Sustainable Fleet Plan

Executive Summary Report

Toronto Parking Authority

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→ **The Power of Commitment**

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1. Introduction

This report offers a focused summary based on the comprehensive Sustainable Fleet Transition Plan for Toronto Parking Authority (TPA). The project compares the total cost of ownership (TCO) between battery electric vehicles (BEVs) and internal combustion vehicles (ICEs) across key vehicle segments, including cargo vans, SUVs, sedans, and utility trucks. Additionally, the study outlines the recommended replacement order and schedule for the next 25 years (2025 to 2050). While this summary provides a brief overview, the full Sustainable Fleet Plan includes a detailed analysis of the financial, environmental, electrical, and infrastructure implications for each scenario. This analysis is divided into three hypothetical transition scenarios:

1. "Business-as-Usual" reference scenario (Scenario 1) in which existing operations persist, and the TPA continues to purchase the same vehicle types (Internal Combustion Engine (ICE) vehicles and certain battery electric vehicles (BEVs).
2. "TransformTO Target" scenario (Scenario 2) in which all vehicles are replaced with EVs through a levelled schedule such that the fleet can achieve net-zero carbon emissions by 2040. This was noted as the highest priority scenario for TPA to explore.
3. "Government of Ontario Target" scenario (Scenario 3) in which vehicles are replaced with EVs at a more gradual rate, emphasizing long-term longevity of existing vehicles due to leniency of the emission target set by the Government of Ontario (80% carbon emission reduction from 1990 levels before 2050). It is important to note that fleet emissions from TPA were not available from 1990 levels, therefore, existing fleet emission levels (2024 carbon emissions) were utilized as a baseline.

1.1 Overview of Scenario Parameters

This analysis utilized financial data provided by TPA, along with external data points, the total cost of operation (TCO) of the fleet for each scenario. The main components of the TCO are the capital expenditures (CAPEX) which include the initial purchase price for vehicles, potential federal rebates for the vehicles, and the initial cost of electrical and charging infrastructure, and operating expenditures (OPEX) which encompass fuel and electricity costs, maintenance for both vehicles and infrastructure, as well as other fleet consumables and insurance. The summarized financial data is presented in Table 1.

A detailed breakdown, including a year-by-year financial forecast, itemized cost breakdowns, and additional information on these components can be found in the full Sustainable Fleet Plan or in the Financial Analysis and Financial Drillthrough tabs of TPA's Fleet Assessment dashboard[1].

[1] https://app.powerbi.com/groups/0f5518ca-20a9-4ee3-81d6-91ce113e70c8/reports/87bedafa-ee62-40ae-8d31-e2733c20e11a/ReportSection14d0898d3ad01279a077?ctid=5e4e864c-3b82-4180-a515-5c8fb718fff8&experience=power-bi

Table 1 Scenario overview

Scenario	Transition Scenario	Fleet Unit Replacement Description	Financial (TCO, CAPEX, OPEX)	Environmental (CO_2 emissions)
1	Business-as-Usual	Between 1-17 replacements per year according to estimated age of units in the fleet.	**$19.7M** TCO **$10.5** Vehicle CAPEX **$9.2M** Vehicle OPEX	No reduction from baseline. **6.3M kg** Total CO_2 Emissions.
2	TransformTO Target	Levelled out to replace between 1 and 10 vehicles per year, nonetheless, condensed to meet net-zero targets.	**$23.0M** TCO **$16.5M** Vehicle CAPEX **$5.0M** Vehicle OPEX **$1.4M** Infrastructure CAPEX **$176.5K** Infrastructure OPEX	100% emission reduction by 2040. **1.3M kg** Total CO_2 Emissions. **5.0M kg** Total CO_2 Offset from Scenario 1.
3	Government of Ontario Target	Levelled out from Scenario 2 to achieve 80% reduction of CO2 emissions by 2050.	**$20.4M** TCO **$12.1M** Vehicle CAPEX **$6.8M** Vehicle OPEX **$1.3M** Infrastructure CAPEX **$166.5K** Infrastructure OPEX	80% reduction by 2050. **3.5M kg** Total CO_2 Emissions. **2.8M kg** Total CO_2 Offset from Scenario 1.

1.2 Vehicle Selections

Based on the fleets' required capabilities and range, 20 replacement vehicles corresponding to different vehicle classifications and drive types were selected for analysis as summarized in Table 2, below. Prices are accurate as of April 2024 and do not include taxes or destination fees. For vehicle classes that are currently unavailable for commercial purchase, a 'concept' vehicle was utilized as a placeholder datapoint to model the transition scenarios. The concept vehicle data was comprised of specifications (purchase price, energy efficiency, service life, etc.) that were extrapolated from available ICE-BEV ratios of other classes. With some garages having limited clearance, shorter models of vehicles were prioritized alongside the consideration of market availability. The full Sustainable Fleet Plan lists out each garage with the selected vehicles that are capable of clearing the roof barrier.

Table 2 Selected vehicle parameters

Classification	Type	Make and Model	EV Range (kms or hrs)	MSRP ($)	Rebate ($)	Height (m)
Car	BEV	Nissan Leaf SV Plus	342 km	$ 66,956	$5,000	1.575 m
Car	ICE	N/A		-		
SUV	BEV	Chevrolet Bolt EUV	397 km	$57,428	$5,000	1.616 m
SUV	ICE	N/A		-		
Cargo Van	BEV	Ford E-Transit	203 km	$99,145	$10,000	2.088 m
Cargo Van	ICE	Ford Transit Connect		$48,393		
Class 2A Truck	BEV	Ford F-150 Lightning Pro	386 km	$81,655	$5,000	1.990 m
Class 2A Truck	ICE	Ford F-150		$57,870		
Class 2B Truck	BEV	Concept Ford F250 EV	**	$99,807	**	**
Class 2B Truck	ICE	Ford F-250		$70,734		
Class 3 Truck	BEV	Concept Ford F350 EV	**	$115,770	**	**
Class 3 Truck	ICE	Ford F-350		$82,048		
Skid-Steer Loader	BEV	Volvo ECR25 Electric	4 hrs	$153,833	$2,000	2.299 m
Skid-Steer Loader	ICE	Bobcat HB880		$100,000		
Sweeper	BEV	Tennant S20 Battery-Powered	4 hrs	$90,000	-	1.530 m
Sweeper	ICE	Advance SW8000		$60,000		
Scrubber	BEV	Tennant T17 Battery-Powered	6 hrs	$90,000	-	1.490 m
Scrubber	ICE	Tennant T20		$60,000		
Utility Vehicle	BEV	Polaris RANGER XP Kinetic Premium	5 hrs	$111,272	$2,000	1.980 m
Utility Vehicle	ICE	Kubota RTV-X1100C		$72,054		

***These parameters for concept vehicles unavailable at this time as the zero-emission vehicle of this type does not exist yet*

1.3 Replacement Order

TPA currently replaces vehicles based on budgetary constraints and operational priorities. For this analysis, a replacement order was developed for each scenario, considering the operating condition and market availability of each asset and discussions with TPA during Workshop #1 on February 13, 2024. Vehicles were assigned a 'service life' of 5, 10, or 15 years, with replacement rates varying each year. In Scenario 2, all vehicles are replaced with BEVs in the initial cycle, achieving a fully ZEV fleet of 67 vehicles, with replacements continuing as vehicles reach the end of their service life. Scenario 3 features a more gradual BEV transition over three cycles, ultimately achieving a fully ZEV fleet beyond 2050. These outcomes are presented in Table 3. Vehicle prioritization for ZEV transition is influenced by current market availability, with older, light-duty vehicles prioritized for earlier transition, and specialized vehicles deferred for later cycles as the technology for specialty vehicles and equipment matures.

Table 3 List of unit replacements by scenario (based on units selected for replacement before 2030 in Scenario 2)

Unit	First Replacement (Scenario 1)	First Replacement (Scenario 2)	First Replacement (Scenario 3)
AAA01	2026	**2026**	2031
AAA02	2026	**2026**	2031
AAA04	2027	**2027**	2027
AAA05	2027	**2027**	2032
AAA07	2027	**2027**	2032
AAA08	2027	**2027**	2027
AAA09	2027	**2026**	2026
AAA11	2027	**2027**	2027
AAA12	2027	**2027**	2032
AAA13	2027	**2027**	2027
AAA14	2027	**2027**	2027
AAA15	2027	**2026**	2031
AAA16	2027	**2028**	2033
AAA18	2027	**2028**	2028
AAA19	2027	**2028**	2033
AAA20	2027	**2028**	2033
AAA21	2027	**2028**	2028
AAA51	2025	**2025**	2035
AAA56	2025	**2025**	2030
AAA58	2024	**2024**	2024
AAA59	2025	**2025**	2035
AAA63	2025	**2025**	2025
AAA66	2028	**2028**	2028
AAA68	2029	**2029**	2029
BBB03	2025	**2025**	2030
BBB05	2025	**2026**	2031
BBB08	2025	**2026**	2036
BBB17	2027	**2027**	2032
BOB01	2025	**2025**	2035
CCC01	2026	**2026**	2026
CCC02	2026	**2026**	2026
CCC03	2029	**2029**	2029
CCC04	2029	**2029**	2034
CCC05	2029	**2029**	2029
CCC06	2029	**2029**	2029
SW-02	2027	**2027**	2032

1.4 Infrastructure Summary

Both Scenarios 2 and 3 will require the same charging infrastructure at full electrification, with Scenario 2 requiring the infrastructure earlier due to a faster transition target. It is expected that TPA will primarily use Level-2 (L2) chargers, which can charge most small- to medium-sized EVs overnight. Direct Current Fast Chargers (DCFC/Level 3) are recommended for TPA's larger, specialized vehicles to meet their higher electrical demands and serve as a backup for smaller fleet vehicles. High power DCFC (L3+) are not currently necessary but may be re-evaluated in the future as TPA's ZEV fleet grows. Charging equipment is projected to be replaced on a 12-year cycle, with recommended periodic reassessment to align with technological advancements and operational needs.

A site visit was completed on March 21, 2024, with visits to four primary sites that host TPA's fleet: 110 Queen St W, 305 Rockcliffe Blvd, 2 Church St, and 30 Roehampton Ave. While other sites do exist, approximately 75% of the vehicles are located at these four sites, establishing them as the focus of the study. Each site was assessed noting potential challenges with limited site capacity, lack of existing charging infrastructure, and considerations for power supply jurisdiction amongst other agencies on-site. Energy usage, power availability and requirements, the number of additional chargers required for the increased service, and costs for infrastructure upgrades are described in detail per site in the full Sustainable Fleet Plan, with key parameters summarized in Table 4, below.

Table 4 Infrastructure summary

Site	# of Vehicles	Current Peak Load (kVA)	Max Additional Demand (kVA)	L2 Chargers Required	DCFC Chargers Required
Site 1: Carpark 36 – 110 Queen St	24	417 kVA	580 kVA	24	2
Site 2: Carpark 43 – 2 Church St.	9	261 kVA	230 kVA	9	1
Site 3: Carpark 49 - 30 Roehampton St	7	18.9 kVA	190 kVA	7	1
Site 4: 305 Rockcliffe Boulevard	11	10.5 kVA	270 kVA	11	1

1.5 Fleet Transition Recommendations

TPA's fleet performs various operational roles, necessitating strategic planning for a decarbonized fleet that meets all asset requirements. As an agent of the City of Toronto, TPA plays a crucial role in promoting a unified shift to a fully zero-emission vehicle fleet through knowledge sharing, joint procurement, infrastructure development, and policy standardization – aligning with environmental goals and enhancing regional sustainability efforts. The key points from the 4-phase Sustainable Fleet Plan report are summarized with risk mitigation recommendations below.

Phase 1 – Planning includes setting clear goals aligned with TPA's sustainability objectives and municipal mandates, such as the TransformTO targets. This phase focuses on strategic planning areas such as vehicle and fuel source selection based on fleet analysis and developing infrastructure plans for refuelling, charging, and maintenance. Lifecycle cost assessments are integral, ensuring comprehensive evaluations of procurement and operational expenses to inform robust decision-making throughout the planning process.

Phase 2 – **Real-World Testing** focuses on practical testing to validate feasibility study outcomes and lifecycle analyses for the selected vehicles. This phase involves deploying pilot vehicles in actual operating conditions to gather telematics and performance data, which informs assessments of vehicle range, charging/fuelling requirements, and infrastructure needs. Feedback from vehicle operators and stakeholders is integrated to refine vehicle selection and infrastructure planning, ensuring readiness for scaling up to a fully zero-emission fleet.

Phase 3 – **Implementation Planning** involves designing and engineering the infrastructure necessary for transitioning to a ZEV fleet. This phase includes securing funding through government initiatives and private sources to support the installation or adaptation of fuelling and charging infrastructure. Key aspects include assessing the scalability of existing infrastructure and planning optimal locations for charging stations based on depot layouts and energy demands.

Phase 4 – **Optimization and Sustainment** focuses on refining operational strategies and implementing training programs to maximize the benefits of the new zero-emission vehicle fleet while addressing operational challenges. Key activities include optimizing operations based on weather conditions' impact on vehicle performance, implementing comprehensive training for operators and maintenance staff, and engaging in change management to ensure smooth adoption and ongoing improvement of fleet operations and public perception.

Operational Recommendations:

- Modify staff schedules to align with fleet availability and range limitations and create a procurement schedule with 12-18 months headway.
- Enhance fuel efficiency through lightweight attachments and low-power vehicle systems and identify opportunities for right-sizing the fleet by first transitioning a smaller subset.
- Develop training programs for drivers and mechanics, invest in vehicle telematics, and create a risk management strategy for various operational challenges.

Financial Recommendations:

- Amortize the costs of zero-emission vehicles and charging infrastructure over a longer term and investigate peak versus non-peak charging rates.
- Apply for grants and funding opportunities and negotiate reduced rates with energy providers.
- To reduce financial overruns, use continuous data analytics for budget planning and develop a preventative maintenance schedule to lower the risk of costly emergency repairs.

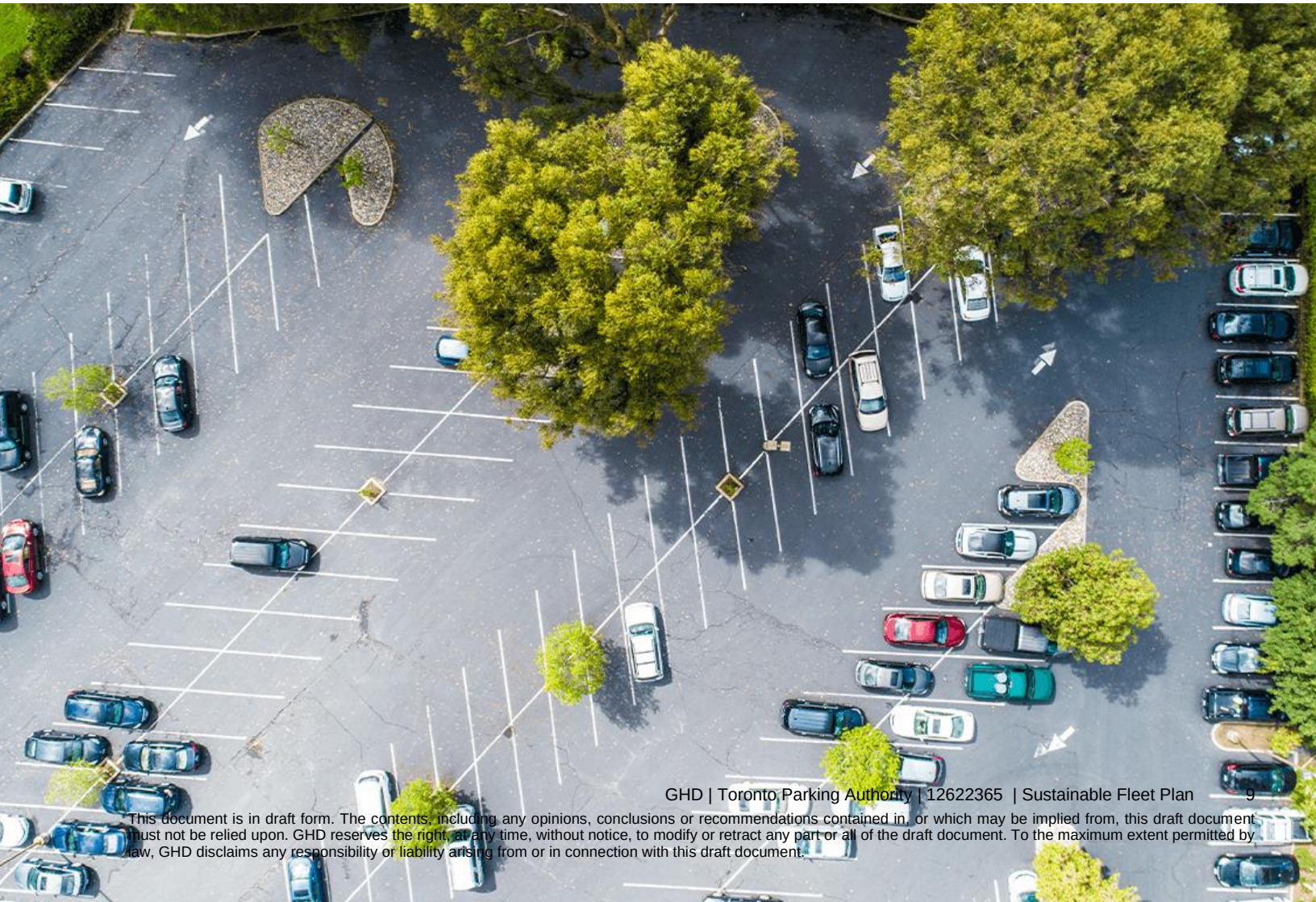
Technology Recommendations:

- Research and consider future subsidies for low-carbon fuels like renewable diesel.
- Model optimized routes based on charging station availability and understand site power grid capacity before procuring zero-emission vehicles.
- Explore renewable energy options like solar panels to offset electricity demand.

1.6 Conclusion

TPA's transition to ZEVs impacts various stakeholders such as the agency's staff, other City agencies, and Toronto residents. The City's emission targets surpass those of Ontario, positioning TPA as a leader in local decarbonization efforts. Scenario 2 of the Plan prioritizes aggressive electrification, projected to offset 5.0 million kilograms of CO_2 compared to Scenario 1, thus aligning with Toronto's emission goals. Concerns about operational disruptions are valid and can be managed through careful planning, phase-by-phase implementation, and KPI monitoring. Continuous advancements in BEV technology necessitate ongoing updates to the transition plan, ensuring strategies evolve alongside technological developments and market availability of medium-duty BEVs and zero-emission equipment.

For more information on the in-depth results of this study, assumptions, calculations, or other information, consult the full Sustainable Fleet Plan report, as well as TPA's Power BI Dashboards.

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