Subject: Green Fleet Strategy

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Report to Public Works and Infrastructure Committee on 27 February 2025

and Council 26 March 2025

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Ward: Citywide

Objet : Stratégie de verdissement du parc automobile

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Rapport présenté au Comité des travaux publics et de l'infrastructure

le 27 février 2025

et au Conseil le 26 mars 2025

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À l'échelle de la ville

REPORT RECOMMENDATIONS

That the Public Works and Infrastructure Committee recommend that Council:

1. **Approve the Green Fleet Strategy for the City of Ottawa attached as Document 1 and as outlined in this report.**

2. **Approve the adoption of an agile implementation framework for the Green Fleet Strategy, incorporating scheduled technology and progress reviews to ensure flexibility and responsiveness to emerging vehicle technologies and industry trends.**

3. **Direct staff to complete the initial comprehensive technology review of the Green Fleet Strategy within five years, focusing on assessing advancements in low and zero-emission vehicle technologies, including electric and hydrogen-powered vehicles, as well as infrastructure developments, and report back to Council with any recommended updates.**

RECOMMANDATIONS DU RAPPORT

Que le Comité des travaux publics et de l'infrastructure recommande au Conseil municipal :

1. **d'approuver la Stratégie de verdissement du parc automobile de la Ville d'Ottawa reproduite ci-joint dans la pièce 1 et décrite dans le présent rapport;**

2. **d'approuver l'adoption, pour la Stratégie de verdissement du parc automobile, l'adoption d'une structure-cadre de mise en œuvre agile, en reprenant les examens programmés de la technologie et des progrès accomplis pour assurer la souplesse et la réceptivité aux technologies automobiles émergentes et aux tendances de l'industrie;**

3. **de demander au personnel d'effectuer d'ici cinq ans l'examen initial complet des technologies de la Stratégie de verdissement du parc automobile, en consacrant son attention à l'évaluation des progrès des technologies automobiles peu polluantes et sans émissions, dont les véhicules électriques et à propulsion hydrogène, ainsi que les perfectionnements à apporter aux infrastructures, et de déposer, auprès du Conseil municipal, les comptes rendus recommandés.**

EXECUTIVE SUMMARY

The Green Fleet Strategy sets a framework for the City's implementation toward a zero-emission fleet and is based on a comprehensive assessment of various low-carbon technologies. The strategy supports the City's Climate Change Master Plan's corporate greenhouse gas (GHG) emissions reduction target of 100 per cent below 2012 levels by

2040, as well as Council's strategic objective to reduce emissions associated with the City's operations and facilities.

In its development, the strategy considered the wide diversity of fleet units owned by the City of Ottawa, the various needs required by each department/service area, market conditions, procurement, monitoring, and the required infrastructure to support expanded opportunities and new technology. The strategy includes a comprehensive evaluation of alternate fuel technologies, a detailed ranking of technologies by asset class, and the creation of a vehicle roadmap that outlines both a reduced emission and zero-emission pathway.

The information and estimates presented in the strategy are based on present day assumptions and analysis that include cost estimates, GHG emissions savings, and fleet composition that may change considerably in the future. To monitor the risk of changing markets and technology, as well as costs and potential GHG reduction impacts, the strategy recommends an agile implementation framework whereby staff would undertake regular reviews to assess improvements or changes of zero or low-emission vehicle technologies and associated charging infrastructure, and market availability. These reviews are proposed to be conducted every five years or sooner as an ongoing practice throughout the lifespan of the strategy.

Staff estimate that within the next five years there will be enough advancement in technology and vehicle markets to warrant the first review of the Green Fleet Strategy, afterwards which staff would report back to Council with the results and any required updates to the strategy. This agile approach will allow the strategy to continue adapting to evolving technologies and market conditions to ensure both short-term progress and preparation for future advancements.

Assumption and Analysis

The potential GHG emission reduction presented in the Green Fleet Strategy is substantial, with the transition to zero-emission vehicles forecasted to yield a 93 per cent savings below the 2012 GHG emissions baseline (29,500 tCO2e), by 2040.

Technology review

A comprehensive technology review was conducted in the development of the strategy. Battery Electric Vehicles (BEV) consistently rank as the most favorable technology, showcasing zero tailpipe emissions, and are a readily available mature technology with an established infrastructure and a lower total cost of ownership. As well, there are diverse market options when selecting and procuring vehicles. Plug-in Electric and Fuel

Cell Electric Vehicles (FCEV) followed in suitability in the evaluation. FCEV emerged as a strong contender for heavy-duty vehicles beyond 2030 and BEV and FCEV as top choices from 2033 onwards.

The technology review reinforced that heavy-duty vehicles have high capital costs and emit high volumes of GHGs, so it will be important for the City to consider alternative technologies for these vehicles when possible. Given the rapid development of technologies over the last few years, there is still a degree of uncertainty of what zero-emission technology will dominate the heavy-duty vehicle sector in the future to support municipal operations. Initial findings indicate that hydrogen fuel cell technology may soon be a viable technology for adoption and could support the City's goal of a reduced or zero-emission fleet, but more research, including pilots, a feasibility study and/or technology reviews are required to assess that assumption. Strategies to extend the useful life of an asset to reduce high capital expenditures and align with zero-emission market readiness may also be considered in future planning. The success of reducing the fleet's GHG emissions below 2012 levels will largely depend on finding a suitable technology to transition heavy-duty vehicles from internal combustion engine technology to low and zero-emission technology.

Implementation plan

In the short-term, the strategy proposes that BEVs will continue to be prioritized for the City's fleet where feasible. In the long-term, when future markets permit and pending the results of a future technology review, it is anticipated that the City will adopt a dual approach involving both battery electric and another technology (currently assumed to be fuel cell electric) for medium and heavy-duty vehicles.

To mitigate waiting until improved technology options for heavy-duty vehicles become feasible, the strategy has built in a short and long-term pathway along with regular review cycles. This will allow staff to monitor industry and technology trends and ensure that the strategy remains current and aligned with the technology that is available in the market.

Currently 251 of the City's 2,815 owned fleet units are hybrid or electric. These are units that have either been replaced or purchased for growth requirements. Of the green units in service, 69 (2.5 per cent) are fully electric and 182 (6.5 per cent) are hybrid. To achieve the maximum projected GHG emissions reduction target of 93 per cent below 2012 levels by 2040, the strategy has modelled potential fleet compositions from 2025 to 2040 based on the technology available in today's market and the predicted options available in the future. Under the Toward Zero-Emissions approach presented in the

strategy, it is projected that the purchasing plan will gradually transform the fleet makeup by 2040 and consist of:

- 75 per cent Battery Electric Vehicles (BEV)
- 13 per cent Fuel Cell Electric Vehicles (FCEV)
- 12 per cent Internal Combustion Engine (ICE)

This deliberate re-allocation is geared towards substantial GHG emissions reductions, with a particular focus on medium and heavy-duty vehicles as they are the vehicle classes that produce the highest volumes of GHG emissions. If the above noted scenario is adopted, a 41 per cent reduction of GHG emissions is projected in the heavy-duty vehicle fleet alone.

The significant change in fleet composition over the next two decades must be supported by appropriate energy supply and refueling infrastructure. Based on current modelling, research and market data, this would include both battery electric charging sites and hydrogen production and refueling infrastructure. Currently, the City has 28 electric vehicle charging stations dedicated to the municipal fleet, with an additional 12 expected by the end of 2025. The creation of hub charging locations are planned, including ensuring that charging infrastructure is in place prior to bringing electric vehicles into service. Planning for future hydrogen refueling infrastructure will be reevaluated after the first technology review for the strategy that is proposed to be conducted within the next five years.

Financial Implications

In the short term, the strategy will be implemented through existing budgets. Staff will continue to assess where additional funding is required (for example, infrastructure, procurement and staffing) and continue pursuing available funding when required, including through Provincial and Federal opportunities. Should additional funds be required, requests will be submitted as part of the annual budget process for Council approval as well as through the annual Fleet Vehicle and Equipment Plan report.

The cost benefit analysis shows that initially there are high capital infrastructure expenses to implement the strategy, but the long-term costs are predicted to decrease due to reduced fuel and maintenance expenses. Should the Green Fleet Strategy adopt a dual technology approach to include both battery electric and hydrogen technologies, the long-term implementation of the Toward Zero-Emissions path is estimated at a cost

of $1,649.5 million with a net savings of up to $6.52 million over the 2023 to 2040 timeframe.

Public Consultation/Input

The Green Fleet Strategy was developed with input from various City service areas including Climate Change and Resiliency Services, Asset Management Services and Facility Operations Services, as well as City fleet user groups. Initial consultation included questionnaires and stakeholder engagement sessions to provide feedback to help guide the direction of the strategy, followed by individual sessions to discuss specific input for consideration in the final strategy. Feedback was generally supportive, and many comments focused on continuing to hold regular discussions with Fleet Services to ensure ongoing operational needs are met when green alternative units are investigated.

Hydro Ottawa was consulted in accordance with motion 2023-12/10. Their feedback included suggestions for additional consideration such as load management strategies, as well as willingness to support the City through future discussions to advance the Green Fleet Strategy. There were no public consultations associated with this report.

BACKGROUND

Fleet Services is committed to meeting the emissions reduction targets set out in the City's Climate Change Master Plan and the 2023-2026 Term of Council Priorities. The Green Fleet Strategy provides a roadmap to support these goals.

Overview of Fleet Services

Fleet Services supports all City departments as well as some City boards and utilities that rely on vehicles and equipment to deliver their services. Fleet is responsible for procuring, maintaining, administering, repairing and replacing the City's diverse fleet of approximately 5,000 non-revenue vehicles, equipment and components through a shared services model. Services are delivered through the City's nine garages and maintenance support is provided on a 24/7 basis.

Of the approximately 5,000 municipal fleet units, 2,815 vehicles and equipment are owned by the City and relied on to deliver municipal services across Ottawa's 2,790 square kilometers, which include by-law enforcement, maintenance of parks, roads, water and wastewater, waste collection, fire and paramedic services, among other services. As of December 2024, 251 units within the City's owned fleet inventory of 2,815 units are hybrid or electric. These are units that have either been replaced or purchased for growth requirements.

City fleet vehicles are grouped into five operational classes:

- Ambulances
- Fire trucks
- Heavy vehicles
- Light vehicles
- Equipment

Vehicle weight class definitions

Gross Vehicle Weight Rating is the maximum weight a vehicle is designed to carry and is set by manufacturers. For the purposes of developing the Green Fleet Strategy, City vehicles were categorized according to the following Gross Vehicle Weight Rating Categories, as defined by Statistics Canada[1].

Table 1: Vehicle categories according to gross vehicle weight rating

Gross Vehicle Weight Rating	**Gross Vehicle Weight Rating Category**	**Example of Vehicle Category**
≤ 4536 kilograms (0 to 10,000 pounds)	Light Duty	Sedan, ½ Ton Pickup Truck, SUV
4536 - 11793 kilograms (10,001 to 26,000 pounds)	Medium Duty	1 ½ Ton Pickup Truck, Ambulance
≥ 11794 kilograms (26,001 pounds and greater)	Heavy Duty	Refuse Collection, Snowplow

Definitions of low-carbon vehicles

The Green Fleet Strategy discusses the following types of low carbon vehicles as defined by Statistics Canada and Natural Resources Canada[2]:

- Battery electric vehicles (BEV) are powered solely by a rechargeable battery pack and produce zero tailpipe emissions.

[1] Statistics Canada (2024, 21 October) *Vehicle registrations, 2023*. Retrieved October 2024 from https://www150.statcan.gc.ca/n1/daily-quotidien/241021/dq241021c-eng.htm

[2] Definitions for BEV, PHEV, ZEV and hybrid electric vehicles were sourced from Statistics Canada (2024, 21 October) *Vehicle registrations, 2023*. Retrieved October 2024 from https://www150.statcan.gc.ca/n1/daily-quotidien/241021/dq241021c-eng.htm Definition for FCEV is sourced from Natural Resources Canada (2024, 21 November). Retrieved November 2024 from https://natural-resources.canada.ca/energy-efficiency/transportation-alternative-fuels/personal-vehicles/choosing-right-vehicle/hydrogen-fuel-cell-vehicles/25321

- Plug-in hybrid electric vehicles (PHEV) have a rechargeable battery pack and an internal combustion engine. They run on electric power until the battery is drained and then the internal combustion engine takes over for propulsion.
- Zero-emission vehicles (ZEV) are vehicles that have the potential to produce no tailpipe emissions such as BEVs and FCEVs.
- Hybrid electric vehicles have a rechargeable battery pack, which provides an extra boost of power, in addition to having an internal combustion engine. They are not considered part of zero-emission vehicles.
- Hydrogen fuel cell vehicles (FCEV) use compressed hydrogen gas and a fuel cell to power the electric motor that propels the vehicle. The vehicle's fuel cell converts hydrogen into electricity which is used to charge a small battery that powers the electric motor. FCEVs emit water vapor and warm air only, they produce no harmful tailpipe emissions.

Green fleet legislative history

The City's Green Fleet Plan has continued to evolve since its introduction in 2002. Council received the Fleet Emissions Reduction Strategy (FERS) (ACS2002-CRS-FLT-0001) in 2002 that committed the Fleet Services Branch to reducing corporate air and greenhouse gas emissions and to report back to Council once every Term of Council with an updated strategy. The first FERS update (ACS2004-TUP-FLT-0001) was presented to Council in 2004. Following a corporate alignment in 2008 where Municipal Fleet and Transit Fleet were separated, FERS was discontinued and Fleet Services developed the Municipal Green Fleet Plan (ACS2009-COS-FLT-0001) which was approved by Council in August 2009. In 2016, an update to the Municipal Green Fleet Plan (ACS2016-COS-PWS-0006) was presented to Council outlining its alignment with the 2014-2018 Term of Council priorities and strategic initiatives.

Fleet Services has evaluated low carbon fuels, introduced electric and hybrid vehicles, replaced older fleet vehicles with fuel efficient vehicles, including "right-sizing" the fleet, to ensure that vehicle specifications do not over match requirements, and introduced life cycle costing into the procurement process. Additionally, the Municipal Green Fleet Plan has been operationalized. It includes guidelines when considering the replacement of light duty units and encourages purchasing green vehicles. This plan communicates the City's direction to consider green options by always looking at electric and hybrid alternatives first that meet the operational needs, even during challenging market

conditions. Where there are viable and available green options, Fleet has transitioned vehicles and equipment as part of their regular lifecycle replacement schedule.

On April 24, 2019, Council declared a climate emergency, joining the growing global movement calling for urgent action to address the climate crisis, followed by the release of a Council-approved Climate Change Master Plan (ACS2019-PIE-EDP-0053) in January 2020 and the Energy Evolution Strategy (ACS2020-PIE-EDP-0036) in October 2020. The Climate Change Master Plan (CCMP) set new targets to reduce GHG emissions from City operations based on 2012 levels by 30 per cent by 2025, 50 per cent by 2030, and 100 per cent by 2040. As a key stakeholder in the strategy, Fleet Services committed to update the City's Municipal Green Fleet Plan by developing a new Green Fleet Strategy that considers the corporate GHG emissions reduction targets and aligns it with the Energy Evolution modelling.

Progress on the municipal fleet transition to hybrid and electric vehicles is reported annually to Council through the Fleet Vehicle and Equipment Plan which, since 2019, is provided supplementary to and tabled with the budget at City Council. In this annual report, staff include the anticipated number of vehicles that are scheduled to be replaced with hybrid and electric models for the following calendar year, among other fleet updates. Additionally, through these annual reports Fleet Services has kept Council informed on the development of the Green Fleet Strategy.

On November 13, 2024, Council received the most recent green fleet update through the 2025 Fleet Vehicle and Equipment Plans report (ACS2024-FCS-FLT-0001). The update describes how staff continue to review available hybrid and electric fleet options for the City's fleet inventory, that have been tested and are commercially sold within the light vehicle class. To date, 251 units within the City's fleet inventory have been transitioned to hybrid or electric alternatives. Of the green units in service, 69 are fully electric and 182 are hybrid. Units, with viable and available green options that meet operational needs, will continue to be transitioned as part of their regular lifecycle replacement schedule. For example, there were 34 growth units that were identified in the 2025 Fleet Vehicle and Equipment Growth Plan that are being evaluated to determine if a green alternative will meet operational needs. And 27 of the 100 fleet units identified in the 2025 Fleet Vehicle and Equipment Replacement Plan have the ability to be replaced with hybrid and electric models that could result in more than 1,394 fewer tonnes of GHG emissions over their life cycle.

Development of the Green Fleet Strategy

The Green Fleet Strategy provides the City with a framework to transition its internal combustion engine (ICE) assets to low carbon and zero carbon technologies through a phased approach, leading to the creation of a zero-emission municipal fleet. The strategy aims to achieve a maximum reduction in greenhouse gas emissions (GHG) by 2040 and align the municipal fleet with the GHG emission reduction targets set out in the Climate Change Master Plan.

Scope

The Green Fleet Strategy is focused on the City-owned municipal fleet and does not include the fleets managed by Transit Services or the Ottawa Police Service. OC Transpo's Zero Emission Bus program was approved by Council in June 2021, and the municipal Green Fleet Strategy is not part of this program's funding model. Despite differing oversight and funding models, there are similar goals among the two green initiatives and Fleet Services is committed to collaborating where possible, in particular on infrastructure and pilot projects.

Preliminary work and establishing baseline calculations

To assist Fleet Services staff in developing the strategy, the City of Ottawa retained the services of WSP Canada Inc., a professional services firm that provides strategy advisory services in collaboration with City staff expertise. Specifically, WSP Canada Inc. undertook:

- **A baseline analysis for 2023 and creation of a business-as-usual scenario out to 2040** for the City's fleet assets to compare various green fleet scenarios. The baseline reflects information for 2023 and the inputs included cost estimates, vehicle classifications, asset replacement plans, fleet capital costs, operating costs, fuel costs, total cost of ownership, and GHG emissions projections. The business-as-usual scenario is a forecast out to 2040, whereby the City's vehicles were classified into light, medium and heavy-duty vehicle categories and the fleet plan reflects annual purchasing objectives under the business-as-usual scenario.

- **The development of an evaluation matrix** to compare various alternative fuels and technologies for reduced GHG emissions and a ranking of technologies to prioritize within each asset class, considering service quality and cost-effectiveness. The matrix included 23 criteria across light, medium, and heavy-duty vehicle segments, to rank nine technologies over four time intervals between 2023 and 2043.

- **The development of the two pathways (Reduced Emissions and Toward Zero-Emissions)** for consideration following a future market and technology review. The strategy includes ongoing periodic reviews to adapt to evolving technologies, to ensure both short-term progress and preparation for the future advancements. Both pathways include a purchase plan and accompanying fleet stock transition forecast, required fueling infrastructure strategy to support the purchase plan, an estimated GHG emissions reduction analysis and anticipated capital and operating expenses.

- **The development of a fleet asset management plan** to establish defined vehicle replacement lifespans for the management of its fleet replacement and procurement strategy.

- **A best practices review** to understand GHG reduction targets, trends and lessons learned in fleet from peer municipalities.

- **Stakeholder engagement sessions** to gather feedback to help guide the direction of the strategy. Engagement meetings were conducted with fleet user groups to understand key themes related to low carbon fleet adoption.

Best practices review

Part of the preliminary work to develop the Green Fleet Strategy included a best practices review. This research was undertaken to understand the GHG reduction targets and trends in fleet from peer municipalities in Canada, as well as to learn from their experiences with implementing similar strategies. Information was gathered from the following three municipalities:

- Abbotsford, British Columbia
- Barrie, Ontario
- Surrey, British Columbia

From these cities' experiences, lessons learned on implementing pilot projects, collaboration, examining alternative fuel types and cost considerations were identified and helped inform Ottawa's strategy. For example, it was observed that pilot projects are crucial, especially when exploring alternative fuels. They allow for real-world testing and evaluation of different technologies, helping cities make informed decisions on the feasibility and effectiveness of alternative fuels. Pilot projects could be used to test emerging technologies (like hydrogen for heavy-duty vehicles) to assess their feasibility, performance and the cost-effectiveness of these technologies.

Like Ottawa, there are cities where fleet and transit operate as two separate entities. In the research, collaboration among fleet groups within the same municipality was highlighted as a best practice to optimize overall fleet operations through coordinated planning and identifying opportunities for shared resources. Additionally, the infrastructure group should be kept fully informed of any fleet initiatives related to upgrading facilities. It was recommended that infrastructure and fleet groups should consult each other to maximize efficiency and ensure their alignment. Under a collaborative cross-departmental strategy, there could be potential for leveraging infrastructure, subject matter expertise and resources.

A number of lessons learned on alternative fuel types, including renewable natural gas, compressed natural gas and renewable diesel, were gathered. For diesel vehicles that won't be replaced in the near term, suggestions included considering renewable diesel opportunities and partnerships

Where feasible and relevant, lessons observed were incorporated into the Green Fleet Strategy and will be taken into consideration during the implementation of the City's strategy, for example:

- Using pilot projects to explore alternative fuels to make informed decisions on their feasibility and effectiveness.
- Investigating ways to address cost implications and making units and required infrastructure affordable and accessible, such as funding grants and partnerships.
- Identifying, where possible, opportunities for shared resources to optimize fleet operations, despite operating as two separate entities.
- Ensuring relevant retrofit projects proceed with adequate consideration of the needs of Fleet.
- Avoiding vehicle retrofit projects, as a focus, as they still produce emissions.

Data limitations and assumptions

The findings, modelling, fleet makeup projections, cost estimates, and GHG emissions savings presented in the Green Fleet Strategy and this report are based on information and data that was collected in 2023 and may change in the future.

Data such as fuel economy and fleet maintenance costs referenced within the strategy are historical data points that helped to inform lifecycle cost assessments of vehicles and equipment and establish a baseline on the City's current fleet operations to make comparisons against low carbon vehicle alternatives. Assumptions included price

projection of assets, fossil fuels and electricity, and rate of the improvement of technologies and carbon intensities, among others.

All estimates and calculations referenced in the strategy are subject to change due to the nature of improving and evolving technologies and future analysis, feasibility studies and reviews of vehicle markets. Future procurement decisions will include thorough price-point analysis to determine the most cost-effective acquisitions.

DISCUSSION

The Green Fleet Strategy is an opportunity for the City of Ottawa to act on its commitment to reduce corporate greenhouse gas emissions in the transportation sector, which is the second largest contributing sector to emissions in Ottawa[3]. As referenced in the Results of the 2020 Community and Corporate Greenhouse Gas (GHG) Inventories, by sector, the municipal fleet represents 13 per cent of corporate City of Ottawa GHG emissions.

The City faces unique fleet challenges due to Ottawa's extensive land area, which surpasses the combined size of several major Canadian cities, and operational requirements where City services are relied on 24/7 for emergency services, enforcement, maintenance of parks, roads, water and wastewater, waste collection and snow clearing, among other services. The strategy provides a realistic plan to transition to a low-carbon and zero-emission fleet over the next two decades (2025 to 2040) and positions the City to remain responsive to evolving technologies, best practices and vehicle market conditions.

Greenhouse gas emissions baseline

The strategy references the following two comparable GHG baselines:

- 2012 baseline: 29,500 tCO2e
- 2023 baseline: 30,700 tCO2e

tCO2e = tonnes of carbon dioxide equivalent

[3] City of Ottawa (2020, October) *Energy Evolution Ottawa's Community Energy Transition Strategy – Final Report*. Section Page 37, section 4.3. Retrieved October 2024, from https://documents.ottawa.ca/sites/default/files/energy_evolution_strategy_en.pdf

In 2012, the annual GHG emissions from the City's owned fleet was 29,500 tCO2e[4]. This figure is included in the strategy as a reference point to align with the GHG emission reduction targets set in the Climate Change Master Plan.

The models presented in the strategy are based on the 2023 GHG emissions baseline, which was the calculation of the annual GHG emissions from 2022 to 2023 of the City's owned fleet. The 2023 to 2040 business-as-usual projection cited in the strategy is a forecast based on the 2023 conditions of the fleet, the anticipated improvement of internal combustion engine (ICE) technology and carbon intensive fuels such as diesel and gasoline.

Rationale for a renewed Green Fleet Strategy for the City of Ottawa

GHG emissions are projected to decrease from 30,700 tCO2e in 2023 to approximately 24,000 tCO2e by 2040 primarily due to expected improvements in ICE vehicles (enhanced fuel efficiency and reducing carbon-intensive outputs) and the federal Clean Fuel Regulations. If the City continues its business-as-usual approach to vehicle replacement (continuing to only replace vehicles with similar ICE models) it is calculated that this reduction in GHG emissions (which is 18.2 per cent lower than the 2012 GHG gas emission baseline) could be achieved by 2040. It was also calculated that if Fleet Services adopted the approach of only focusing on currently available options in the market which are battery electric options to transition ICE vehicles along with pilot programs (in addition to the improvements related to federal Clean Fuel Regulations), the estimated GHG savings may result in a 38.2 per cent GHG savings below 2012 emission levels by 2040.

Despite the possible reduction in GHG emissions in both these scenarios, neither of these improvements are sufficient to meet the City's own GHG reduction target of 100 per cent below 2012 baseline levels as set out in the Climate Change Master Plan. Therefore, additional efforts are required to transition the City's vehicles with internal combustion engines to low and zero-emission vehicles by 2040. This report provides an overview of these efforts outlined in the Green Fleet Strategy and brings forward several recommendations for its successful implementation.

[4] Based on data from City of Ottawa (2021, September). *Results of the 2020 Community and Corporate Greenhouse Gas (GHG) Inventories*. Retrieved 2023, from https://documents.ottawa.ca/sites/default/files/2020_ghg_inventory_en.PDF

Recommendation 1: Approve the Green Fleet Strategy for the City of Ottawa attached as Document 1 and as outlined in this report.

The Green Fleet Strategy provides a framework for the City's implementation of a toward zero-emission fleet, which is based on a comprehensive assessment of various low-carbon technologies. The strategy supports the City's Climate Change Master Plan and the targets set out in the City's Energy Evolution transportation sector by transitioning the municipal fleet to zero-emission technologies to support corporate GHG emissions reduction targets of 100 per cent below 2012 levels by 2040[5]. Additionally, it directly supports Council's strategic objective 16 of reducing emissions associated with the City's operations and facilities.

Anticipated results

The projections and estimates presented in the strategy are models based on the current data and are subject to change as new information on technology and markets emerge and the strategy undergoes regular reviews, as proposed in this report.

Greenhouse gas emission reduction

By 2040, the potential GHG emissions reduction presented in the Green Fleet Strategy is substantial, with the transition to zero-emission vehicles forecasted to yield a 93 per cent savings below the 2012 GHG emissions baseline. This estimate may change following future technology and market reviews.

Projected fleet composition

To achieve the maximum projected GHG emissions reduction of 93 per cent below 2012 levels by 2024, the strategy has modelled potential fleet compositions from 2025 to 2040, based on the technology available today in the market and the predicted options available in the future. Under the Toward Zero-Emissions approach presented in the strategy, it is projected that the purchase plan will gradually transform the fleet makeup by 2040 and consist of:

- 75 percent Battery Electric Vehicles (BEV)
- 13 per cent Fuel Cell Electric Vehicles (FCEV)
- 12 per cent Internal Combustion Engine (ICE)[6]

[5] City of Ottawa (2020, January). *Climate Change Master Plan*. Retrieved October 24, 2024, from https://documents.ottawa.ca/sites/default/files/climate_change_mplan_en.pdf

[6] Of the 12 per cent that remain on ICE technology, 9 per cent correspond to equipment, 1 per cent corresponds to HDV, 1 per cent corresponds to LDVs, and 1 per cent corresponds to MDVs. Some LDVs still remain as ICE because some of the daily energy requirement or range is bigger than the average useful battery capacity or range of a BEV LDV, particularly considering winter conditions.

In contrast, in 2024 the municipal fleet consists of approximately 2.5 per cent of BEV units and 6.5 per cent hybrid units.

This deliberate re-allocation is geared towards substantial GHG emissions reductions, with a particular focus on medium and heavy-duty vehicles as they are the vehicle classes that produce the highest volumes of GHG emissions. To achieve significant environmental impact, medium and heavy-duty vehicles need to transition to zero-emission technologies. If the above noted scenario is adopted, a 41 per cent reduction of GHG emissions is projected in the heavy-duty vehicle fleet alone.

Energy supply and refueling infrastructure investments
The significant change in fleet composition over the next two decades needs to be supported by an appropriate energy supply and refueling infrastructure. Based on current modelling, research and market data, this would include both battery electric charging sites and hydrogen production and refueling infrastructure.

Estimated cost savings
The implementation of the Toward Zero-Emissions path is estimated at a cost of $1,649.5 million[7] with a net savings of up to $6.52 million over the 2023 to 2040 timeframe.

The sections below provide an explanation of the technology review, anticipated approach to fleet transition, infrastructure planning and a cost benefit analysis.

Technology review findings
In 2023, a comprehensive technology review was conducted to compare the following nine alternative fuels and technologies for reduced GHG emissions, across 23 criteria and four time intervals between 2023 and 2043:

- Battery electric
- Hybrid electric
- Plug in hybrid electric
- Compressed natural gas
- Renewal natural gas

[7] All cost projections are considered in real dollars with the reference year being 2023. This is meant to avoid speculation on the projection of inflation. Depreciation cost is not considered.

- Bio-diesel
- Renewable diesel
- Hydrogen-diesel dual fuel
- Hydrogen

Examples of the evaluation criteria included technology maturity level, interoperability, maintenance complexity, heating system usage during winter and potential for GHG reduction.

These technologies and criteria were considered for light, medium, and heavy-duty vehicles and the result was a prioritized list of preferred technologies that helped to inform the Green Fleet Strategy direction and recommendations.

BEV consistently ranked as the most favorable technology for light, medium and heavy-duty vehicles because they have zero-tailpipe emissions, are a readily available mature technology with an established infrastructure and a lower total cost of ownership. As well, there are diverse market options when selecting and procuring vehicles. Plug-in electric and FCEV followed in suitability in the evaluation.

FCEV emerged as a strong contender for heavy-duty vehicles beyond 2030 and BEV and FCEV as top choices from 2033 onwards.

Focus on heavy-duty vehicles
The research reinforced that heavy-duty vehicles have high capital costs and emit high volumes of GHGs, so it is important (in the short and long-term) to consider alternative technologies for these vehicles where possible. The success of reducing the fleet's GHG emissions below 2012 levels will largely depend on finding a suitable technology to transition heavy-duty vehicles from internal combustion engine technology to low and zero-emission technology. This may include strategies to extend the useful life of an asset to reduce high capital expenditures and align with zero-emissions market readiness.

Table 2: Asset classes with the highest shares of annual emissions to 2040 in Ottawa

Class	Per cent of greenhouse gas emissions per year
Heavy-duty (Class 8)	41.2 %
Light-duty (Class 2)	18.2 %
Medium-duty (Class 4)	14.0 %
Equipment	12.5 %

The research showed that currently, there are a limited number of heavy-duty fully battery electric vehicles in Canada. However, this is a rapidly emerging market sector with lots of research and development activity along with investment. Battery electric technology is gaining momentum as the preferred zero-emission technology for heavy-duty vehicles, along with hydrogen fuel cell vehicles for some applications such as longer distance transportation.

Hydrogen fuel cell technology

Given the rapid development of technologies over the last few years, it is still uncertain what zero-emission technology will dominate the heavy-duty vehicle sector in the future to support municipal operations, particularly when operations, periodically, need to run 24 hours a day to meet operational requirements. Initial findings indicate that hydrogen fuel cell technology may soon be a viable technology for adoption, but more research is required to assess this assumption.

The findings in the research indicated that hydrogen fuel cell vehicles (also referred to in this report as fuel cell electric vehicles) are being developed with some promising performance projections; however, the technology is premature in the automotive market with only two types of FCEV available in the market. As an alternative fuel, the current barriers to adopting hydrogen include the scarcity of publicly available hydrogen fueling stations in Canada, the limited number of available passenger vehicles in Canada and the high purchase price of vehicles.

Despite these current limitations, the results of the research study are optimistic. The findings presented hydrogen as a technology with substantial emissions reduction

potential, and found it is supported by governmental emphasis on hydrogen production and on-going programs and trials for hydrogen vehicles in the heavy-duty sector to progress this technology. Researchers anticipate that hydrogen availability will significantly improve in Canada supported by local supply chains, and it is possible that this technology may become a viable alternative in the medium to long term if vehicle price points, green hydrogen availability, infrastructure and cost parity with conventional hydrocarbons all continue to improve.

The strategy proposes that hydrogen will be a key technology to support the City's goal of a reduced or zero-emission fleet but is subject to the results of future pilots and technology reviews as well as a feasibility study. To mitigate the need to wait until technology options like hydrogen become feasible, the Green Fleet Strategy has built in regular review cycles so that staff can continue to monitor industry and technology trends and ensure that the strategy remains current and aligned with the technology that is available in the market.

Equipment

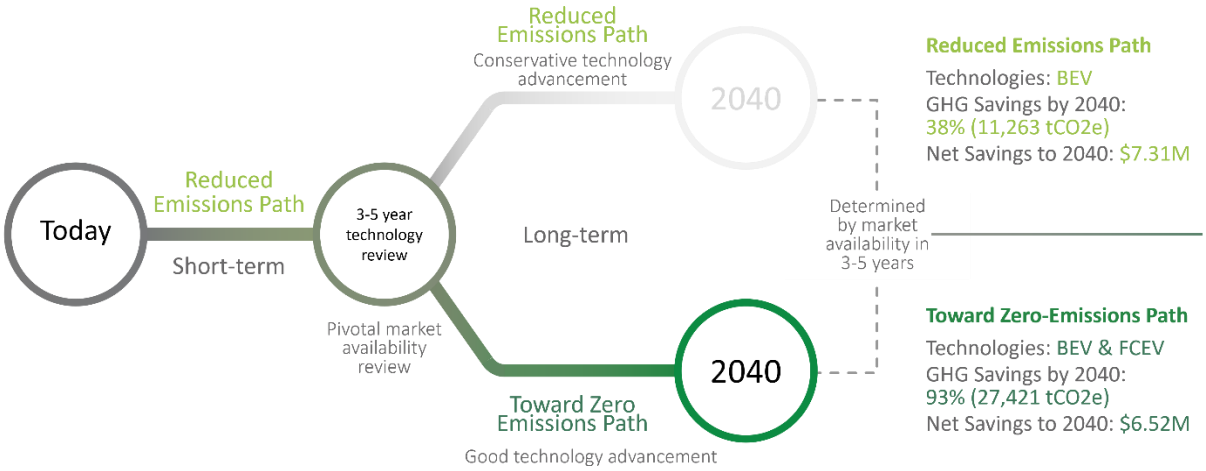
Staff are committed to providing zero-emission solutions where possible. Presently, Fleet Services always looks at electric and hybrid alternatives first, where feasible, and if they meet operational needs.

While equipment categories were not explicitly part of the technology review, based on market readiness, battery electric technology is recommended for transitioning various equipment classes. The versatility and diverse energy constraints within the equipment segment align well with the benefits offered by BEV technology, ensuring an effective transition for a wide range of applications. Equipment transitions favor BEV technology, ensuring a diverse and efficient adoption strategy.

The path toward zero-emissions by 2040

Based on the key finding that battery electric vehicles are the preferred option for all vehicle types in the short-term, and the assumption that there will be a more suitable technology to target heavy-duty vehicles in the future (currently assumed to be hydrogen fuel cell), the fleet replacement strategy takes both a short and long-term outlook which are referenced in the strategy as the Reduced Emissions and Toward Zero-Emissions pathways. This adaptive approach will allow the City to financially plan for a zero-emission fleet by 2040.

Figure 1: Green Fleet Strategy Pathways



Reduced Emissions pathway – present-state

The Reduced Emissions pathway is the present state and is based on the technology that is available in the market today. In the short term, staff will continue acquiring assets with reduced and zero-emission vehicle options and seek opportunities for pilot projects to test new technologies for all vehicle types. Battery electric vehicles for light, medium and heavy-duty vehicles and equipment will continue to be prioritized as this is currently the most suitable technology available in the market. Understanding that exclusively focusing on present-day battery electric options and pilot programs is only anticipated to yield a 38.2 per cent GHG savings by 2040, staff will continue to closely monitor technology and markets in order to assess when other technologies may be ready for adoption by the City.

Toward Zero-Emissions pathway – long-term outlook

The Toward Zero-Emissions pathway is an idealistic scenario that takes into consideration future improvements and emerging technologies and an increase in market availability of zero-emission vehicles. It is based on the current research and development in the sector and a prediction on where technologies will evolve over the next few years. It is the potential pathway that could lead to a zero-emission fleet by seeking to find technologies that will allow for heavy-duty vehicles to transition from ICE to ZEV, thereby improving GHG reductions because it assumes future technologies will offer better or improved options for this goal. It is anticipated that the City may be ready to shift to the Toward Zero-Emissions path following a comprehensive technology and market review within the next five years.

When future markets permit and it is feasible to shift to this pathway, a dual approach involving both battery electric vehicles and another technology (currently assumed to be fuel cell electric vehicles) for medium and heavy-duty vehicles would be adopted. Battery electric vehicles would continue to be integrated for light-duty fleet vehicles, as they stand out as the more practical choice due to the electric vehicle charging infrastructure being readily available to purchase and install, lower total cost of ownership and technological maturity.

The strategic combination of different technologies ensures adaptability to various energy constraints and supports both a more comprehensive fleet transition plan and the City's 24/7 operations such as snow clearing operations and emergency services.

The Toward Zero-Emissions pathway includes a phased ZEV purchase plan guided by three principles: planned uptake rates (the rate at which an internal combustion engine vehicle is replaced by a zero-emission vehicle), cost parity projections and a selective aging program. The strategy includes planning for 100 per cent ZEV purchases when cost parity with ICE options is anticipated and the unit meets operational needs. Market reviews every five years (or sooner) will inform this decision-making. Additionally, Fleet Services will prioritize assets for selective aging, strategically delay purchases where possible to align with ZEVs becoming available for that segment. See Document 1 for information on extending an asset's useful life.

Although the GHG emissions reduction under the Green Fleet Strategy is not currently calculated to yield a 100 per cent GHG reduction below 2012 levels, adopting concurrent dual technologies does offer a more substantial GHG savings estimated at 93 per cent and, pending the results of future technology and market reviews, this figure could improve over time.

See Document 1 for more information on the Reduced Emissions and Towards Zero-Emissions pathways.

Infrastructure planning required to support the towards zero-emission fleet

To support the operation of a zero-emission fleet, it is crucial that the appropriate energy supply and refueling infrastructure is in place first. The Green Fleet Strategy outlines a fueling infrastructure plan that includes installing battery electric vehicle charging infrastructure aligned with the number of purchased assets, as well as planning for, constructing and operationalizing two or more hydrogen production and refueling sites by 2036.

Infrastructure investments required to support new technology adoption, such as hydrogen, would only be considered following the first technology and market review which will take place within five years. The models in the strategy are based on 2023 data and are subject to change pending future technology and market reviews.

Battery electric vehicle infrastructure

The Green Fleet Strategy proposes that at least one year before any ZEV fleet purchases are made, that Fleet Services initiate the building-level upgrades and civil infrastructure and procure the necessary charging equipment to support the assets. Although site electrification planning for City facilities is outside the scope of the Green Fleet Strategy, Fleet Services is providing input and working in support of Facility Operations Services who are leading this ongoing work.

Prioritizing sites for chargers and ensuring redundancies for electrical circuits is identified in the strategy. Hub charging locations will be created and the charging infrastructure will be in place prior to bringing electric vehicles into service. The strategy has forecast an anticipated number of assets (level 2 and 3 chargers) to be purchased annually and the associated infrastructure to support these assets. The peak requirement for new charging infrastructure is estimated in 2033, with 142 charging stations, and anticipates a peak of BEV purchases in 2034. A total of 741 charging stations are forecasted to be required by 2040 based on modelling. These assumptions are based on the technology available in the market today and is subject to change following future technology reviews and updates to the strategy.

Currently, the City has 28 electric vehicle charging stations dedicated to the municipal fleet, with an additional 12 expected by the end of 2025.

Fuel cell electric vehicle infrastructure

Based on the strategy's assumption that hydrogen fuel cell technology may be a viable technology in the near future for medium and heavy-duty vehicles, the strategy has considered on-site green hydrogen production facilities, and the model suggests plans for the future production and use of up to two-thousand kilograms of hydrogen per day. The first site is proposed to begin operating by 2031 which is the year when the first FCEVs are proposed to start operation. Production and refueling systems are estimated to take approximately four years from design to start of operation.

On-site hydrogen production facilities have been proposed because they eliminate the uncertainties about major transport and distribution of hydrogen. As well, the research

indicated that the cost of hydrogen production and refueling plants is projected to bring the cost of hydrogen down to a competitive price in the 2030s.

All plans and estimated costs for FCEV infrastructure presented in the strategy are models based on 2023 data and would be subject to a future technology review that would include an assessment on the feasibility of hydrogen, as recommended in this report. Estimates and timelines may vary after the initial market scan and review for the strategy.

Short-term implementation plan

Over the next five years, staff will continue to transition the City's fleet by pursuing assets and building infrastructure for the technology that is available in the market today, which is battery electric. Staff plan to look at pilot programs to assess the feasibility of potential future hydrogen adoption, including working with an industrial gas supplier on next steps for hydrogen fueling infrastructure to support future pilot projects. This approach will support the City's momentum towards a zero-emission fleet until more information about technological advancements can be incorporated into the strategy.

Fleet Services will continue to provide ongoing training for fleet management and maintenance staff to ensure they are equipped with the necessary skills and knowledge to handle ZEVs. Additionally, to address the rising demand for electric vehicle technicians, the City has partnered with Centennial College who offers the two-tiered EV Technician Certification Program that equips professionals with the expertise to service and maintain these advanced vehicles. Electric vehicles require specialized skills in electric motors, battery management, power electronics, and high-voltage safety and unlike traditional combustion engines they involve unique diagnostics and repair processes. This program addresses industry skill gaps such as safe handling of high-voltage systems and learning software that manages electric vehicle performance and updates. Understanding the training requirements related to potential hydrogen adoption will be considered in the future following results of future pilots and technology reviews.

Other short-term work will include continuing to provide input into the site electrification study; working to support the installation and operations of required battery electric infrastructure; and ongoing evaluation of potential funding opportunities to support future ZEV infrastructure. Fleet Services will also continue supporting fleet user groups to match low carbon vehicles to their operational and service delivery requirements as part of its' ongoing vehicle and equipment replacement and growth planning process.

Cost-benefit analysis

The estimates and figures presented in the Green Fleet Strategy were provided by WSP as part of the development of the framework for the Green Fleet Strategy and based on 2023 data. Figures are estimates and subject to change based on operational implementation of the strategy and following future vehicle market and technology reviews.

The Green Fleet Strategy is designed to facilitate the technology transition while maintaining a total cost of ownership comparable to the current operating expenses of the internal combustion engine fleet.

A cost-benefit analysis compared the following three scenarios in terms of GHG emission savings by 2040 as well as capital and operating expenses, including maintenance, fuel and tools, training and personal protective equipment costs:

- Baseline (ICE)
- Reduced Emissions (BEV)
- Toward Zero-Emissions (BEV and FCEV)

The analysis favours the Toward Zero-Emissions pathway primarily because of the significant reduction in GHG emissions that it may offer, which is 93 per cent below 2012 levels, bringing the City's fleet more in line with the GHG emissions reduction targets set in the Climate Change Master Plan. In comparison, only adopting BEV technology through the Reduced Emissions pathway is estimated to yield a 38.2 per cent GHG emissions savings below 2012 levels.

In addition to the potential significant GHG savings, the analysis supports the Toward Zero-Emissions path because of its estimated savings of approximately $6.52 million over the long-term, from 2023 to 2040. In contrast, only adopting BEV technology (through the Reduced Emissions Pathway) is estimated to yield a $7.3 million cost savings over the long-term but falls short in terms of achieving the City's GHG emissions reduction target by 2040.

Estimated capital and operating expenses

It is estimated that there will be initial high capital infrastructure expenses to implement the Green Fleet Strategy, but there are long term cost savings anticipated as operating costs are predicted to decrease from reduced fuel and maintenance expenses. The long-term net savings calculated under the Toward Zero-Emissions path is associated

with the transition to BEVs and FCEVs as they have few moving parts and therefore require less maintenance. For example, maintenance costs for BEVs and FCEVs are estimated to be 60 per cent and 75 per cent of ICE maintenance costs, respectively, contributing to long-term operational efficiency, and fuel costs alone contribute to significant savings of an estimated $82.03 million across all vehicle categories.

The model, as calculated by WSP forecasts that shifting from the Reduced Emissions path to the Toward Zero-Emissions path may entail an increase in capital infrastructure costs ranging from an estimated $23.25 million to $105.6 million compared to the baseline. However, there are potentially substantial net savings in operational expenses, ranging from an estimated $38.93 million for the Reduced Emissions Path to an estimated $129.57 million for the Toward Zero-Emissions path, which effectively neutralize the financial impact of the transition.

In the model, the potential net savings is calculated despite the estimated additional $118 million cost associated with the electric charging infrastructure and the hydrogen production and refueling infrastructure. An important note, the estimated capital infrastructure costs only include items related to the installation of the charging stations, for example, level 2 and 3 chargers, electrical labour and construction, charging ports, electrical panel or transformer upgrades, signage, networking or activation fees among others. The costs related to potential infrastructure upgrades for sites are not included in the capital infrastructure estimates.

The selective aging of assets built into the plan will also contribute to some significant savings as calculated in the strategy. The savings are, in general, maximized when cost parity to ICE technologies occurs. Therefore, a slower uptake rate for heavier vehicles as well as selectively aging certain assets to align with ZEV technology availability will help to ensure both fiscal responsibility and technology readiness.

Table 3: Cost comparison between 2023 Baseline, Reduced Emissions Pathway and Toward Zero- Emissions Pathway

	Baseline	**Reduced Emissions**	**Toward Zero-Emissions**
CAPEX Fleet ($ million)	807.53	810.39	819.99
CAPEX Infrastructure ($ million)	-	23.25	105.61
Maintenance Cost ($ million)	492.10	479.11	444.56
Fuel Costs ($ million)	356.41	330.48	274.38
Tools, Training and PPE ($ million)	-	5.51	5.1
Totals ($ million)	**1,656.04**	**1,648.72**	**1,649.5**
Overall Cost Difference ($ million)	**-**	**-7.31**	**-6.52**
Overall Cost Difference (%)	-	-0.44	-0.39
CAPEX only Cost Difference ($ million)	-	26.09	118.07
GHG Emissions in 2040 (Tonnes of CO2e)	24,123	18,237	2,079
GHG Emissions Savings in 2040 Compared to 2023 Reference (%)	-	-24.4	-91.4
GHG Emissions Savings Compared to 2012 Reference (%)	**-18.2**	**-38.2**	**-93.0**
Net $/Tonne of CO2 saved (2023 to 2040)	-	154	37

Budget and funding opportunities

The Green Fleet Strategy is designed to facilitate the technology transition to zero-emission vehicles while maintaining a total cost of ownership comparable to the current operating expenses of the internal combustion engine fleet. In the short term, the strategy will be implemented through existing budgets. Should there be a need for additional funds in the future, requests will be submitted as part of the annual budget process for Council approval as well as through the annual Municipal Fleet Vehicle and Equipment Plans report that, since 2019, is provided supplementary to the budget and tabled with the Budget at City Council.

To support the strategy's fleet transition, infrastructure plans and pilot projects over the next twenty years, there are various funding opportunities that can be sought through the Provincial and Federal governments. For example, in 2022, the City successfully secured $247,500 in funding from Natural Resources Canada through the Zero Emission Vehicle Infrastructure Program to support electric vehicle charging infrastructure from 2023 to 2025. A second application has been submitted to the Zero Emission Vehicle Infrastructure Program for additional funding in 2024 with the funding awards to be announced in early 2025. In the development of the strategy, various funding and grant opportunities were researched. As part of implementation, staff will continue to assess where additional funding is required (for example, infrastructure, procurement and staffing) and pursue available funding and partnership opportunities when required.

Consultation

The Green Fleet Strategy was developed with input from various City service areas who were engaged through questionnaires and stakeholder engagement sessions to provide feedback to help guide the direction of the strategy. As well, Hydro Ottawa was consulted in accordance with motion 2023-12/10. See the Consultation Implications section of this report for a description of the strategy's consultation activities and results.

Recommendation 2: Approve the adoption of an agile implementation framework for the Green Fleet Strategy, incorporating scheduled technology and progress reviews to ensure flexibility and responsiveness to emerging vehicle technologies and industry trends.

The two key principles of the Green Fleet Strategy include its agile approach and long-term outlook. In support of these principles, staff propose that the strategy undergo regular reviews to ensure it remains responsive to emerging and continuing innovations in technology and market availability of alternative vehicles and fuel options as well as other industry trends. Each review would be followed by a report to Council with the results including any required updates to the strategy.

Regular reviews and updates to Council

The information and estimates presented in the strategy are based on present day assumptions and analysis that include cost estimates, GHG emissions savings and fleet composition that may change in the future. To monitor the risk of changing markets and technology, as well as associated costs and potential GHG reduction impacts, staff recommend that regular reviews of zero-emission vehicle technologies and market availability be conducted every five years or sooner as an ongoing practice throughout the lifespan of the strategy.

Ongoing comprehensive technology reviews and market scans will help staff assess the available alternative and zero-emission technology options and inform any necessary adjustments to the strategy to continue toward the City’s zero-emission goal in 2040. It is also expected that these regular reviews will provide insights into when alternative ZEV options could attain cost parity with internal combustion engine counterparts. The strategy considers that the additional cost associated with refueling infrastructure should be factored in when assessing the competitiveness of ZEV options against ICE alternatives. Furthermore, this added cost should be weighed against the long-term benefits of fostering continuous ZEV technology adoption. Informed by robust research on the Canadian vehicle market, this approach allows the City to accelerate ZEV uptake when the cost becomes comparable, ensuring optimal cost-benefit in ZEV acquisitions.

The proposed reviews would consider:

- Available ZEV options in the market that align with the City's operational and service requirements
- Options that meet the majority of a class's requirements and explore commercially proven upfits that reliably fulfill specific needs
- Evaluation of the reliability of the energy supply chain, which is essential for the ZEV fleet
- A cost-benefit analysis to help determine the most suitable zero-emission options in the market

The ongoing regular review process would continue to support the alignment of the fleet transition plan with the uncertainties in asset markets, as well as the unpredictable nature of fuel, energy prices, and technological advancements. And as innovations in technology and market data on alternative vehicles emerge, the strategy will remain current, support cost-effective procurement decisions and ensure alignment with City needs and infrastructure considerations.

Following these periodic reviews, the strategy would most likely require adjustments to update cost estimates, GHG emissions savings, fleet make-up projections, and infrastructure requirements, among other elements. Fleet Services will provide regular updates to Council on the findings of future technology reviews and required adjustments to the strategy.

Recommendation 3: Direct staff to complete the initial comprehensive review of the Green Fleet Strategy within five years, focusing on assessing advancements in low and zero-emission vehicle technologies, including electric and hydrogen-powered vehicles, as well as infrastructure developments and report back to Council with any recommended updates.

Within approximately the next five years, staff anticipate that there will be enough advancement in technology and vehicle markets to warrant the first review of the Green Fleet Strategy. This review will include an assessment of the improvements or changes in zero or low-emission vehicle technologies, including electric and hydrogen-powered vehicles and accompanying infrastructure, followed by a report back to Council with the results and any required updates to the strategy for their approval.

The first review will help staff assess if there are any new or improved technologies that the City can adopt that would assist the City in targeting heavy-duty vehicle emissions. In particular, this first review, modeled in the report to occur in 2027, is pivotal because the models in the strategy are built around the assumption that hydrogen will be a viable technology for medium and heavy-duty vehicles in the near to medium future. The review will enable the elements in the strategy such as the infrastructure plans and cost estimates to be adjusted to remain current. GHG savings calculations may also require adjustments after this review.

Following the first review, the results will be brought back to Council and direction will be sought to continue informing and updating the City's Green Fleet Strategy, including whether the strategy is ready to shift to the Toward Zero-Emissions path.

Conclusion

Fleet Services is committed to meeting the GHG emissions reduction targets set out in the City's Climate Change Master Plan and the 2023-2026 Term of Council Priorities. The Green Fleet Strategy provides a roadmap to meet these goals. It is based on present-day vehicle technology market readiness and availability and the understanding that as technology advances, so will the Green Fleet Strategy. Through regular reviews and continued collaboration with stakeholders, the strategy will be able to respond to short-term challenges, anticipate mid-term impacts, and remain focused on the overarching goal of achieving maximum greenhouse gas emissions savings by 2040.

Staff will provide regular reviews and updates to Council and continue to assess the feasibility and success of the strategy outlined within this report.

FINANCIAL IMPLICATIONS

In the short term, the strategy will be implemented through existing budgets. Staff will continue to assess where additional funding is required (for example, infrastructure, procurement and staffing) and continue pursuing available funding when required, including through Provincial and Federal opportunities. Should additional funds be required, requests will be submitted as part of the annual budget process for Council approval as well as through the annual Fleet Vehicle and Equipment Plan report.

LEGAL IMPLICATIONS

There are no legal impediments to implementing the recommendations as outlined in this report.

COMMENTS BY THE WARD COUNCILLOR(S)

This is a citywide report.

CONSULTATION

The following City service areas were consulted, and their feedback considered in the development of the final Green Fleet Strategy, as set out in Document 1:

- Asset Management Services
- Climate Change and Resiliency Services
- Facility Operations Services
- Fleet user groups:
    - Building Code Services
    - By-law and Regulatory Services
    - Ottawa Fire Services
    - Ottawa Paramedic Service
    - Parks Maintenance and Forestry Services
    - Roads and Parking Services
    - Solid Waste Services
    - Traffic Services
    - Water Services - Drinking Water (Linear)
    - Water Services - Vertical Water (Drinking Water and Wastewater)

There were no public consultations associated with this report.

Initial consultation

Initial consultation consisted of a questionnaire followed by a series of engagement sessions with City service areas to understand the operating demands of the vehicles

within each user group's fleet, as well as the key themes related to low carbon fleet adoption. Discussions included topics such as an overview of each group's services, fleet composition, service demand, needs of each vehicle type, key challenges (as they pertained to fleet operations and vehicles), and preferred technology and/or alternative fuel. This information was used to inform alternative fuel choices for vehicle replacement assumptions; this included considerations such as range, load capacity, and additional requirements to meet operating demands. Additionally, lessons learned regarding alternative fuel vehicle deployment to date (for example, compressed natural gas and hybrid vehicles) were compiled to further advise the vehicle replacement assumptions.

Initial stakeholder engagement findings revealed:

- Most service areas and staff are open to trying alternative fuels and technologies, as long as it is proven technology.
- Operations are often split between east and west, as well as urban, suburban, and rural areas.
- Heavy vehicles are stored inside where possible.
- Waste vehicles are the largest source of maintenance costs for the City.
- Most vehicles are returned to their respective base, very few are taken home and only when on call.
- Most of the sites have indoor space constraints and electrical capacity constraints.
- Most service areas do not have experience with alternative fuels (biodiesel, compressed natural gas, renewable diesel, etc.), and few have experience with electric vehicles.
- Staff education will be extremely important when introducing new technologies.

Follow-up consultation

Following the development of a draft document, stakeholders were re-engaged for their subject matter expertise and to ensure that their initial feedback was incorporated accurately. Follow-up sessions were held with service areas that provided feedback, to validate their input for consideration in the final strategy. Feedback was generally supportive and many comments focused on continuing to hold regular discussions with Fleet Services to ensure ongoing operational needs are met when green alternative units are investigated.

Council motion 2023-12/10 directed staff to consult with Hydro Ottawa on developing projects in the City of Ottawa that may impact the electricity grid's current and future capacity/resiliency, so that Hydro Ottawa may provide expertise and advice, subject to any restrictions contemplated by applicable competition legislation. In support of the

Council motion, Fleet Services shared the draft Green Fleet Strategy with Hydro Ottawa in August 2024. Their feedback included suggestions for additional consideration such as load management strategies, as well as willingness to support the City through future discussions to advance the Green Fleet Strategy.

ACCESSIBILITY IMPACTS

The Green Fleet Strategy addresses the City's sustainability initiatives, in support of broader Climate Change Master Plan, which outlines ambitious greenhouse gas emissions reduction targets. This strategy aims to guide the City in achieving its goal of net-zero fleet emissions by 2040.

Finance and Corporate Services adheres to the requirements of the *Accessibility for Ontarians with Disabilities Act, (2005)* and the *Integrated Accessibility Standards Regulation, 191/11* in its operations, programs and initiatives.

The City will ensure that all applicable accessibility legislation and standards are adhered to, as well as consultation with the community of persons with disabilities will be undertaken where applicable, during implementation of the Green Fleet Strategy.

ASSET MANAGEMENT IMPLICATIONS

The recommendations documented in this report are consistent with the City's Comprehensive Asset Management (CAM) program objectives. Specifically, the phased Green Fleet Strategy, purchase plan, and related recommendations consider:

- An agile implementation strategy and periodic review to address numerous uncertainties
- Optimization of cost-benefit
- Infrastructure required to implement the strategy
- Initial upfront costs, operating costs, maintenance costs, extending the useful life of existing assets, and total cost of ownership
- Training and skill development required
- Monitoring of the strategy implementation and reporting
- Alignment with the Climate Emergency Declaration, Climate Change Master Plan, and Energy Evolution

The implementation of the CAM program enables the City to effectively manage existing and new infrastructure to maximize benefits, reduce risk, and provide safe and reliable levels of service to community users. This is done in a socially, culturally, environmentally, and economically conscious manner.

When the City commits to the acquisition of new assets, consideration must also be given to the City's commitment to fund future operations, maintenance, and renewal costs. It must also account for future depreciation when reviewing long-term financial sustainability. When reviewing the long-term impacts of asset acquisition, it is useful to consider the cumulative value and lifecycle costing of the acquired assets being taken on by the City.

Any assets acquired in the future through the implementation of the Green Fleet Strategy would be added to the inventory of assets and financial forecasts in the appropriate Asset Management Plan.

CLIMATE IMPLICATIONS

The replacement of gasoline and diesel-powered vehicles within the City's Fleet is expected to result in significant reductions in GHG emissions and progress towards the targets in Energy Evolution. Current emissions from the Corporate Fleet are estimated to be approximately 30,000 tonnes of CO2 annually.

The adoption of zero emission technologies such as battery-electric and hydrogen vehicles are expected to result in emissions reductions of 93 per cent compared to the baseline emissions of 2012.

Emissions are expected to gradually decrease over time as traditional vehicles are retired and new zero emission vehicles are purchased.

As zero-emission technology is experiencing high levels of innovation, there is a potential for the pace for zero emission vehicles to accelerate should vehicle availability continue to increase and cost of ownership continue to decrease.

ENVIRONMENTAL IMPLICATIONS

Emissions generated through the combustion of fossil and alternative fuels contribute to air pollution and low air quality. The Green Fleet Strategy aims to transition the City's fleet to zero-emission vehicles where possible, to help reduce fuel use, air pollution and GHG emissions.

RISK MANAGEMENT IMPLICATIONS

There are risk implications. These risks have been identified and explained in the report and are being managed by the appropriate staff.

RURAL IMPLICATIONS

In the development of the Green Fleet Strategy, rural operational requirements were considered in the evaluation criteria that was developed to rank the various vehicle technologies selected in the evaluation matrix. For example, range challenges, service inoperability, maintenance downtime and refueling time were considered when reviewing the various technologies. There are no specific rural implications with the recommendations of this report.

Fleet Services considers the unique geography of rural communities in its operations, for example when determining vehicle suitability during procurement and in the deployment of vehicles for service.

TERM OF COUNCIL PRIORITIES

This report supports the current 2023-2026 Term of Council Priorities, specifically a city that is green and resilient, strategic objective 16: Reduce emissions associated with the City's operations and facilities. The Green Fleet Strategy supports the City's efforts to reduce corporate fleet greenhouse gas emissions.

SUPPORTING DOCUMENTATION

Document 1 – Executive Summary – City of Ottawa Green Fleet Strategy

DISPOSITION

Fleet Services will implement the recommendations as approved by Council and continue to report annually to Council through the Fleet Vehicle and Equipment Plans report with updates on the municipal fleet's transition to low and zero-emission vehicles.

***Note**: Minor revisions were made to Figure 1 on page 20 of the English report and Figure 1 on page 24 of the French report—specifically, removing "2023" and repositioning "Today/Aujourd'hui," updating references from "2024" to "2040," and revising the French text to "Déterminé par la disponibilité du marché dans 3 à 5 ans"—further to the City Clerk's Delegated Authority, as set out in Schedule C, Section 8 of Delegation of Authority By-Law 2025-69.*