to electric transit and light-duty fleet vehicles. The Council-approved 2018-2022 Corporate Strategic Plan accounts for the remaining 5% through carbon offset purchases. Facilities has a 19% planned reduction for 2026, which has an overall corporate reduction of approximately 6.3%.

Figure 1 also demonstrates that while long-term targets can be closely associated with total GHG reduction targets at the larger corporate scale, sector specific targets work on shorter time scales that are more iterative and linked with approved capital budgets. For example, the City had to significantly re-adjust their overall operational and capital budgets due to the increased expenses and decreased revenues from operations during 2020 and 2021 as a result of the financial impact from the Covid-19 pandemic. For the Fleet sector, achieving the 7% GHG reduction largely depended on procuring 12 EV transit buses by 2022, but only 2 are currently in service. The adjusted plan will now

see 5 electric buses approved for purchase in 2023 through capital budget, with an expected delivery time of 2024. This adjustment could decelerate the transition to electrified transit by 2030, contingent on funding acquisition for expedited EV procurement and the availability of electric buses.

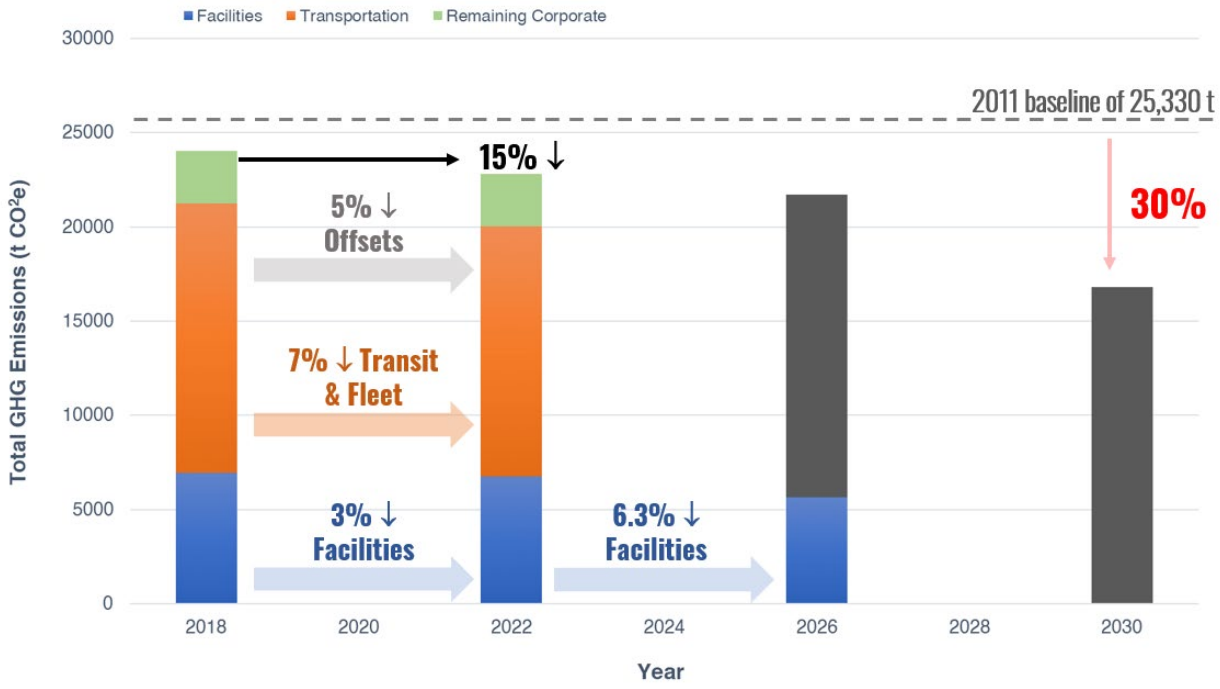

Figure 1. Illustration of the City's timeline-based targets as outlined in the CLP, including a 15% reduction by 2022 from 2018 levels, and 30% reduction by 2030 from the 2011 levels. The grey shaded areas in 2026 and 2030 signal sectors with less specific or fully funded reduction plans, showing progression beyond short-term targets.

WSP's modeling of both the BAP and Moderate pathways projected increased total corporate emissions for 2030 and 2040. This rise is attributed to the anticipated growth in demand for municipal services, such as transit and new facilities, and a projected increase in the carbon intensity of Ontario's electricity grid, outweighing the reductions from planned actions. This is why additional actions and more aggressive implementation was considered. Of the three scenarios examined by WSP, corporate actions planned in the most aggressive pathway were estimated to result in a GHG decline of 74% by 2040 when compared to 2011 emission levels, prior to the procurement of offsets. As this translates to a GHG reduction of approximately 35 - 40% reduction by 2030, the emissions modelled within the CLP were short of complete carbon neutrality in 2040 but potentially surpassing the reduction goal for 2030. Key corporate initiatives from the CLP, which were instrumental in modeling these emission pathways, are detailed in Appendix B. Noteworthy initiatives for corporate operations, as highlighted in this report, include:

- Advocate for provincial support and policy for virtual and community-level net metering arrangements
- Install photovoltaics on all new municipal buildings where feasible and explore options for solar photovoltaics during roof replacements or other major renovations of municipal facilities.
- Retrofit City facilities to reduce emissions 19% by 2026 from 2018 levels
- Implement a framework to transition municipal facilities to Net Zero Energy by 2040 and incorporate relevant initiatives and funding into the approved 15 year capital budget forecast.
- Continue to procure biodiesel for the City's transit bus fleet during its transition to low carbon transit vehicles and explore feasibility of increasing to B50 or B100.
- Prioritize electrification of the City's bus fleet and Solid Waste Collection fleet, aiming for complete transition by 2040.
- As commercial electric vehicles become more widely available, explore group procurement for multiple commercial partners.

3.1.2. Corporate Sector Energy Consumption

The CLP illustrated that in the year 2018, more than 98% of the City's GHGs from Corporate operations came from a combination of its buildings (including energy used within water and wastewater facilities) and fleet vehicles (including transit) (Table 3). This was verified in the 2022 GHG inventory where the remaining balance of corporate emissions came from streetlights and waste (2%). Consequently, this report primarily focuses on the City's fleet vehicles and buildings, including water and wastewater facilities managed by Utilities Kingston. [2]

Understanding the types of energy used within City operations can help inform development of GHG reduction strategies like fuel switching and renewable energy generation projects. Based on the 2018 Corporate GHG Inventory, the breakdown of energy used by each of the sectors is shown in Table 4. In terms of the primary energy sources of these emissions, combustion of diesel in fleet accounted for more than 49% of emissions and natural gas 32% in the year 2018. Gasoline consumed within the corporate (non-transit) fleet represented the more than 11% of corporate GHGs whereas electricity accounted for les than 7.5% of emissions (Heating oil and propane were relatively nominal sources of GHGs at <0.5%). Consequently, actions that effectively move the City towards its deep carbon reduction goals will need to dramatically lower the use of these fossil fuels within building and fleet operations over the coming years - particularly diesel in heavy-duty vehicles and natural gas used for space and water heating.

[2] Building electricity and natural gas consumption only – i.e., fugitive methane from WWTP process is included in the community GHG inventory scope.

Table 3: Summary of sector emission results from the 2018 GHG Inventory; used as the baseline for the City's short- and long-term reduction targets and strategies.

Operations Sector	% of Emissions	GHG Emissions (tonnes CO_2e)
Facilities	28.99	6,968
Transportation	23.06	5,542
Transit	36.30	8,724
Streetlights	0.45	109
Wastewater	7.30	1,754
Water	2.34	562
Waste	1.57	377
TOTALS	**100.0%**	**24,037**

Table 4: Summary of emission results from Energy Use Sectors in the 2018 GHG Inventory; used as baseline for City's short- and long-term reduction targets.

Energy Use Sector	% of Emissions	GHG Emissions (tonnes CO_2e)
Electricity	7.27	1,720
Natural Gas	32.04	7,580
Gasoline	11.18	2,644
Diesel	49.12	11,622
Heating Oil	0.28	66
Propane	0.12	27
TOTALS	**100.0%**	**24,037**

Important to consider for future emissions from electricity consumption, the GHG intensity of Ontario's electricity grid is expected to significantly increase out to 2030. During this period, major refurbishment and retirement of a few key nuclear reactors will be replaced by gas fired generation plants and it is expected there will be a tripling of electricity emission factors (IESO 2020; 2021). Therefore, the associated increases in electricity consumption from the City's planned electrification of facilities and fleet over time will increasingly dampen the expected emission benefit between now and 2040 as a result of the more carbon intensive power grid.

3.1.3. Enhanced 2030 Targets – Required Reductions & Timelines

Figure 2 provides a summary of the timeline used within the current analysis. The important baseline years associated with short- and mid-term targets are described. The total tonnes of CO_2e required to achieve business-as-usual and more aggressive emissions reductions by 2030 based on previous inventory levels are summarized in Table 5. The business-as-usual 2030 30% target requires approximately 7600 tonnes of CO_2e to be reduced from 2011 levels, and a 6,257 tonne reduction from more recent 2018 levels (Table 5). According to the City's most recent corporate GHG inventory, there were 1,909 less tonnes of CO_2e emitted in 2022 than in 2018, a reduction of 8%.

To achieve the 30% reduction target by 2030 will require another 4,348 tonnes to be reduced from 2022 levels. To attain a 40% reduction by 2030, 6,881 tonnes of GHGs must be cut from the 2022 levels. For a 50% reduction, the reduction rises to nearly 9,415 tonnes. Based on total operational sector emissions summarized from 2018 earlier, the 50% reduction target would require a reduction nearly equal to the entire fleet sector emissions, in addition to the planned emissions reductions to reach 30% reduction emissions.

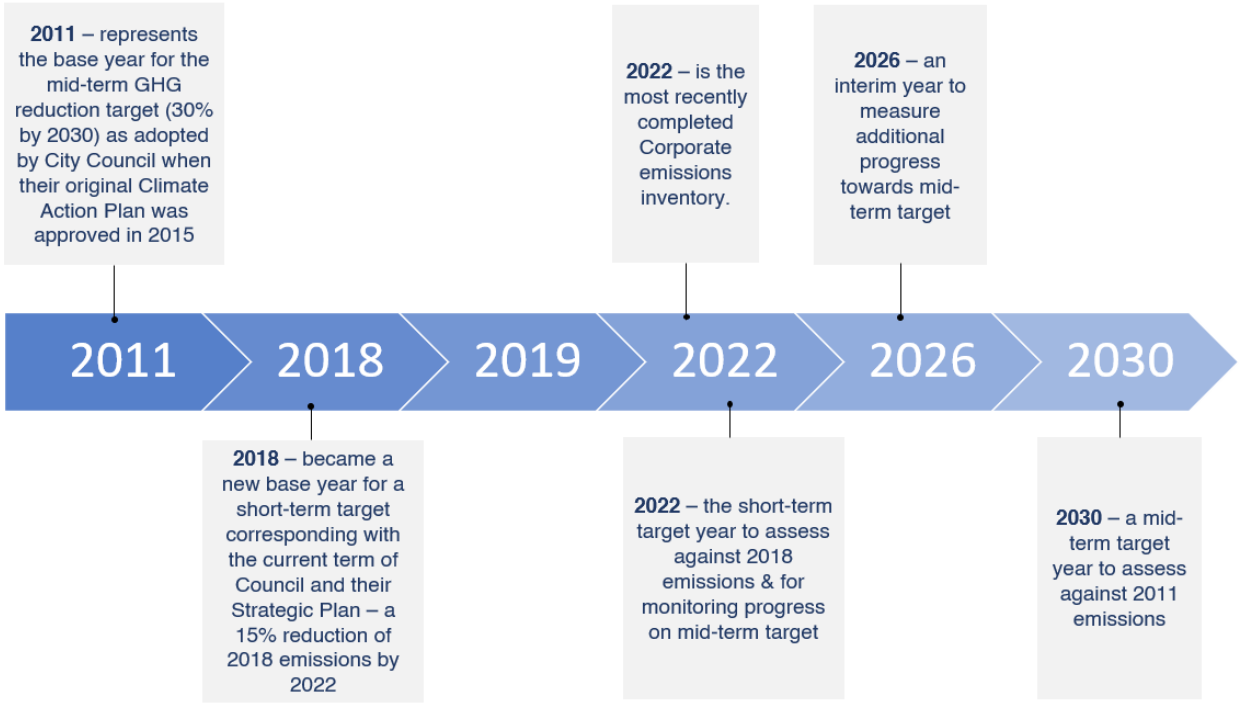

Figure 2. Timeline used within the current analysis of a business as planned emission trajectory as well as the potential for an accelerated GHG reduction path

Table 5. Reference data for base year emissions for existing 30% reduction target of 2011 levels by 2030 and values for a 40%, 45% and 50% reduction.

Past Emissions (tonnes CO_2e)			**Target GHG Emissions (tonnes CO_2e) a.k.a Carbon budget for 2030**			
2011	2018	2022	30%	**40%**	**45%**	**50%**
25,330	23,988	22,079	17,731	15,198	13,931	12,665
Emissions to be reduced --->			***7,599***	***10,132***	***11,399***	***12,665***

3.1.4. Current Initiatives & Projects

Based on the interviews conducted with key City staff, along with documents reviewed from the major corporate emissions sectors, numerous initiatives are underway to support the BAP trajectory and the pursuit of the original 2030 reduction target. Given the large corporate emission footprint of Facilities and Transportation (Fleet and Transit), the most significant current projects and reduction pathways from those sectors are focused on within this section. City initiatives underway from the CLP and Strategic Plan, to support the pursuit of the original 2030 reduction target, include:

Facilities

Facilities' Energy and Asset Management funding is supporting a multi-stage program to develop a spending framework for transitioning municipal facilities to Net Zero Energy by 2040. The stages of the program include:

Stage 1 – Recommissioning (RCx): Optimizing existing buildings to ensure equipment and systems are running efficiently (as designed) to meet occupant needs. The fine tuning completed at this stage can lead directly to operational efficiencies, energy savings and GHG reductions.

Stage 2 – Deep Carbon/Energy Audits: Detailed review, energy modeling, and analysis of building systems. Aim to understand deeper energy conservation measures and retrofit scenarios that can significantly reduce facility GHGs (80% minimum).

Stage 3 – Net Zero Transition Plan: Review of various GHG reduction scenarios along with detailed electrification demand modelling for all facility locations. This scope of work will be used to establish potential costs of meeting facility related GHG reduction targets identified in the approved CLP. Various scenarios will be assessed and findings will also be reviewed with Utilities Kingston to understand the full impacts of electrification and to assist with long-term planning.

To date, Stages 1 and 2 have been completed for the City's most energy intensive facilities, and Stage 3 work is currently underway. Some of the major projects, initiatives, and reduction timelines for Facilities' BAP approach that have been completed or are planned are summarized in Figure 3. The first phase of reductions is to address efficiency retrofits, recommissioning, and heating electrification (fuel switching) where technically feasible in the highest energy using buildings. Funding for the Facilities Energy and Asset Management Plan is currently forecasted to 2026 (subject to approval). Additional funding will be requested through subsequent capital budget cycles as work in Stages 1 to 3 above is completed. Overall, this approach will be used to establish the required spending levels and framework to transition municipal facilities to Net Zero Energy as identified in the CLP.

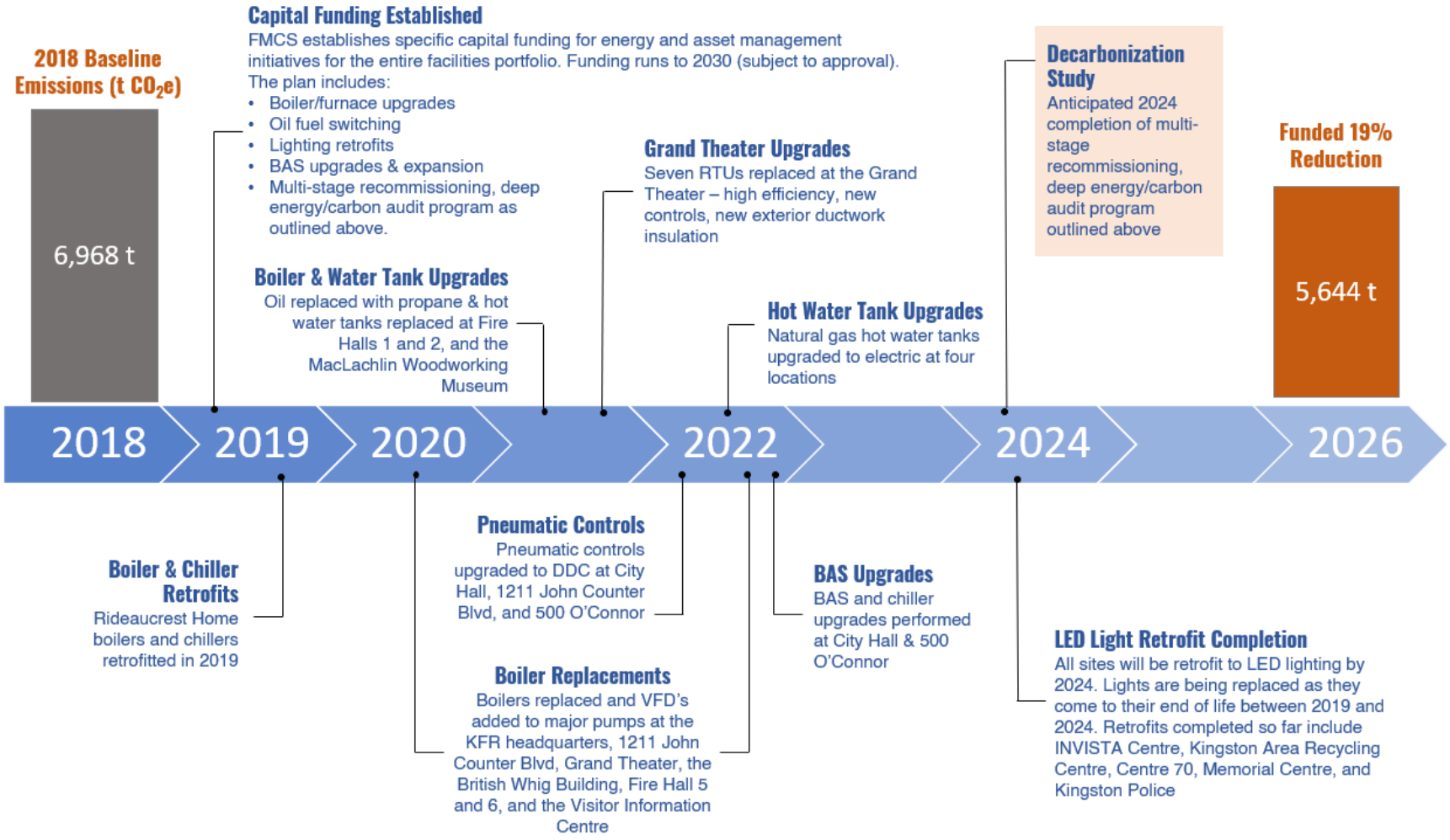

Figure 3. Timeline of some of the significant projects within the facilities portfolio. Specific projects listed on this figure are part of the capital funding plan established to reduce total facilities emissions by 19% by 2026 from the 2018 baseline.

Transportation

The major projects and timelines for the Fleet and Transit BAP plan, including the incremental electrification of light-duty vehicles (LDV), transit buses, refuse trucks, and some specialty vehicles, are outlined in Figure 4. This plan includes telematics deployment for LDV utilization assessment and the Council's 2023-2026 approved Strategic Priorities to purchase of 18 electric buses (replacing diesel buses) by the end of 2026. The first five (5) are expected in Q1, 2025, supported by $18.3M from the Canada Infrastructure Program (ICIP), confirmed in August 2023.

More than half of the LDVs could be electric by 2030 with adequate funding, improved supply chain conditions, increased market competition, OEM model availability, and enhanced electric vehicle production capacity. Similar to Facilities, upcoming studies due by the end of 2023 will create a roadmap for electrifying the transit bus fleet by 2040, focusing on vehicle charging requirements and an expanded municipal fleet electrification model. These studies will inform the City's GHG reduction strategies.

There has also anticipated incremental costs associated with future capital budget forecasts for transit bus electrification which have been included in the 2024, 15-Year Capital Plan to be presented by the Mayor in January 2024. Combining the results of the 2023 report with these updated budget forecasts will help establish a framework that can be used to create a detailed reduction plan that will need to be funded through approved capital budgets. This type of plan is likely to model the Facilities plan that uses an iterative process to enhance regular renewals identified in the capital plan, and accelerate decarbonization of operations as much as funding will allow. It is expected that the 2023 reports to be completed by the end of the year on fleet and transit electrification will be crucial for deciding the best strategies to achieve at least a 30% reduction in the City's transportation emissions.

Water & Wastewater

Although not the largest portion of the Corporate emissions portfolio, Water and Wastewater sectors can help reduce the reduction burdens needed for other more intensive sectors. Some current projects include changeover to more efficient pumping locations, building envelope improvements, and various other facility upgrades improving energy efficiency. Solar PV for net metering is also being explored. Similar to both Facilities and Transportation sectors, a major strategic initiative is being developed by Utilities Kingston that will result in a Climate Action Leadership Plan, specifically for water and wastewater operations, aimed at identifying the financial resources required in 2027-2030 capital budget to achieve carbon neutral operations by 2040.

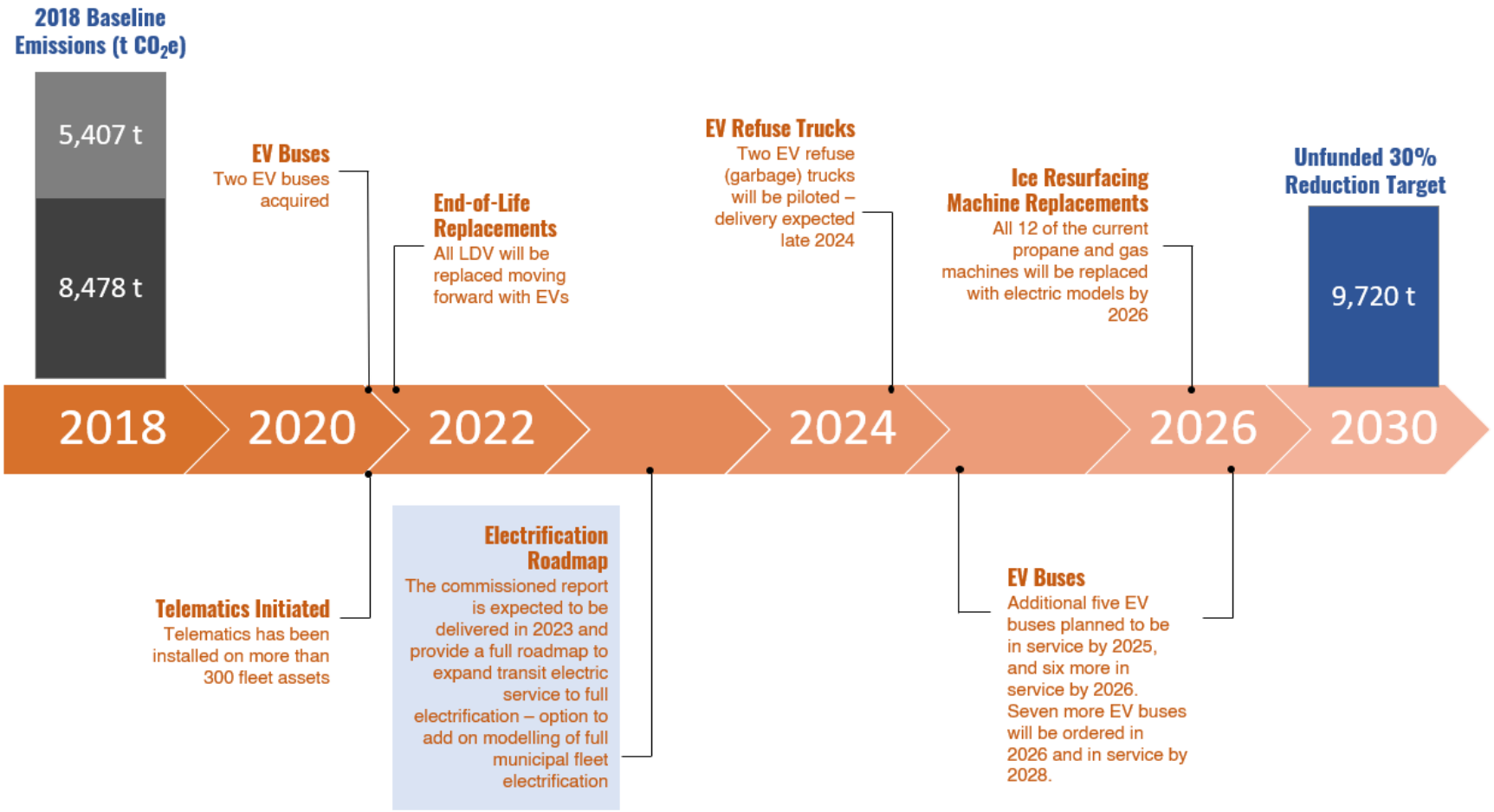

Figure 4. Timeline of current completed projects within the Transit and Fleet portfolios. The expected completion of the Roadmap in 2023 is highlighted, showing the seven-year period following its completion where corporate transportation sectors can implement reductions strategies from it.

3.2. Accelerated GHG Reduction Potential – New & Existing Projects

In addition to existing initiatives, several areas offer potential for deeper GHG reductions for the City. These areas, contingent on insights from the ongoing studies referenced earlier in this report, play a vital role in achieving the City's current reduction target timelines. An overview of a few of these opportunities within the largest energy using sectors at the corporate scale (buildings and transportation) are summarized below.

3.2.1. Facilities (Buildings)

The Facilities division is anticipating being able to meet the existing 2030 mid-term GHG target for the buildings emission sector with current funding in place. The GHG emission footprint for buildings managed by Facilities in 2022 (2.76 kg CO_2e/ft^2) is currently 13.8% lower than 2018 levels (3.2 kg CO_2e/ft^2). The pending decarbonization studies expected to be completed by 2024 will identify the most feasible additional actions that would further reduce emissions for the 2025 – 2030 period. In addition to these reports that will help guide future reduction plans, Facilities is also engaged in a number of other activities and projects that may not accelerate projects right now, but will likely have the capacity to inform and accelerate reduction plans in the near future. While many of these initiatives are still a year or more away from seeing direct results, they do align with when the decarbonization studies are likely to be available, providing Facilities with a suite of options to help inform the planning of emission reductions initiatives further in the near future.

The link between decarbonization and capital planning is well understood within facilities and it is recognized that 2025 is likely the last year a fossil-fuel based heating system, such as a natural gas furnace, can be installed based on the current life expectancy of these types of assets. Based on work currently underway as outlined above, Facilities will be developing an updated framework in 2023 - 2024 that will also be reflected in subsequent 15-year capital budget forecasts. This is an iterative process to enhance regular renewals identified in the capital plan and to accelerate/optimize decarbonization of facilities as much as funding will allow. As part of centralized energy management, Facilities will also be reviewing the potential for direct purchase of renewable natural gas (RNG) which may play a role in the transition of the portfolio to net zero energy.

Advancing fuel switching to electricity within buildings

Advancing photovoltaic (PV) net metering projects and other on-site power generation opportunities (e.g., CHP) will be critical going forward as the carbon intensity of the provincial power grid is expected to increase threefold over the time horizon of this report in comparison to 2018 electricity emission factors for Ontario. These PV projects

typically require substantial upfront capital resources and have a longer payback compared to some retrofit projects. However, they also have the ability to offset some of the expected operating costs associated with switching from less expensive natural gas to more expensive grid electricity (i.e., on the basis of $ per gigajoule (GJ) of purchased energy). Furthermore, switching to air source heat pumps for example provide much higher energy efficiency levels than even the highest efficiency natural gas heating equipment (specifically the coefficient of performance of the equipment in delivering the required energy service). Higher energy efficiency levels of equipment will also help reduce operating costs as well as lower emissions.

Water and Wastewater initiatives

Previously, no water or wastewater initiatives were incorporated into the emissions modelling conducted for the CLP. These facilities are subject to Ontario Regulation 507/18 which requires annual reporting of public sector energy consumption and submission of energy conservation and demand management plans (ECDMP) every five years.[3] The most recent ECDMP for these process facilities was developed in 2019/2020. Approximately 2,200 MWh of electricity savings were achieved in 2020 and 2021, with an additional 1,600 MWh and 6,500 m^3 of natural gas savings anticipated by 2024. Additional actions will be incorporated through the development of a water and wastewater focussed Climate Action Leadership Plan being prepared by Utilities Kingston, which will have added value when combined with their next ECDMP when both are completed by 2025. Initiatives include: a municipal class environmental assessment to examine the feasibility of constructing a regional biosolids/biogas facility, and investigating options to better harness the thermal energy in wastewater.

3.2.2. Transportation (Fleet)

Accelerating the transition to electric transit and other fleet vehicles will have a significant impact on corporate GHG emissions from diesel fuel and gasoline consumption, which combined account for nearly 57% of the City's 2022 carbon footprint. In the past, the City has been able to more rapidly replace and or accelerate their expansion plans for transit vehicles when supplementary federal or provincial funding is available. For example, in 2012 and 2017, procurement was more than double the usual annual replacement units.

Following the release of the electrification report by the end of 2023 for the City's transportation sectors, there will need to be enhancements to the City's vehicle and transit procurement budget in order to achieve carbon neutrality by 2040. The process from budget approval to procurement can take two years or longer, depending on vehicle type or model. Therefore, reduction measures being achieved through budget planning need to happen quickly and early in order to help facilitate reductions within

[3] https://www.ontario.ca/laws/regulation/180507

the planned target timeframe. In addition to larger budgets for electric vehicles though, there are a few operational timelines that could be considered to help ensure vehicles are transitioned efficiently and as quickly as possible based on existing operational capacity:

- There may be operational and maintenance cost benefits to accelerating the vehicle replacement rate as it is often older vehicles that have performance issues and require more costly maintenance, renewal and repair.

- The continued and accelerated advancement of using telematics can also provide further opportunities to reduce fuel use in corporate fleet vehicles. Telematics can inform fleet management best practices such as helping identify which vehicles excessively idle the engine, which vehicles are under or over utilized as well as flag driving practices that prematurely wear vehicle components and waste fuel etc. such as jack rabbit starts and hard braking. Of particular interest from early Telematics data is the short- and mid-term emissions reductions potential of switching fleet assets to hybrid fuel vehicles. Based on 2022 inventory data, the average fuel consumption of gasoline vehicles was 20.78 L/100 km, compared to only 6.43 L/100 km for hybrids. This represents a nearly 60% reduction in fuel use which would directly translate into GHG emissions reductions if fleet assets were converted to hybrid fuel engines.

- Excessive idling is common in police, operations, and roads vehicles where on-board computers, refrigeration, hydraulics and temporary re-directional traffic lighting requires ongoing running of the vehicle's motor, thus wasting fuel and causing unnecessary GHG emissions. Auxiliary power units (APUs) can provide the required power via a supplementary electronic battery which is recharged when the vehicle is being driven. The APU's can significantly reduce the need to idle the motor and decrease fuel consumption and GHGs. Vehicles that excessively idle can also require more repair and maintenance as systems are designed to operate more effectively when the vehicle is in motion.

- The CLP identified use of biofuels, specifically biodiesel, in heavy duty diesel fleet where the bulk of consumption occurs in transit vehicles. However, fuel supply is not always available (see challenges and barriers). Despite supply chain and technological constraints restricting usage beyond B20, staff are continuously exploring advancements in manufacturing and fuel production to meet this CLP objective.

3.3. Challenges & Barriers

This current analysis did not include the detailed cost benefit analysis expected from the pending studies outlined earlier in this section. It's anticipated that significantly increased budget support will be necessary to hasten the City's ambitious climate actions already underway in facilities and fleet operations. Indeed, across all staff interviewed and reports reviewed, accelerating existing actions or advancing new initiatives will require substantially enhanced budgets and human resources in order for them to be implemented.

A closer look at the scale of fleet changes required provides an example of the magnitude of impact. Accelerating the current transit bus replacement schedule would necessitate adding millions to the capital budget from 2022 to 2030. Under the current replacement schedule of 12-15 years, between 30 and 60 busses are slated for replacement by 2030 and EV busses are currently at a 55% cost premium. There are also 138 light-duty fleet vehicles that could potentially be replaced with EVs by 2030 which represents 85% of the non-transit corporate fleet. Although these vehicles have a lower relative cost premium (20% - 30%) and applicable federal rebates, there are more of these gasoline vehicles to replace. For some vehicles such as EV pick-up trucks, supply chain issues for existing orders are currently an issue, suggesting any current acceleration in procurement will be limited by issues of supply and demand beyond the significant financial resources required for the premium vehicles and associated EV charging stations.

In the context of Facilities, any opportunity to reduce emissions beyond current projects and initiatives will in large part be dependent on securing additional budget support required to implement the recommendations from the decarbonization studies. However, there are financial advantages associated with accelerating GHG reductions that should be considered when enhanced budgets are proposed for reduction funding. For example, the current Energy and Asset Management Plan being implemented by Facilities is expected to yield $500,000 in utility cost savings by 2026, suggesting there is a viable business case for expanding many of their initiatives.

Beyond financial hurdles, numerous technical and logistical challenges must be addressed to meet the existing 2030 GHG reduction target, even under current initiatives. Therefore, in addition to financial resources, the following are the challenges and barriers that City staff are faced with in meeting Council's existing GHG reduction targets, in order of magnitude:

- **Limited electricity service capacity** at some City facilities which currently would not support both fuel switching to electric heating and substantial EV charging expected from fleet/transit in the near future.

- **Continued population/community growth and increased demand** on municipal services (e.g., transit, new facilities, more water supply and WW treatment).
- **Supply chain delays** – HVAC equipment, biodiesel availability, renewable natural gas
- **Contractor availability and other labor shortages** (e.g., new skilled staff to support accelerated implementation)

The listed challenges significantly impede the rapid implementation of fleet and facility initiatives critical for meeting 2030 targets. Challenges like limited electricity service capacity span multiple sectors, including Facilities, Transit, and Fleet electrification. Addressing these requires collaborative efforts across various domains. These challenges present opportunities for long-term GHG emission and operational cost reductions through shared infrastructure and projects, but they require planning, cooperation, and time.

3.4. Carbon Pricing and Procurement of Offsets

3.4.1. Carbon Shadow Price as a Reduction Strategy

Using a carbon price to evaluate energy and emission reduction initiatives is increasingly recognized as a best practice. This approach highlights the financial consequences, or alternate costs, of not meeting GHG targets compared to the cost of implementing effective reduction initiatives. The City's Facilities division already does this when assessing their energy and emissions management projects using the Federal carbon pricing regime as summarized (in $ per Tonne of CO_2e) in Table 6.

Table 6. Federal Governments Carbon Pricing in $ per Tonne of CO_2e (2018 - 2030).

YEAR	2018	2022	2023	2024	2025	2026	2027	2028	2029	2030
Carbon Price ($)	20	50	65	80	95	110	125	140	155	170

Within the CLP plan, it was estimated that in order to meet the City's Carbon Neutrality target in 2040, the equivalent of 30% of base year emissions would need to be purchased as carbon offsets. This shortfall was modelled assuming fairly significant implementation of actions as previously mentioned in section 3.1.1 and detailed within Appendix B. The emission reductions target for 2030 will need to reduce emissions by nearly 7600 tonnes in order to reach its 30% reduction target as previously indicated within Table 5. The City plans to compensate for any emission reduction shortfalls

through measures like carbon offsets or reinvesting in community-based projects. This is part of the City's commitment to Climate Leadership and is a measure of accountability for their aggressive GHG reduction targets.

3.4.2. Carbon Offset Costs of Missed Reduction Targets

To provide sufficient context to examine the role of carbon offsets, this report examined three different emission scenarios (all before purchase of offsets), based on the information collected, against three different reduction target values for the year 2030 as listed in Table 7. The first GHG reduction scenario, the ***most*** likely scenario, modelled what missing the 30% target by 5% would look like in 2030 in terms of GHG emissions and total carbon offset costs. The ***less*** likely scenario calculated carbon price scenarios where the 40% target would be missed by 10%, and the ***least*** likely scenario looked at a 50% target that was missed by 15% in 2030.

Table 7. GHG reduction scenarios and the expected total % reductions modelled for each scenario.

GHG Reduction Scenario	% Reduction in 2022	% Reduction in 2026	% Reduction in 2030
Most Likely	7.5*	15	25
Less Likely	10	18	30
Least Likely	15	25	35

*The updated actual % reduction measured for 2022 was 8%.

The assumptions for the most likely scenario were based on the barriers to planned implementation as derived from the interviews with staff and documents reviewed. For instance, achieving a 30% reduction in the transportation sector would require tripling the number of EV transit buses initially planned for procurement by 2026 to be operational by 2030. Even if the funds were available for this rapid procurement of EV transit vehicles, the obstacle of ensuring sufficient electricity service for all the new charging equipment required still remains a major challenge on top of the same challenge in electrifying municipal facilities. In addition, although Facilities will likely meet a 30% reduction for their sector by 2030, this reduction accounts for less than 9% of the total corporate emissions using 2018 values. The moderate and aggressive reduction scenarios, similar to those in the CLP, use more stringent 2030 targets for to meet this report's objectives. The higher percentage target reductions were used in the more aggressive scenarios in comparison to the lower, more likely reduction scenario because it is assumed that if these more aggressive targets were established, an increase in the magnitude of action implementation would also be stimulated internally.

The shortfall of emissions projected in Table 7 were compared and a detailed description of all three scenarios (including annual and cumulative dollar values of required carbon offset purchases) are provided in Appendix C. Based on the ***most*** likely scenario, there was 6,200 tonnes of CO_2e that would need to be purchased as offsets.

Conversely, the ***less*** likely and ***least*** likely scenario shortfalls from the larger 40% and 50% reduction targets resulted in 8,700 and 11,300 tonnes of needed offsets respectively. When these GHG gaps are compared against future carbon pricing models, there is more than $1.3 million in cumulative cost difference between the most likely and least likely scenarios (Figure 5). Falling short of the 30% the 2030 target by 5% would cumulatively cost $1,168,324 from 2022 – 2030. In contrast, the less and least likely reduction scenarios could lead to higher cumulative costs of $2,178,511 and $2,406,444 respectively. This carbon price modeling illustrates that ambitious targets without a clear implementation plan could lead to substantial annual and cumulative financial risks.

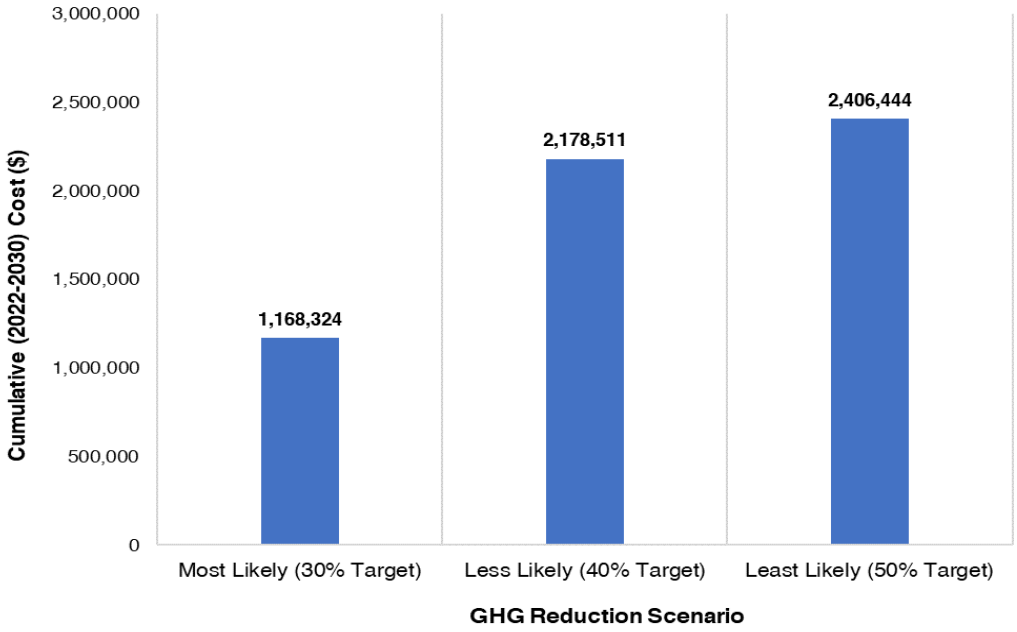

Figure 5. Cumulative cost ($) of potential carbon offsets when larger reduction targets are missed. Reduction gaps are based on values summarized on Table 7.

4. Takeaways & Summary

This report has explored the implications of pursuing higher reduction pathways and how City initiatives and programs might align with both existing or more ambitious targets. There are three key takeaways and associated recommendations that can be made, based on the findings in this report:

1. Wait for in-depth Transportation and Facilities studies

The in-depth assessments being completed for Transportation (2023) and Facilities (2024) will not only provide detailed analysis of GHG emitting operations, but they will be able to provide the most realistic level of corporate emissions attainable by 2030, subject to available resources. The outcomes of these technical studies will be crucial in shaping long-term targets and determining the practicality of achieving the existing mid-term 2030 reduction targets. ***Setting a more ambitious 2030 reduction target is inadvisable without data from these assessments, as they are crucial for formulating informed strategies for both mid- and long-term targets.***

2. Adopt federal carbon pricing to understand implications of imposed reduction targets

Missed ambitious targets can be expensive. While there are planned budgets and technologies available that should help Facilities meet their reduction targets, the Fleet and Transit sectors need a lot of help from a number of different resources such as funding, infrastructure, policy, technology, and supply chains. A clearer understanding of carbon pricing's impact on budgets better will aid in setting realistic targets and fully grasping the financial consequences of not achieving them. ***Therefore, it is recommended that the practice of using the federal carbon pricing be adopted across all sectors and budgeted for accordingly in the future in order to hold accountable self-imposed GHG reduction targets.***

3. Consider re-investment strategies using federal carbon pricing

The total value of the carbon cost for the City each year that falls short of their targeted emission value has the potential to be significant, as outlined in the carbon modelling within this report. However, using carbon price forecasting can be a valuable tool to understand what the trade-offs would be if rather than purchasing carbon offsets, the funds could be directed to a new *internal* carbon reduction fund. This fund could be used to further support corporate initiatives that could actually accelerate corporate reductions faster over time than if those funds were used to pay for annual carbon offsets. This strategic internal carbon funding strategy could augment the overall business case of corporate climate action by adding to the expected operating and maintenance cost benefits of many GHG reduction initiatives being incrementally implemented and further explored by City staff. These funds can also be used as matching funding when pursuing external grants from federal and provincial funding opportunities as they arise, creating a more resilient and adaptive approach to carbon reduction. ***It is recommended that the City use the federal carbon pricing approach to examine whether re-investment of carbon offset purchases would accelerate GHG reductions faster if the money was re-invested in local GHG reduction and renewable energy production projects instead of investing in carbon offsets.***

4. Consider setting future mid- and long-term targets to 2018

Currently there two sets of targets: those set in 2011 and those set in 2018. Some sectors are setting targets almost exclusively from the more recent 2018 levels and this can sometimes create confusion in documents about which baseline targets are referring to. ***Thus, it is recommended to base all new mid- and long-term targets on 2018 levels, ensuring consistency in climate action planning.***

Summary

Given these takeaways, setting more aggressive 2030 targets presently is not advisable. Not only do sectors like Fleet and Transit not have current funds or resources available to meet those targets, they are going to need significant help in order to reach existing reduction targets by 2030. Additionally, the information needed by both Facilities and Transportation sectors won't be available until 2023 and 2024 to adequately support the decision-making needed to make informed target setting choices. **Should the City consider re-evaluating their mid- and long-term reduction targets, it would be more appropriate to do so around 2025 and 2026, once in-depth assessments have been completed for key sectors, and where they can be included within new strategic planning frameworks.**

5. References

City of Kingston (2018). Kingston's Strategic Plan 2019 -2022.

City of Kingston (2021). Climate Leadership Plan Summary Report – Nov 2021. City of Kingston

City of Kingston (2021). Climate Leadership Plan – Dec 13, 2021.

City of Kingston (2021). Climate Leadership Plan – Appendix A – Mitigation Technical Report. Dec. 13, 2021.

City of Kingston (2022). Report to Environment, Infrastructure & Transportation Policies Committee. June 14, 2022. Report Number EITP 22-007

City of Kingston (2022). Capital Budget By-Law. By-Law Number 2022 - 24

City of Kingston (2022). Capital Budget Summary

IESO (2020). Annual Planning Outlook – A view of Ontario's electricity system needs. January 2020. 44 pp.

IESO (2021). Decarbonization and Ontario's Electricity System – Assessing the impacts of phasing out natural gas generation by 2030. October 7, 2021. 27 pp.

Sustainability Solutions Group (2018). 2017 Community Greenhouse Gas Inventory. December 2018. Consulting Report.

Triedge & Associates (2020). City of Kingston Corporate Greenhouse Gas Inventory 2018 update. Consulting Report

Triedge & Associates (2020). Kingston Community Greenhouse Gas Inventory update. 2018. Consulting Report.

WSP (2021). City of Kingston Mitigation Team Meeting – Meeting Minutes.

WSP (2020). City of Kingston Mitigation Check-In. Presentation presented on Sept. 29, 2020

WSP (2021). City of Kingston Climate Leadership Plan – Mitigation Team Meeting 3. Presentation presented on May 19, 2021 by Carolyn Johanson.

WSP (2021). Climate Leadership Plan Development. CMT Presentation. Presentation presented on June 29, 2021. Presented by City of Kingston and WSP.

6. Appendix

6.1. Appendix A - Interview Questions for City Staff

Overarching questions for all interviews with staff:

1. What is the status (recently completed, in progress, planning/feasibility stage) of major projects in your department that will reduce or already have resulted in GHG emission reductions (reduction of fossil fuel consumption and electricity)?
2. Are you aware of or are already investigating any additional technically feasible opportunities to reduce GHGs in your area of responsibility the next 7 years (i.e., financial resources excluded as a limiting factor)?
3. Would your department be able to assess the potential costs and GHG impact of expanded initiatives or additional actions in time to be considered in the next 2023 City budget?
4. Are there specific changes in provincial and federal regulations that will also be key to enabling municipalities like Kingston to reach their carbon reduction targets between now and 2030?[2]
5. Have demand forecasts for your service been updated regarding increasing or decreasing trajectories for fossil fuel use and electricity consumption?

Department specific questions:[3]

Facilities Management [4]

6. What would be required to augment the 2026 target of 15% reduction in facilities emissions to 40-50% by 2030 (types of projects, magnitude of financial resources)?
7. Are there any significant technical, administrative or operational obstacles to accelerating GHG reductions in facilities (other than population growth and the commensurate increased demand for services as well as the expected increase in the grid carbon intensity during that time)?

Transportation & Public Works (Fleet incl. Transit, and contracted waste collection)

8. What would be required to significantly accelerate the electrification of fleet vehicles by 2030 (i.e., charging infrastructure, magnitude of financial resources)?

9. Have Auxiliary Power Units (a.k.a. as anti-idling devices) been considered for fleet vehicles which have high idling time from use of on-board equipment (e.g., computers/radios in police vehicles, flashing lights and hydraulics in roads and other engineering/operations vehicles)?
10. Has increasing the bio-fuel content to B50 in existing transit and other heavy-duty diesel vehicles been investigated?

Utilities Kingston

11. How many groundwater wells does the city use for water supply or is supply all from Lake Ontario?
12. Are there any anaerobic WWTP used and if so, is the methane harnessed for energy use onsite in any way (e.g., CHP, offset NG use)?
13. What is the current plan to improve energy efficiency within WW/Water operations?
14. What would be required to significantly reduce GHG emissions in Water and Wastewater operations by 2030 (types of projects, magnitude of financial resources)

6.2. Appendix B - Carbon Reduction Pathway for Municipal Operations

The list below summarizes actions included in the Interim Carbon Reduction Pathway which are directly related to municipal operations by the Corporation of the City of Kingston, as taken from the CLP Appendix A "Mitigation Technical Report" December 13, 2021. These actions were developed through consultation with each City department as well as actions outlined in the City's Strategic Plan. Further details are presented following the summary.

Sector: Buildings & Energy Production

New Buildings

• 2022: 50-80% energy savings for all new builds after this date due to City's Net Zero commitment

Municipal Facilities (Excluding Wastewater & Water Treatment)

• 2022: 2-3% reduction in emissions through typical efficiency upgrades

• 2026: 15% reduction in emissions through fuel switching, PV and retrofits

• 2040: 11% divestment of overall floor area due to 50% reduction in required office space associated with work from home, 26% of remaining facilities fuel switch, 74% undergo deep retrofits

Local Renewable Energy

• 2040: 32,000 GJ on-site electricity generation (new builds and suitable existing rooftops during roof replacement, other sites as required)

Mode Share

• 2034: 15% Transit mode share and population growth increases transit vehicle energy consumption

Transit Buses

• 2022: 3% EVs (two electric buses)

• 2040: 100% EVs

• Biodiesel procurement for all FF use until full electrification achieved

Fleet Vehicles

• 2040: 50% EVs (passenger vehicles, solid waste vehicles, cargo vans)

All Sectors

• 2040: 6600 tonnes of offsets to achieve a 100% reduction in corporate emissions (Offset cost of $165,000 in 2040 assuming a $25/tonne rate)

Based on the fairly aggressive actions detailed above, corporate emissions are projected to decline by 70% as of 2040 when compared to 2018 emissions, prior to procurement of offsets. Compared to 2011, the 2040 reduction is 74%.

6.3. Appendix C - Carbon Budget and Offset Calculations

Straight line target pathway to 2030 (30% reduction target)														
2011	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	
25,330	24,037	23,937	23,373	22,809	22,245	21,681	21,116	20,552	19,988	19,424	18,859	18,295	17,731	**Corporate t CO_2e**
													6,206	**Tonnes reduced**
													564	**annual 2020-2030**
					Projected emissions from scenario (straight line pathway 2022 - 2030)									
Low scenario (25% reduction modeled against a 30% target)					22,234	22,058	21,882	21,706	21,531	20,897	20,264	19,631	18,998	
Shortfall					11	-378	-766	-1,154	-1,543	-1,474	-1,405	-1,336	-1,267	
Fed Carbon Pricing /T CO2e					$50	$65	$80	$95	$110	$125	$140	$155	$170	
Carbon Offset cost					- -	-$24,552	-$61,282	-$109,659	-$169,686	-$184,197	-$196,637	-$207,006	-$215,305	-$1,168,324
Cumulative Offset cost						-$24,552	-$85,834	-$195,493	-$365,179	-$549,376	-$746,013	-$953,019	-$1,168,324	TOTAL

Straight line target pathway to 2030 (40% reduction target)														
2011	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	
25,330	24,037	23,937	23,143	22,348	21,554	20,759	19,965	19,170	18,376	17,581	16,787	15,992	15,198	**Corporate T CO_2e**
													8,739	**Tonnes reduced**
													794	**annual 2020-2030**
Projected emissions from scenario (straight line pathway 2022 - 2030)														
Moderate scenario (30% reduction modeled against a 40% target)					21,633	21,457	21,281	21,106	20,771	20,137	19,504	18,871	17,731	
Shortfall					-79	-698	-1,316	-1,935	-2,395	-2,556	-2,717	-2,878	-2,533	
Fed Carbon Pricing /T CO2e					$50	$65	$80	$95	$110	$125	$140	$155	$170	
Carbon Offset cost					-$3,967	-$45,363	-$105,317	-$183,827	-$263,407	-$319,482	-$380,395	-$446,145	-$430,610	-$2,178,511
Cumulative Offset cost					-$3,967	-$49,330	-$154,646	-$338,473	-$601,880	-$921,362	-$1,301,757	-$1,747,901	-$2,178,511	TOTAL

Straight line target pathway to 2030 (50% reduction target)														
2011	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	
25,330	24,037	23,937	22,913	21,888	20,863	19,838	18,814	17,789	16,764	15,739	14,715	13,690	12,665	**Corporate t CO_2e**
													11,272	**Tonnes reduced**
													1025	**annual 2020-2030**

	Projected emissions from scenario (straight line pathway 2022 - 2030)									
Aggressive scenario (35% reduction modeled against a 50% target)	20,431	20,073	19,714	19,356	18,998	18,364	17,731	17,098	16,465	
Shortfall	432	-235	-901	-1,567	-2,233	-2,625	-3,016	-3,408	-3,800	
Fed Carbon Pricing /T CO2e	$50	$65	$80	$95	$110	$125	$140	$155	$170	
Carbon Offset cost	$0	-$15,248	-$72,069	-$148,878	-$245,676	-$328,117	-$422,304	-$528,237	-$645,915	-$2,406,444
Cumulative Offset cost	$0	-$15,248	-$87,316	-$236,194	-$481,870	-$809,988	-$1,232,292	-$1,760,529	-$2,406,444	TOTAL