



SUBJECT: Green Fleet Strategy Update

TO: Environment, Infrastructure & Community Services Cttee.

FROM: Roads, Parks and Forestry Department

Report Number: RPF-24-23

Wards Affected: All

File Numbers: 465-11

Date to Committee: October 5, 2023

Date to Council: October 17, 2023

Recommendation:

Receive and file the roads, parks and forestry department report RPF-07-23, providing an update to the City of Burlington's Green Fleet Strategy; and

Direct the Director of Roads, Parks and Forestry together with the Corporate Strategic Lead, Government Relations to seek funding opportunities to support the city's green fleet transition, including the purchase of vehicles and the installation of the necessary infrastructure.

PURPOSE:

The purpose of this report is to provide a road map and framework to achieve our corporate fleet target of being net carbon neutral by 2040.

Vision to Focus Alignment:

- Support sustainable infrastructure and a resilient environment.
- Deliver customer centric services with a focus on efficiency and technology transformation.

Background and Discussion:

The primary objective of the City of Burlington's (the City's) Green Fleet Strategy Update in 2023 is to reassess the fleet transition roadmap, and its economic and

environmental impacts to amend the 2008 Green Fleet Strategy with the most appropriate low-carbon or zero-emissions fleet alternatives, which can support the City's broader goal of achieving corporate carbon neutrality for its corporate, fire and transit fleet by the year 2040.

The Green Fleet Strategy Update assesses the current state of the City's fleet inventory and operations to understand the fleet mix and its performance requirements. A current state assessment was undertaken, resulting in a fleet transition strategy and implementation roadmap including economic modelling which compared pathways to two potential future states – one with internal combustion engine (ICE) vehicles resulting from business-as-usual (BAU) procurement practices and the other involving a green fleet. The comparative assessment specifically evaluated the periodic and cumulative profiles of greenhouse gas (GHG) emissions, capital expenditures and operating expenditures associated with the two transition pathways.

The green fleet transition pathway is shaped by the following principles:

- Diesel and gasoline ICE vehicles (also referred to as GHG vehicle technologies) to be ideally replaced by zero-emissions technologies with no tailpipe emissions. Hybrid-electric technology will be used as an intermediate pre-electrification solution where feasible.
- Alternative low-carbon fuel technologies should be avoided to the best possible extent considering GHG reduction targets for the year 2040 and the complexities of operating a fleet using multiple fuels.
- Fit for purpose and opportunities for down-sizing of a vehicle or vehicle group, including pooling may be considered at the time of replacement based on utilization ratios as well as operational needs to support optimal service delivery models.

The executive summary for the Green Fleet Strategy Update study document is attached in Appendix A.

Current Vehicle Types

The City of Burlington owns and operates a fleet of over 353 vehicles. Each of the City's fleet Operating Groups, Fire Department and Transit Department use a mix of vehicles such as Cars/Minivans/SUVs, Fire/Emergency Vehicles, Medium-Duty Vehicles, Heavy-Duty Vehicles, Pickups/Vans, Tractors/Loaders, Street Sweepers, Transit Buses, and Utility Vehicles/Gators.

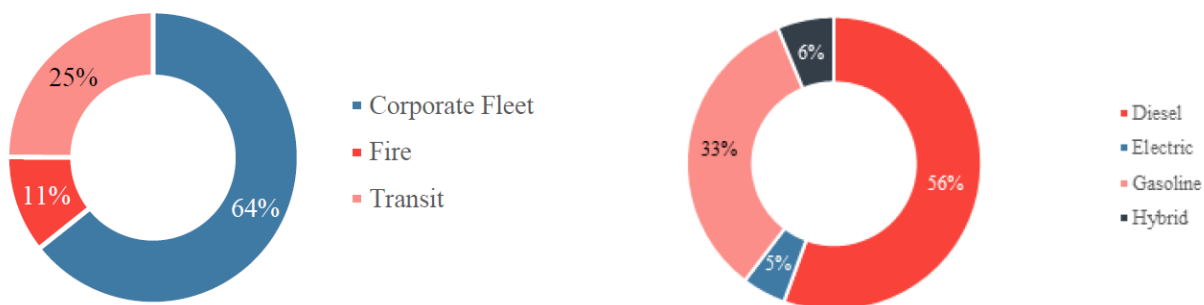


Figure 1: Distribution of Vehicles by Fleet-Operating Group and Fuel Type

A majority of the vehicles in the City’s fleet are propelled by ICEs. A fleet transition to lower-carbon or zero-emissions alternatives has begun starting with the light-duty passenger vehicle segment. 11% of the fleet uses electric or plug-in hybrid vehicle technology.

Current Emissions

Emissions are defined by Scope 1, Scope 2 and Critical air contaminants (CAC). Scope 1 emissions are greenhouse gas emissions that occur from sources that are controlled or owned by the City (vehicle emissions). Scope 2 emissions are indirect emissions associated with the purchase of electricity as a result of the City’s use (charging costs). CAC emissions are air pollutants that cause smog, acid rain and other health hazards. Emissions analysis indicates a general downward trend in the Scope 1 and Critical air contaminants (CAC) emissions from fleet operations driven by the decreasing average annual fossil fuel consumption per vehicle. Such a reduction in fuel consumption can be partly attributed to the transition of light-duty passenger vehicles to Electric Vehicle (EV), Plug-in Hybrid Electric Vehicle (PHEV) technology and more efficient ICE engines. Closer observation indicates that:

- **Scope 1 emissions** have primarily declined for the diesel operated portion of the fleet whereas they have increased for the gasoline operated portion in contrast.
- **Scope 2 emissions** have increased from 2019 to 2022 because of an addition of EVs and PHEVs, the only contributors to Scope 2 emissions in this study. These vehicle technologies increase indirect emissions from the increased consumption of electricity by the City of Burlington.
- **CAC emissions** have declined, predominantly due to a decreasing consumption of diesel from 2019 to 2022.

Scope 1 GHG emissions and CACs will continue declining in the near-term with the electrification of light and medium-duty passenger vehicles as shown in the downward trend from 2019-2022 in Figure 2. The downward trend is expected to slope steeper in

the medium-term depending on the technological readiness of electric or hybrid-electric variants of medium and heavy-duty vehicles.

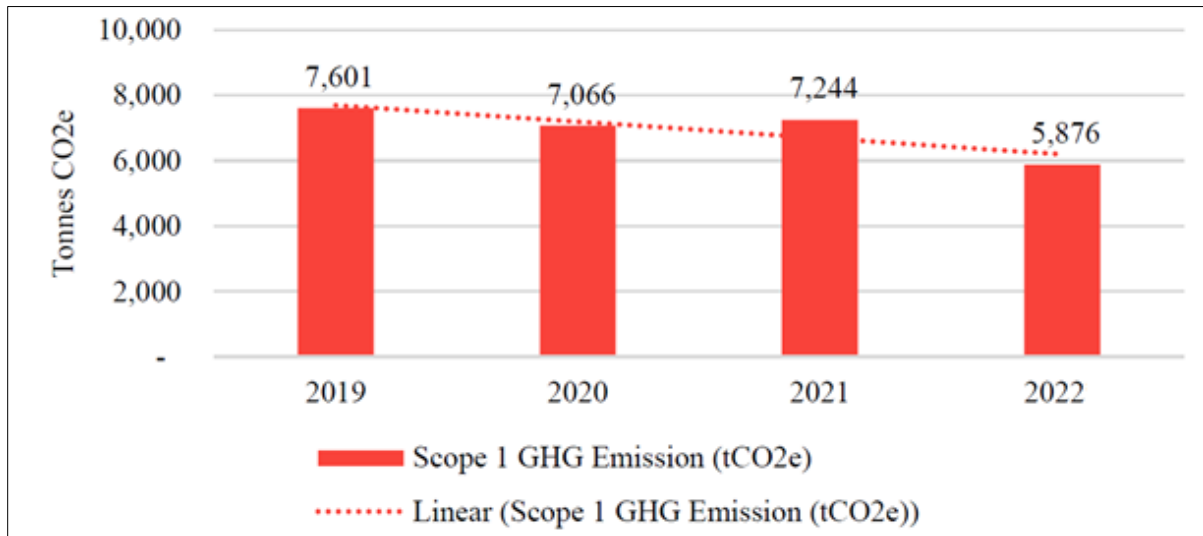


Figure 2: Historical Reduction of Scope 1 Emissions

Strategy/process/risk

Transition Plan

It is recommended that the implementation of the City's Green Fleet Strategy is phased to meet expectations of industry procurement. Many of the technologies suggested in Phase 1 are readily available whereas technologies in Phase 2 and 3 are in their infancy. This plan follows industry best practices for decreasing emissions while purchasing vehicles at their best value with technology availability. See figure 3 below showing procurement phasing. The vehicle count in each phase are green vehicle purchases. In the first phase, not all vehicles being purchased will be green due to technology availability. These vehicles will be replaced in phase 3 once they reach their expected life cycles and technology is more widely available.



Figure 3: Fleet Transition Phasing Strategy

Phase 1: Year 2024 to 2028

It is recommended that the replacement of light-duty and passenger vehicles with battery electric or hybrid electric alternatives at the end of their expected useful life (EUL) take precedence in Phase 1 of the transition. A variety of models in this vehicle segment are beginning to be widely adopted and are capable of delivering a reliable power and range performance at par with diesel and gasoline vehicles. A green transition for transit buses is recommended to commence in Phase 1 considering the availability and increasing large-scale deployment of battery electric and hydrogen fuel cell electric buses in Canada and abroad.

Phase 2: Year 2029 to 2033

Advancement towards full electrification started in Phase 1 and will continue with additional light-duty and passenger vehicle, as well as transit bus replacements with zero-emissions or hybrid-electric alternatives in Phase 2. The replacement of fire trucks as well as medium-duty (MDV), heavy-duty (HDV) and utility vehicles may also begin in Phase 2 considering the anticipated commercial advancement of relevant zero-emission vehicles and fueling technologies. A substantial proportion of the fleet - 42 per cent - will transition in Phase 2.

Vehicle technologies as well as availability is expected to improve during this phase as it aligns with the federal government's proposed regulation that will require 60% of new light-duty vehicle sales be zero-emission vehicles by 2030, increasing to 100% of sales by 2035.

Phase 3: Year 2034 to 2040

Remaining fire trucks as well as MDVs, HDVs and utility vehicles, especially new GHG units procured during Phase 1, all of which constitute up to 15 per cent of the City’s fleet, may be eventually replaced with zero-emissions alternatives in Phase 3. This transition is contingent on the technological advancement and availability of equivalent zero emission vehicle and equipment alternatives.

Achieving Fleet Carbon Neutrality

Tailpipe emissions from vehicles will drop to zero leading up to the year 2040 as the green fleet inventory expands to all vehicle groups. As depicted in Figure 4, the fleet will undergo a notable drop in overall Scope 1 and 2 emissions during the period of the fleet transition from 2024 to 2040 as well – amounting to a 57 per cent cumulative reduction compared to continued diesel vehicle replacements.

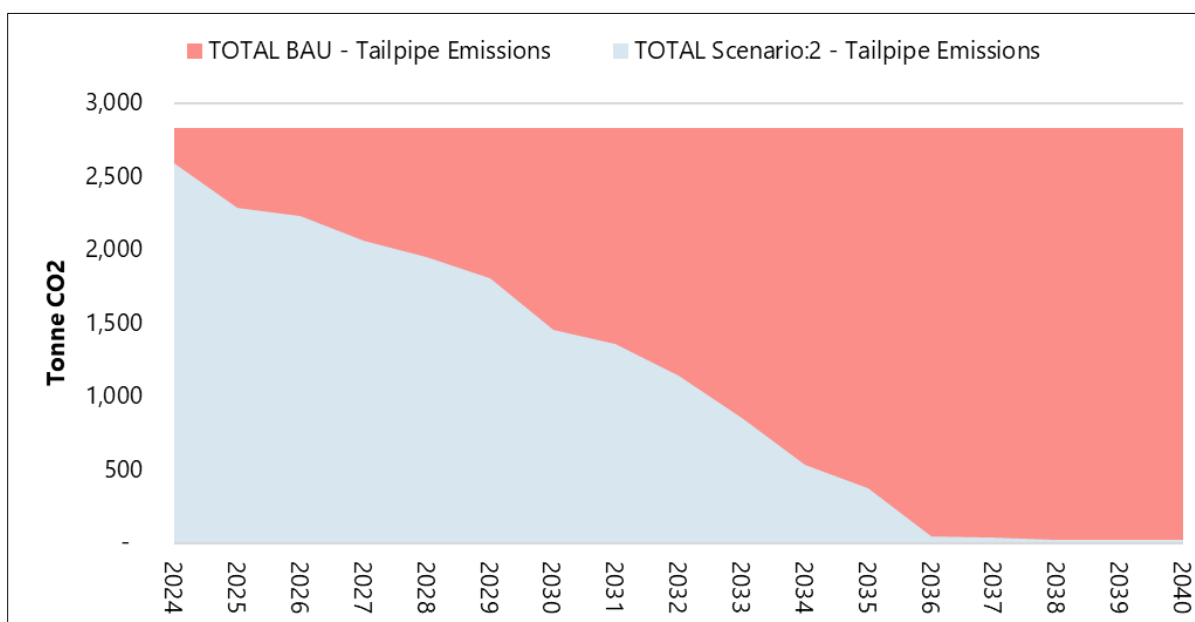


Figure 4: Tailpipe Emissions Trajectories for the Green Fleet Transition

Low-carbon hydrogen also has the potential to play an important role as an alternative fuel to eliminate tailpipe emissions from certain vehicle groups for which battery-electric technology would limit performance capabilities. While the hydrogen fuel cell electric vehicle (FCEV) market diversifies to different vehicle types, hydrogen supply infrastructure is the other critical value chain link requiring advanced planning. Early engagement and partnership planning with other potential regional end-users of hydrogen would allow the City of Burlington to share the risks and opportunities involved in piloting and deploying a hydrogen supply chain for its fleet.

Managing Risk

Based on the fleet transition roadmap and strict performance demands dictated by strenuous duty cycles, it is recommended that the City initiate pilot projects to acquire user experience, gather empirical performance data and prepare for asset management of newly commercializing zero-emission models. Piloting before committing to their large-scale deployment can be a valuable 'stepping-stone' initiative to create familiarity with and reliance on a new technology. This includes understanding the ability of a vehicle to perform its required duty cycle, identifying its strengths, and identifying weaknesses that require solutions on the vehicle or service-delivery planning side. Such familiarity helps refine the procurement strategy and fleet transition rate to better inform the selection of suitable charging or fueling solutions.

Other Considerations - Infrastructure and Ancillary Facility Requirements

Infrastructure support and ancillary facility modifications will be required in order to properly accommodate the new electrified fleet. Figure 5 shows the facility and infrastructure upgrade guideline to accommodate the new fleet. Power infrastructure requirements are estimated based on period-values of power demand as well as resulting charger requirements and substation, switchgear and transformer upgrade timings. The period-values of power demand for each vehicle group are based on its annual energy consumption estimate, number of active operating days and the number of charging hours per day.

The power infrastructure upgrade is a high-level cost estimate based on a general/overall needs assessment in specific years as the EV fleet expands. This plan is being closely coordinated with the Facilities & Buildings and the Infrastructure groups as the plan progresses. These costs are included in the capital expenditure plan in Figure 6 under Financial Matters.

	Phase 1: 2024 – 2028	Phase 2: 2029 - 2033	Phase 3: 2034 - 2040
Facility & Infrastructure	<ul style="list-style-type: none"> • Upgrade on-site utility infrastructure to accommodate BEV and HEV passenger electric vehicles, LDVs and ZEBs • Expand on-site charging infrastructure to accommodate capacity for expected Phase 2 ZEV electrical charging requirements 	<ul style="list-style-type: none"> • Continue to upgrade utility infrastructure to accommodate incoming Phase 2 electric vehicle procurements • Expand charging infrastructure to accommodate capacity for Phase 2 and Phase 3 expected charging requirements 	<ul style="list-style-type: none"> • Continue to upgrade utility infrastructure to accommodate incoming Phase 3 electric vehicle procurements • Assess infrastructure upgrades to accommodate fleet growth beyond the year 2040 • Review & update infrastructure & facility plans

Figure 5: Facility Transition Plan Outline

Financial Matters:

The gross costs of a green fleet transition between the years 2024 and 2040, including vehicle operating costs within that period are expected to surpass \$432 million compared to \$362 million in the case of business-as-usual procurement practices. This amounts to a nearly 19 per cent increase in the cumulative fleet expenditure for the City as shown in Figure 6.

Capital and Operating Cost Summary		
Cost Summary	Business as Usual Scenario	Green Fleet Scenario
CAPITAL COSTS		
Gross Fleet Renewal Cost	206,155,015	317,332,762
Gross Infrastructure Cost	-	9,187,602
Sub-total	206,155,015	326,520,364
OPERATING COSTS		
Gross Fleet Maintenance Cost	84,475,611	68,725,464
Gross Fleet Fuel Cost	61,667,434	31,990,064
Gross Fleet Charging Utility Cost (Demand Charges)	-	90,939
Gross Fleet Infrastructure and Staff Operations Costs	425,983	2,226,527
Gross Fleet Carbon Tax	9,219,124	2,632,130
Sub-total	155,788,152	105,665,124
Total - Without External Funding (2023 Dollars)	361,943,167	432,185,488
Gross Cost Difference –Green Scenario versus Business as Usual		+19.4%
Total - With External Funding (2023 Dollars)	361,943,167	423,197,974
Gross Cost Difference – Green Scenario versus Business as Usual		+16.9%

Figure 6: Gross cost summary for the Business as Usual and Green Fleet Scenario

Assuming that a portion of these total costs can be offset by external capital funding contributions for public transit (30%) and municipal fleets (10%) from now until 2027 and 2030 respectively, the green fleet scenario will cost approximately \$423 million to the City of Burlington. In other words, the modeled external capital funding for vehicle procurement until year 2030 has the potential to relieve the municipal expenditure burden by a maximum of \$9 million based on current assumptions. Figure 7 shows the capital expenditures for the implementation of the green fleet strategy which includes infrastructure costs, external funding, transitional capital costs as well as the fleet renewal budget. The largest costs occur during phase 2 and 3 of the study as the heavy-duty technology and assets are replaced during these phases.

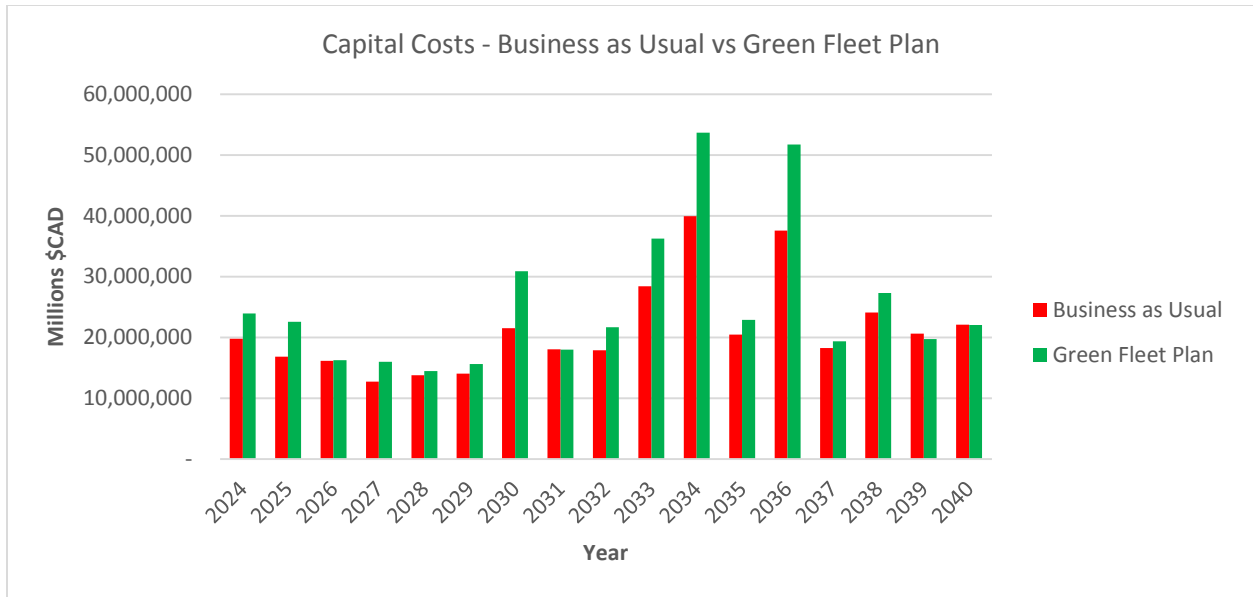


Figure 7: Periodic Capital Expenditure Profile for the Green Fleet Transition

The procurement and use of electric vehicles presents operating cost savings for maintaining an electrified fleet. An electrified fleet generally has less maintenance costs due to the absence of differing components from an ICE vs an EV vehicle. These operating cost savings are shown in Figure 8. We are cautiously optimistic that savings will be achieved with an electrified fleet, and this will be closely monitored, however it should be noted that new operating costs associated with software and battery system maintenance will likely be needed for these new technologies.

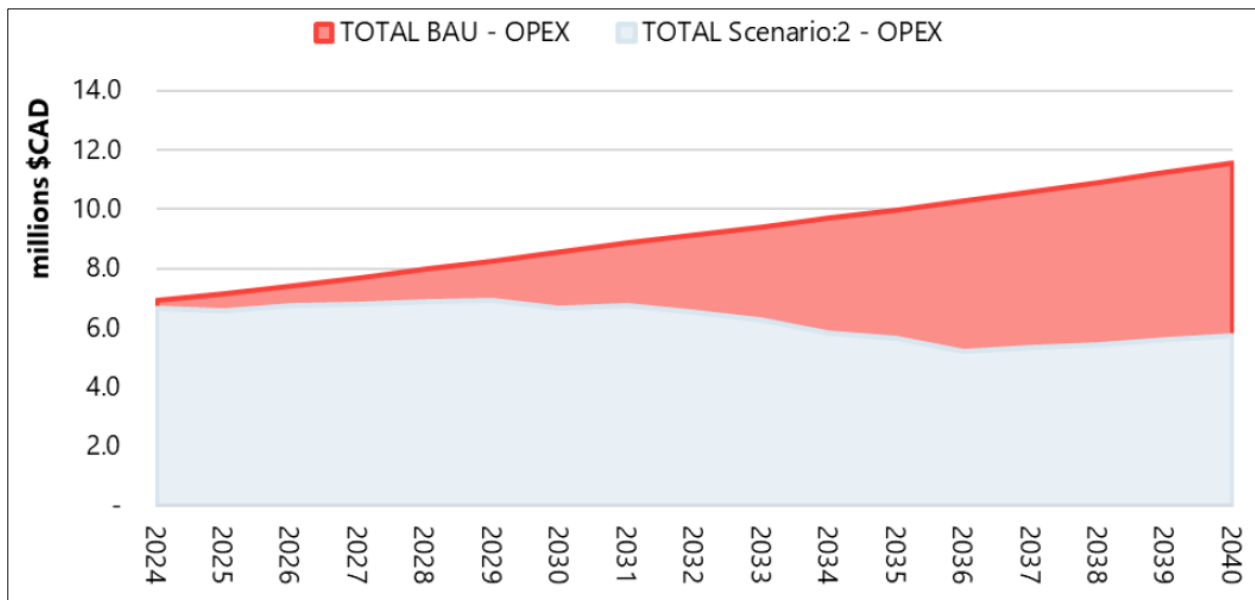


Figure 8: Operating Expenditure Profile Reduction over Business as Usual (BAU) for the Green Fleet Transition

The capital expenditure profile for the green fleet scenario is likely to be untenable within the City of Burlington's current fleet renewal budget. Forecasts are most notable for the years 2030, 2033, 2034 and 2036, exceeding the City's annual budget as shown in Figure 7. Fire trucks, HDVs, MDVs and Tractor/Loaders – categories predominantly due for transition in years with expenditure peaks – all cost at least 50 per cent more than their ICE variants.

Although this report does not seek direct approval for funds, it is requested that consideration be given to:

- increased investment to achieve the City's carbon neutrality through fully electric vehicle purchases, upgrading infrastructure to accommodate additional electric vehicles, installation of chargers and alternative/pilot green procurement. Although additional funding will likely be required for larger vehicles, the investment should show lower operating costs over the lifecycle of the vehicle and lower our carbon footprint.
- engage provincial and federal agencies to raise awareness and seek grants or supplemental funding in order to facilitate green fleet transition and mitigate the city's costs.

Connections:

This plan has several connections to other plans and policies such as the Corporate Energy and Emissions Management Plan, Corporate Sustainable Building Policy and Corporate Energy Policy. Installing infrastructure to accommodate electric vehicles such as chargers is intended to be incorporated into Asset Management Plans and Facility Master Plans.

In addition, coinciding with the Green Fleet Strategy is the Zero-Emission Bus Fleet Implementation and Rollout Plan being completed by Burlington Transit with the Canadian Urban Transit Research and Innovation Consortium (CUTRIC). This Green Fleet Strategy update provides a preliminary overview and costs of transit plans. However, more in-depth details on Transit's conversion plan will follow from Burlington Transit.

Finally, connections with many day-to-day decisions will be impacted by this plan and its importance to offset climate impact in association with the City's Climate Emergency Declaration.

Engagement Matters:

The City continues to participate in energy conservation events and engagement through its environmental sustainability division. The Take Action Burlington blog is also used to engage staff and the public in energy conservation initiatives. City staff are planning further initiatives to increase public awareness of our corporate energy use through publishing information on the city's website pertaining to energy consumption.

Conclusion:

The updated 2023 Green Fleet Strategy provides a road map and framework to achieve our corporate fleet target of being net carbon neutral by 2040. The plan is contingent on funding as well as advancements in zero-emission technologies for medium duty, heavy duty and utility vehicles while not impacting existing service capabilities. This strategy therefore needs to be reviewed and updated on a regular basis at a 5-year cycle as technology in the automotive industry is developing rapidly.

Respectfully submitted,

Paul Swioklo, P.Eng.
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Appendices:

A. Executive Summary of 2023 Green Fleet Strategy

Report Approval:

All reports are reviewed and/or approved by the Department Director, the Chief Financial Officer and the Executive Director of Legal Services & Corporation Counsel. Final approval is by the City Manager.