Green Fleet Strategy

CITY OF KELOWNA

Prepared for: Ian Wilson

Prepared by: Josh Caplan, MBA, CEM; Adam Franklin, P.Eng; Ainaz Bozorgzadeh, P.Eng.

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320 - 3605 Gilmore Way, Burnaby, BC V5G 4X5 main: 604 298 4858 toll free: 888 724 1715 prismengineering.com

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EXECUTIVE SUMMARY

Over the last 10 years, the City of Kelowna (the City) has been working to reduce greenhouse gas (GHG) emissions related to their fleet. They have purchased a number of electric vehicles (EVs) and hybrids, purchased renewable diesel, employed telematics in most of their vehicles, have partnered with MODO Co-Operative to provide shared vehicles at City Hall, and have a Sustainable Fleet Policy. To expand on these efforts this Green Fleet Assessment provides the following:

- Summarizes the current GHG emissions from the City's vehicle fleet;
- Assesses scenarios for transitioning the fleet to zero emission vehicles (ZEVs) through electrification (i.e. battery electric vehicles);
- Provides a high-level review of additional opportunities for reducing the City's fleet emissions; and,
- Provides recommendations for transitioning to electric vehicles and reducing fleet GHG emissions.

As of June 2021, the City's fleet is comprised of 267 vehicles made up of a variety of classes, makes and models. The table below summarises the baseline fleet make-up, operating costs and GHG emissions.

Vehicle Category	No. of Vehicles	Annual Operating Costs	GHG Emissions (tCO_2e)[1]
Cars	32	$93,637	41
SUVs	10	$50,641	40
Light Duty Pick-Up Trucks (LDT)	75	$274,396	236
Light/Medium Duty Pick-Up Trucks (LMDT)	22	$137,987	128
Medium Duty Pick-Up Trucks (MDT)	43	$318,404	222
Heavy Duty Trucks (HDT)	50	$1,392,226	869
Vans	35	$107,140	85
Total	**267**	**$2,374,431**	**1,648**
**Total number of EVs*	*11 (4%)*	-	-

Over the next 10 years, the City anticipates a 2% annual growth in fleet size. If the City continues their businesses-as-usual vehicle procurement strategy, they can expect to see a 20% growth in fleet emissions by 2031.

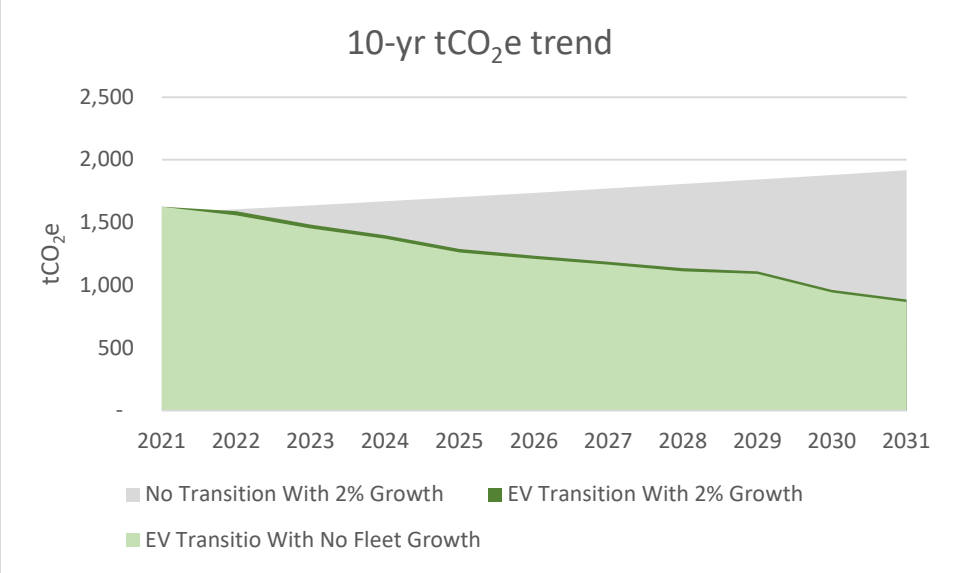
However, the City is committed to reducing their fleet emissions and is looking at electrification as the cornerstone to that effort. Notably, under the West Coast Electric Fleets initiative, the City has pledged to convert 10% of their light duty vehicle fleet to EVs by 2023, contingent on the availability of EV inventory.

[1] tCO_2e = metric tonnes of carbon dioxide equivalent

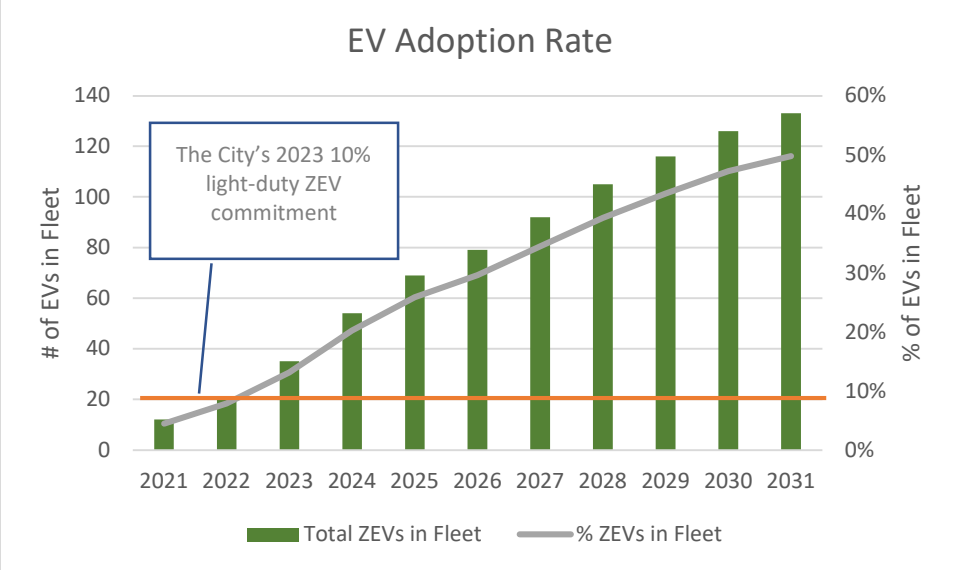
Of the vehicle classes within the City's fleet, there are ZEV replacement options available currently or within the next 3 three years for the following vehicle classes:

- Cars
- SUVs
- LDTs
- Select HDTs
- Vans

If the City were to electrify all fleet vehicles based on known technological availability over the next 10 years, they would achieve a 49% reduction in emissions compared with their 2021 emissions.



This transition would also provide for a 49% EV adoption rate by 2031, surpassing their current goals.



While this level of EV adoption would increase their capital spend, it would reduce their operating expenses. As a result, the total life cycle costs of their fleet would be reduced by 2%.

The following table compares the City's baseline expenses **versus** replacing existing internal-combustion engine (ICE) vehicles with new ICEs **versus** replacing ICE vehicles with new EVs.

	Baseline	ICE to ICE Conversions	ICE to EV Conversion
Total Capital Costs	$26,115,270	$27,814,807	$33,082,664
Life Cycle Operating Costs *(based on 10-year life of asset)*	$23,744,306	$23,744,306	$17,293,310
Total Life Cycle Costs ***(based on 10-year life of asset)***	**$49,859,576**	**$51,559,113**	**$50,375,974**

The City also has an opportunity to review the utilization and right-sizing of their fleet to achieve additional emission reductions. The City's Corporate Fleet Sustainability Policy identifies annual utilization targets (annual KMs) for each duty class within their fleet, however, the alignment rate is 50% or less across the portfolio. There may be good reason for this, however given the overall low alignment, a review of these targets and of those vehicle not aligning is recommended.

The biggest barrier at this time to full electrification is the lack of EV options for Light/Medium Duty Pick-Up Trucks (LMDT) and Medium Duty Pick-Up Trucks (MDT). Until such time as these types of vehicles enter the market, the City should evaluate these categories of vehicles with the following questions in mind:

1. Can the existing LMDTs or MDTs be eliminated from the fleet (due to low utilization, for example)?
2. Can the existing LMDTs or MDTs be transitioned to LDTs? (i.e right sizing)

Overall, if the City of Kelowna transitions all potential ICE to EV vehicles over the next 10 years they will achieve:

- **A 49% EV adoption rate;**
- **A 49% reduction in emissions; and**
- **A 2% reduction in the life cycle cost of their fleet.**

What's more, these number are expected to improve due to anticipated:

- Reductions in EV capital costs;
- Increases in the carbon tax (note we did not model this increase);
- Additional EV replacement options, particularly for LMDT, MDT and HDT vehicles.

Prism recommends the following strategies to supplement the City's existing fleet management and fleet sustainability strategies:

a) **Capital Plan Refining and Tracking:** This report provides a roadmap to transition to fleet electrification. However, we expect that this plan will need to be adjusted based on context specifics of the organization. We recommend reviewing the plan and adjusting and tracking on an annual basis against the adoption rates being prescribed.
b) **GHG Targets:** While the City currently does not have a GHG emission target specific to their fleet, many regions do in the range of 40-50% by 2030. If the City of Kelowna were to adopt a similar target, this strategy would position them to meet that goal while also demonstrating their commitment to sustainability and climate action.
c) **Fleet Utilization Review:** Annual utilization targets have been identified by vehicle duty class under the City's Corporate Fleet Sustainability Policy. Alignment with these annual targets is 50% or less across the portfolio. There may be good reason for the utilization, however, given the overall low alignment, a review of these targets and those vehicles not aligning is recommended.
d) **Fleet Rightsizing Review:** The biggest barrier at this time to full electrification is the lack of EV options for LMDTs and MDTs. Until such time as these types of vehicles enter the market, the City should evaluate these categories of vehicles with the following questions in mind:
    - Can the existing LMDTs or MDTs be eliminated from the fleet (due to low utilization, for example)?
    - Can the existing LMDTs or MDTs be transitioned to LDTs?
e) **Carbon Price:** Our research indicated internal carbon price at rates ranging from $160 - $300 /tCO2e can be used reasonably to support an electrification business case. Given the City's current support for electrification, we understand this lever may not be necessary. However, in future, this could be added into the City's existing Purchasing Policy and would also support the integration of climate into the financial assessment of other capital projects within the City.

The City of Kelowna is in a strong position to play a significant contributing role to the regions transition to electric vehicles, while reducing their GHG footprint. Through a combination of EV adoption, and a review of their fleet size and makeup, the City has an opportunity to continue to be a leader in sustainable transportation while also demonstrating fiscal prudence.

1. INTRODUCTION

To help meet the City of Kelowna's (the City) Greenhouse Gas (GHG) reduction goals, the City is interested in developing a new Green Fleet Strategy, building on work that has been underway over the last 10 years. The City has already converted approximate 4% of their corporate fleet to Zero Emission Vehicles (ZEVs). Under the West Coast Electric Fleets initiative, the City has pledged to convert 10% of their light duty vehicle fleet to ZEVs by 2023, contingent on the availability of EV inventory. This aligns with the Province's Zero-Emission Vehicles Act, where the Province has committed to 10% of new light duty vehicle (LDV) purchases being zero emission by 2025, 30% by 2030 and 100% by 2040. Similarly, Canada now has a mandatory sales target of 100% zero emission cars and light-duty trucks starting from 2035.

To meet these commitments, the City commissioned Prism Engineering Ltd. (Prism) to conduct a Zero Emissions Vehicle (ZEV) Fleet Assessment that aligns with the parameters of the CleanBC Go Electric Fleets Program. This assessment looked at the following:

1. Identified the City's ZEV goals;
2. Established an existing fleet baseline (including emissions and costs)[2];
3. Identified opportunities for conversion to zero emission vehicles (ZEVs), including:
    a. Availability of ZEVs to replace internal combustion engine (ICE) vehicles
    b. Projected energy and emission savings through EV conversion
    c. Provided a comparison of replacing existing internal combustion engine (ICE) vehicles with new ICE vehicles, versus EV vehicles, including:
        i. Emissions
        ii. Capital costs
        iii. Operating costs
        iv. Combined life cycle costs
4. Developed a roadmap, capital plan and projected annual capital and operating expenses over the next 10 years based on EV conversion of the fleet;
5. Charging infrastructure requirements;
6. A review of other comparable regional sustainable fleet policies, targets and goals; and,
7. Overall conclusions and recommendations.

[2] Assessment of EV Infrastructure, contractor fleets, Kelowna airport Fleet, or RCMP vehicles is not included in this project scope.

2. PROJECT METHODOLOGY

The project scope included the following methodology steps:

1. Data collection from the City which included City Works and GeoTab data;
2. Modelling of current fleet profile to establish operating costs, life cycle costs and emission baseline;
3. Research into available EVs in BC (both current and known forthcoming models);
4. Modelling of future scenarios including:
    a. ICE to ICE vehicle replacement
    b. ICE to EV vehicle replacement, considering EV availability, vehicle intended use, and daily range requirements
5. Developments of a ten-year capital planning roadmap based on an annual 2% growth in fleet size;
6. Alignment of EV model with parallel infrastructure assessment;
7. Development of a charging strategy based on infrastructure plan and charging requirements; and,
8. A review and benchmarking of what other municipalities in BC are doing to transition their fleets to EV.

This report summarizes the findings during the project steps and concludes with recommendations for Kelowna's green fleet strategy.

2.1 Notes and Assumptions

The following assumptions were made in compiling the analysis summarized in this report:

1. Average fuel spend was compared against average fuel cost over this same period to estimate fuel consumption.

2. Fuel Price Source: 3-yr average, 2019 to present, from Natural Resource Canada[3]

3. Emissions are based on the CleanBC "Fleet Assessment without telematics specification" document provided by the City.

4. Increases in the Provincial and Federal carbon taxes have not been included in the modelling used for this assessment.

5. Operating costs include energy/fuel, maintenance, insurance.

Further details are provided in Appendix C.

[3] https://www2.nrcan.gc.ca/eneene/sources/pripri/prices_bycity_e.cfm?productID=5&locationID=6&frequency=M&priceYear=2021&Redisplay=

3. FLEET BASELINE

As of June 2021, the City's fleet is comprised of 267 vehicles made up of a variety of classes, makes and models. The City classifies their fleet into nine categories. For the purpose of this assessment Prism has aggregated these nine vehicle categories into seven. Table 1 below describes how these categories correspond.

Table 1: City of Kelowna Fleet Categories vs. Prism Categories

City of Kelowna Fleet Categories		Prism Categories		
City Code	Vehicle Description	Category	Vehicle Examples	Vehicle Count
C	Car	Cars	Focus, Toyota, Kona EV, Leaf	32
S	Sport Utility Vehicles	Sport Utility Vehicles (SUV)	Escape, Explorer, RAV4	10
P	Pickup	Light Duty Truck (LDT)	F-150, Ford Ranger	75
T1	Truck, 10,000# GVW to 17,000# GVW	Light-Medium Duty Truck (LMDT)	F-250	22
T2	Truck, 17,001# GVW to 35,000# GVW	Medium Duty Truck (MDT)	F-350, F450	43
T3	Truck, 35,001# GVW to 60,000# GVW	Heavy Duty Truck (HDT	F-550, Freightliner, International, Sterling	50
T4	Truck, 60,001# GVW to 110,000# GVW			
T5	Truck, 110,000# GVW & up			
V	Van	Van	Transit, Econoline	35
			TOTAL	**267**

The graph below shows the vintage profile of the current fleet vehicles and highlights the vehicle class and fuel type.

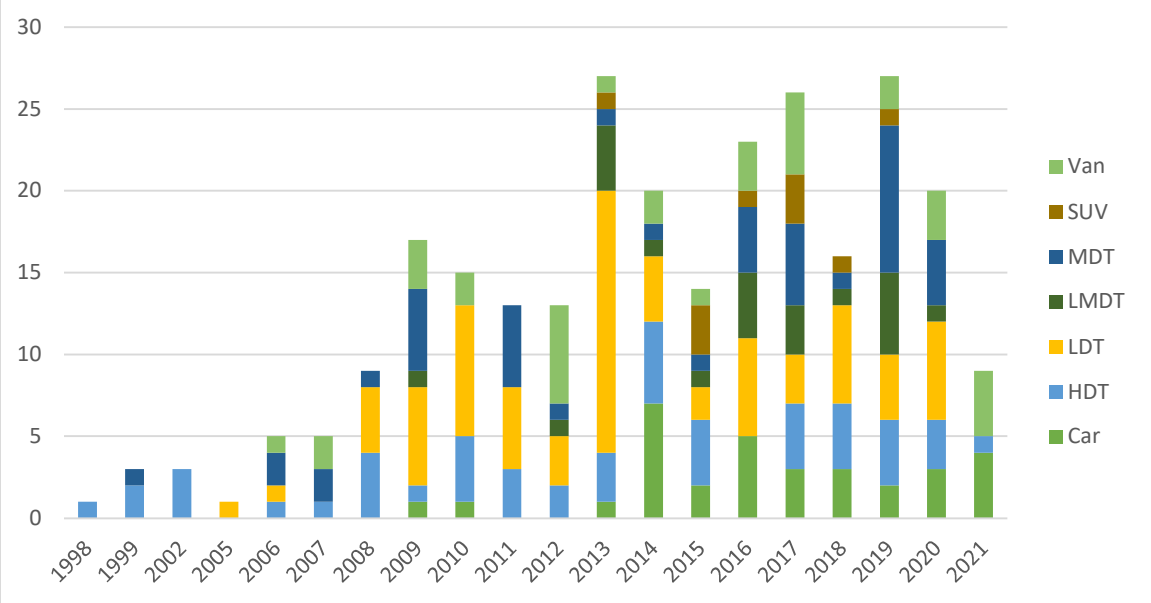


Figure 1: Vintage Profile of Current Fleet Vehicles

Vehicles are employed across the organization in a variety of capacities (Branches), including:

1. Traffic Operations
2. Building & Permitting
3. By-Law Services
4. Crime Prevention
5. Fire Department
6. Infrastructure Delivery
7. Parking Services
8. Police Services
9. Roadways Construction
10. Traffic Operations
11. Urban Forestry
12. Utility Services
13. Water Quality
14. Biosolids
15. Building Services
16. Community Services
17. Facilities
18. Fleet Services
19. Landfill
20. Parks, Beaches & Sports fields
21. Regional Services
22. Roadways Operations
23. Traffic Signals & Systems
24. Utilities Construction
25. Wastewater Treatment
26. Water Supply

The following graph shows the type and number of vehicles being used by branch.

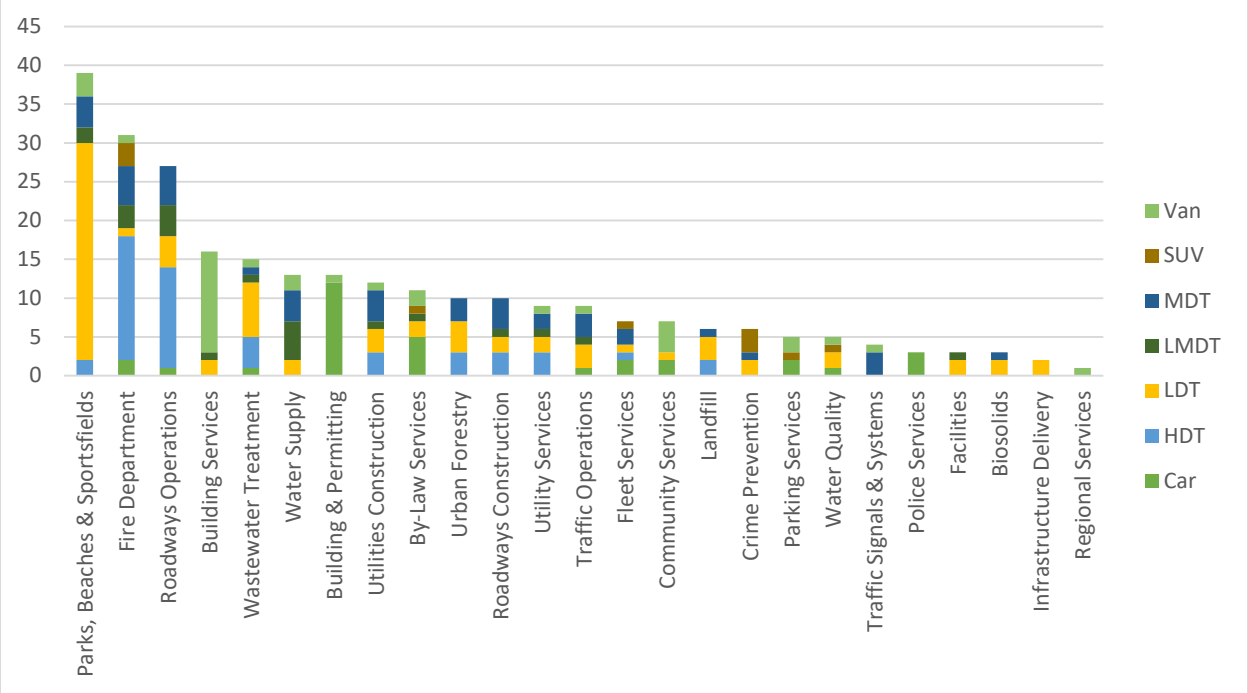


Figure 2: Type and Number of Vehicles Used by Branch

3.1 Baseline Greenhouse Gas Emissions

The largest greenhouse gas (GHG) contributor to their fleet are their heavy-duty trucks; representing 54% of total fleet emissions, but only 19% of the fleet size. Examples of these vehicles are the Freightliners and International trucks. The second largest GHG contributors are the light duty pick-up trucks (LDTs), generating 14% of all fleet emissions, and representing 28% of the fleet size. Examples of these are the Ford F-150s. The next two GHG contributors by

vehicle class are the light/medium duty trucks (LMDTs) and the medium duty trucks (MDTs). Examples of these vehicles are the Ford F-250 – F-550. These two classes of vehicles represent 8% and 13% of the fleet's total emissions respectively. Combined these two classes represent 21% of the fleet's total emissions, however, there is currently a gap in the availability of EV replacement for these vehicles. As will be shown further on, combined these classes will represent the largest contributors to the City's fleet emissions over the next 10 years, until replacements option come on the market. For a complete breakdown of vehicles by class description refer to Appendix B.

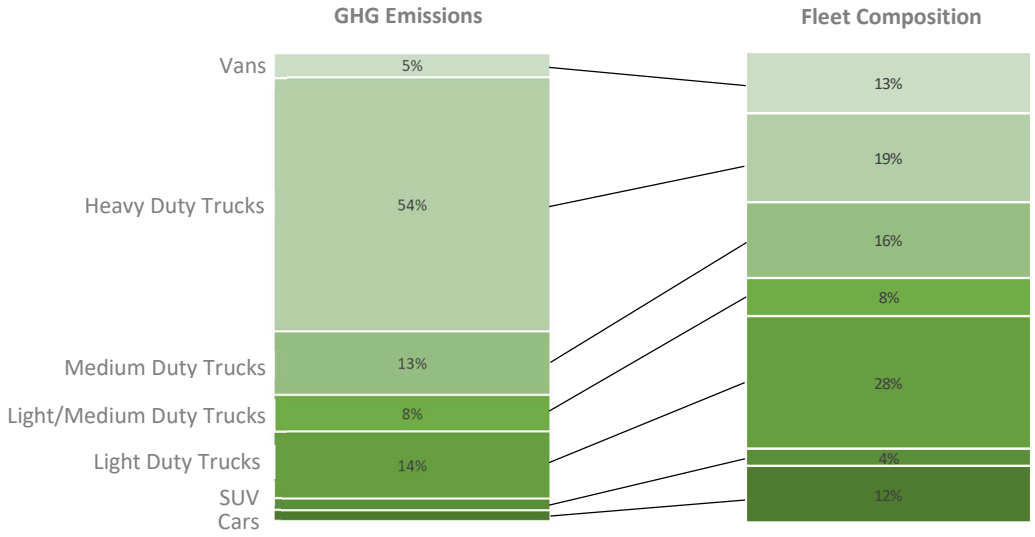


Figure 3: GHG Emissions and Fleet Composition

Table 2: Baseline Asset Inventory Summary

Vehicle Category	No. of Vehicles	GHG Emissions (tCO_2e)[4]
Cars	32	42
SUVs	10	40
Light Duty Pick-Up Trucks (LDT)	75	236
Light/Medium Duty Pick-Up Trucks (LMDT)	22	128
Medium Duty Pick-Up Trucks (MDT)	43	222
Heavy Duty Trucks (HDT)	50	896
Vans	35	85
Total	**267**	**1,648**
**Total number of EVs*	*11 (4%)*	-

This next graph shows the GHG emission by Branch. While similar to the graph is Section 3.0 outlining the number of vehicles by branch, this graph reflects how the vehicle types influence

[4] tCO_2e = metric tonnes of carbon dioxide equivalent

the each Branche's GHG emission, not just the number of vehicles. This is notable, for example, with Roadways Construction, the 11th highest number of vehicles, but 3rd highest GHG contributor.

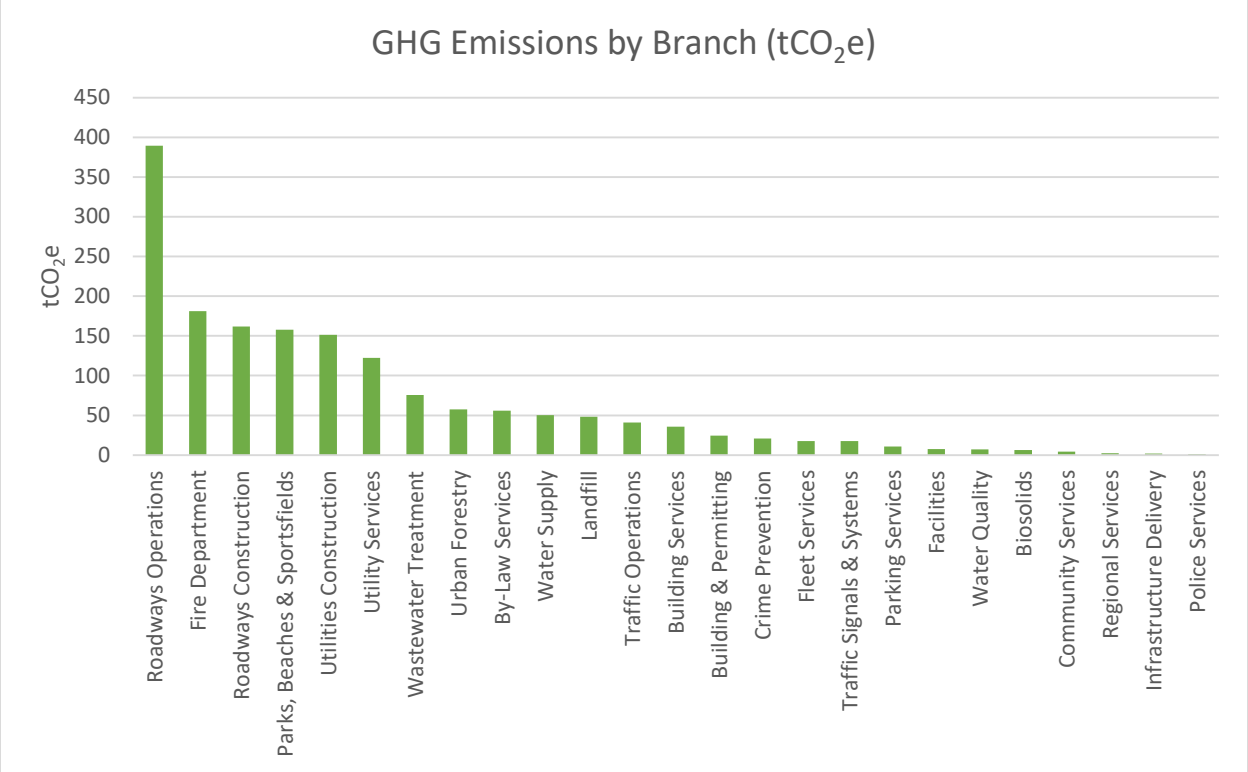


Figure 4: GHG Emissions by Branch (tCO2e)

4. FUTURE EMISSIONS SCENARIOS

4.1 Opportunities for Conversion to EVs

Of the vehicle classes within the City's fleet, there are EV replacement options currently or within the next 3 three years for the following vehicle classes:

- Cars
- SUVs
- LDTs
- Select HDTs
- Vans

Depending on the vehicle class there may be multiple options for EV replacement. Prism identified a selection of vehicle replacement options based on:

1. Cost value
2. Vehicle range
3. Vehicle size
4. Vehicle reviews

Prism considered the following vehicles:

Table 3: Vehicle Class and EV Option

Vehicle Class	EV Option
Car	Nissan Leaf (62 kW-hr battery pack)
Car	Hyundai Kona Electric
Car	Chevrolet Bolt EV
Car	Hyundai Ioniq Electric
Car	Tesla Model 3 Standard Range Plus
SUV	Kia Soul Electric
SUV	Kia Nero
SUV	Volvo XC40 Recharge
Van	Ford E-Transit
LDT – Pick-Up	F-150 Lighting
HDT	Lio8 Tractor
HDT	Volve VNRE62T300
HDT – Garbage Truck	Lion8 Refuse REL

For the purposes of modelling, Prism further refined the vehicle options to the following:

Table 4: Vehicle Class and EV Option (Refined)

Vehicle Class	EV Option
Car	Chevrolet Bolt EV
Car	Nissan Leaf (62 kW-hr battery pack)
SUV	Kia Nero
Van	Ford E-Transit
LDT – Pick-Up	F-150 Lighting
HDT	Lio8 Tractor
HDT	Volve VNRE62T300
HDT – Garbage Truck	Lion8 Refuse REL

Based on EV availability the following table compares the current fleet profile versus a proposed EV replacement profile by 2031 (this assumes no adjustment have been made based on a utilization review):

Table 5: Duty Class and Fuel Type - 2021 vs. 2031

Duty Class	Fuel Type	
	2021	**2031**
Car	10 EVs 16 Hybrids 6 Gasoline / Diesel	30 EVs 2 Hybrids
SUV	1 Hybrid 9 Gasoline / Diesel	6 EVs 1 Hybrid 3 Gasoline / Diesel
Van	35 Gasoline / Diesel	26 EVs 9 Gasoline / Diesel
LDT	75 Gasoline / Diesel	64 EVs 11 Gasoline / Diesel
LMDT	22 Gasoline / Diesel	1 EV 21 Gasoline / Diesel
MDT	1 EV 1 Hybrid 41 Gasoline / Diesel	1 EV 1 Hybrid 41 Gasoline / Diesel
HDT	1 Hybrid 49 Gasoline / Diesel	4 EVs 1 Hybrid 44 Gasoline / Diesel
Total	11 EVs (4%)	132 EVs (49%)
	256 Other (96%)	135 Other (51%)
	267 vehicles	**267 vehicles**

2% Annual Growth

The City anticipates an annual growth in their fleet of approximately 2% per year, however, details on exactly where this growth would occur was not available. Therefore, while the fleet breakdown in the table above does not account for this growth, the GHG and financial projections further on do account for growth.

4.2 GHG Emission Scenarios

Prism looked at three emission scenarios:

1. Current baseline annual emissions;
2. Annual emissions if existing ICE vehicles are replaced with new ICE vehicles; and,
3. Annual emissions if existing ICE vehicles are replaced with EVs based on current and expected future availability.

Table 6 outlines the emission outlook based on these three scenarios.

Table 6: % Change from Baseline Based on Vehicle Class and Emission Scenarios

Vehicle Class	GHGs (tCO_2e)			% Change from Baseline
	Baseline	ICE to ICE	ICE to EV	
Car	42	41	14	-68%
SUV	40	25	6	-86%
Van	85	86	24	-72%
LDT	236	231	69	-71%
LMDT	128	123	126	-2%
MDT	222	234	234	5%
HDT	896	897	368	-59%
Grand Total	**1,650**	**1,641**	**840**	**-49%**

The following chart reflects the reductions in GHG emissions by vehicles class described above. As noted earlier, the LMDT and MDT vehicles experience very little change in their emissions due to lack of available replacement. Combined these two classes will represent 29% of the 2031 fleet emissions. Heavy duty trucks do have some replacement options and therefore do see a 59% reduction in emissions. What is interesting about the HDT replacement is that only four of the current 49 HDT would be replaced under this scenario, and yet the reduction is still very significant.

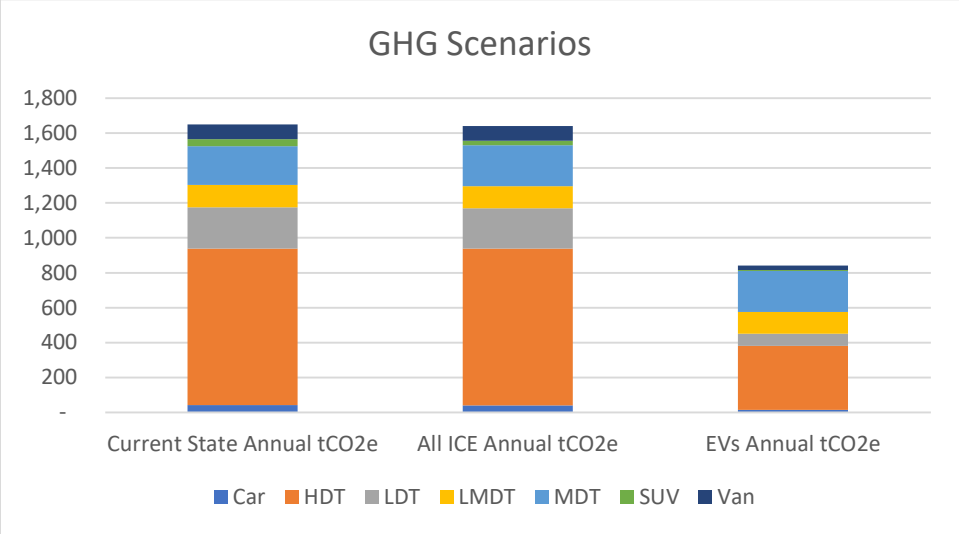


Figure 5: GHG Scenarios

Overall, if the City of Kelowna transitions all potential ICE to EV vehicles over the next 10 years (equal to a 49% EV adoption rate), they can achieve a 49% reduction in emissions.

However, the City of Kelowna is projecting a 2% annual growth in the size of their fleet over the next 10 years. As a result, the annual avoided emissions in 2031 are protected to be as much as 54% (1,033 tCO_2e).

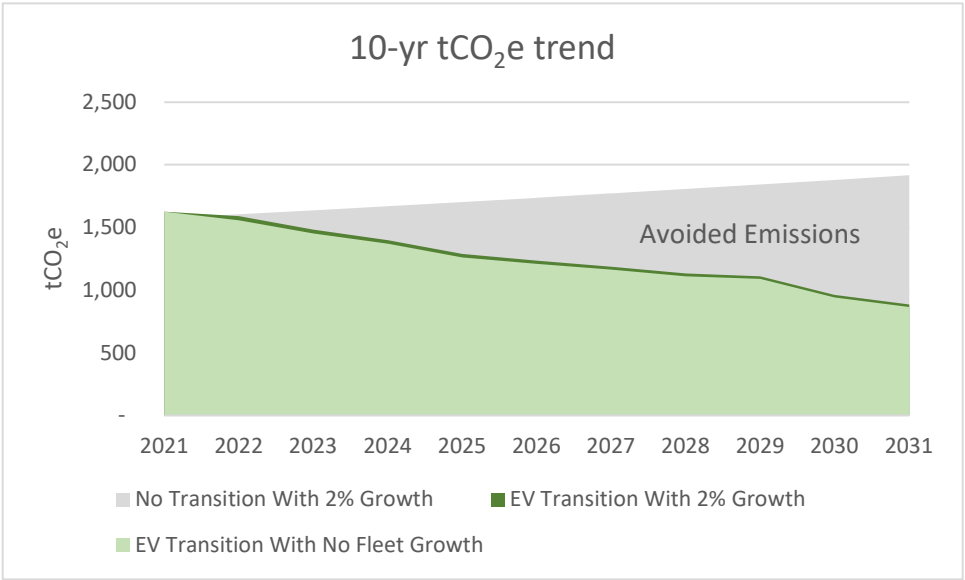


Figure 6: 10-yr tCO2e Trend

4.3 10-year Capital Planning Roadmap

The following chart outlines the replacement forecast based on a 10-year life of the vehicle and the replacement plan provided by the City. Please refer to Appendix B and accompanying Excel Calculator for a complete breakdown of replacement option, vehicle location, etc.

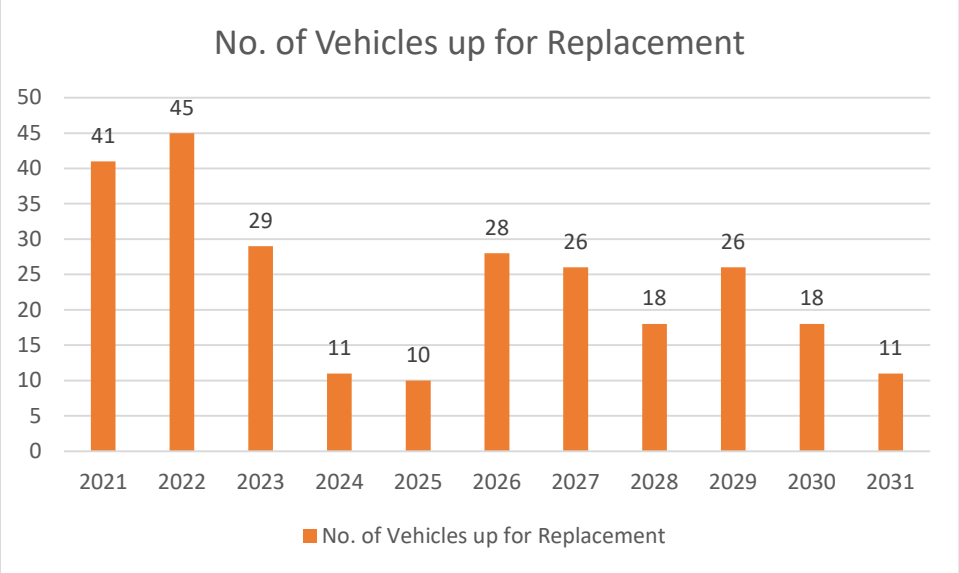


Figure 7: No. of Vehicle up for Replacement

Based on this preliminary replacement plan, the next chart represents the annual EV acquisitions numbers over the next 10 years.

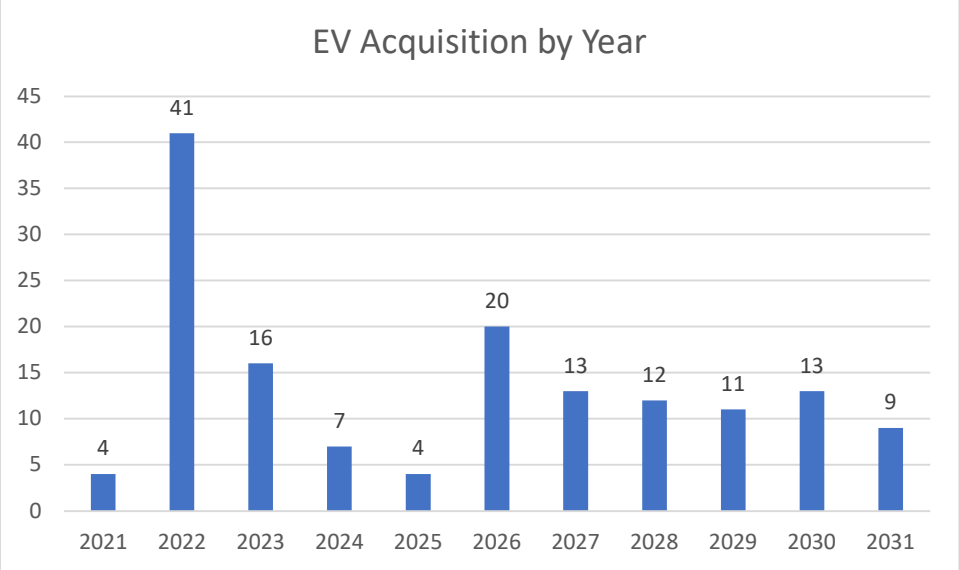


Figure 8: EV Acquisition by Year

However, to match the City's existing capital fleet renewal plan, Prism recommends replacing approximately 20 – 21 vehicles over the next 12 years. Under this scenario the EV acquisition plan would look more like the following.

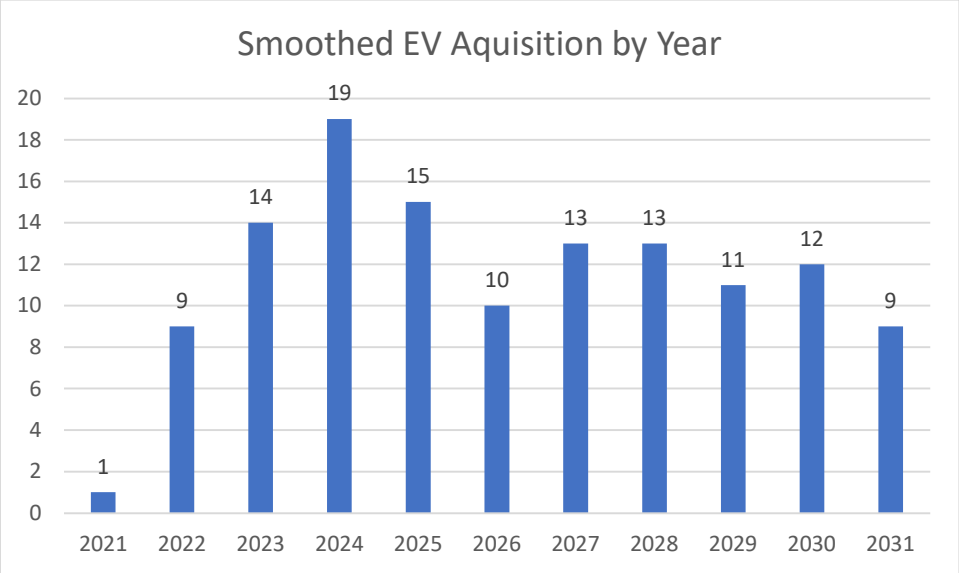


Figure 9: Smoothed EV Acquisition by Year

The following chart displays the EV adoption rate over the next 10 years, compared with the City's adoption targets. As we can see, based on the proposed EV transition plan, the City will achieve a 13% adoption of EV by 2023, surpassing their current 10% in 2023 commitment.

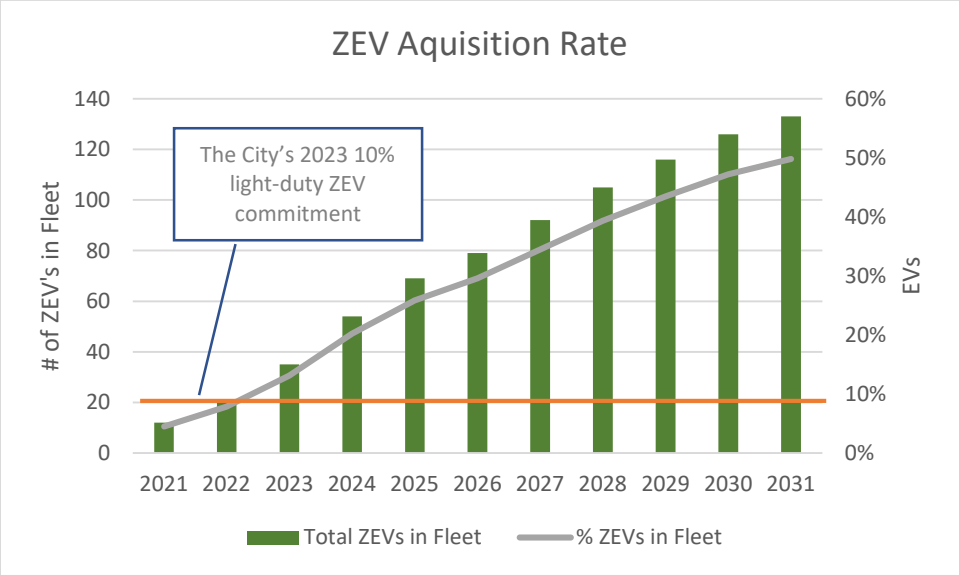


Figure 10: EV Acquisition Rate

If we incorporate the 2% expected annual growth of the City's fleet, in 10-years we can expect 39% ($1,125,516) of avoided annual operating expenses.

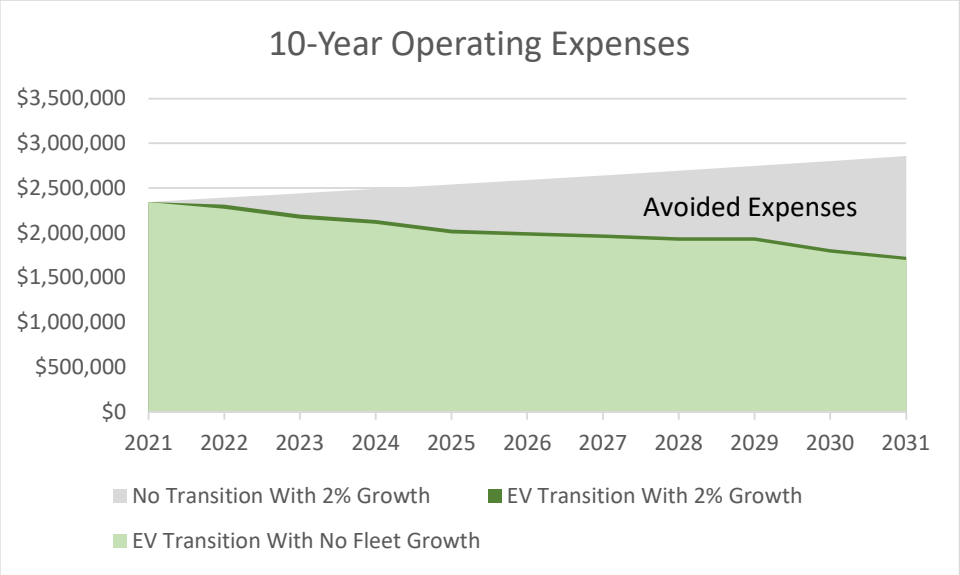


Figure 11: 10-Year OPEx

Table 7: Annual Operating and Maintenance (O&M) Costs

	Annual Operating and Maintenance (O&M) Costs
Current State / All ICE State*	$ 2,345,636
Future EV State	$ 1,698,142
Future EV State with 2% Growth	$1,733,706
% Change with 2% Growth	-39%

*Note: Current state and future ICE state are expected to have similar operating costs.

The ICE-to-ICE capital outlay and operating costs over the next 10 years will be as follows.

Table 8: ICE to ICE Capital Outlay and Operating Costs over the Next 10 Years

Year	Capital Cost[5]	Operating Cost	Total Budget
2021	$3,522,250	$2,345,558	$5,867,808
2022	$2,070,333	$2,345,558	$4,415,891
2023	$1,645,429	$2,345,558	$3,990,987
2024	$1,144,228	$2,345,558	$3,489,786
2025	$1,370,129	$2,345,558	$3,715,687
2026	$1,556,276	$2,345,558	$3,901,833
2027	$1,867,098	$2,345,558	$4,212,656
2028	$1,028,951	$2,345,558	$3,374,509
2029	$1,041,218	$2,345,558	$3,386,775
2030	$2,083,341	$2,345,558	$4,428,899
2031	$3,353,799	$2,345,558	$5,699,357

The ICE to EV capital outlay and operating costs over the next 10 years be as follows:

Table 9: ICE to EV Capital Outlay and Operating Costs over the Next 10 Years

Year	Capital Cost[6]	Operating Cost	Total Budget
2021	$3,709,654	$2,345,558	$6,055,212
2022	$2,621,217	$2,269,495	$4,890,712
2023	$2,376,207	$2,157,478	$4,533,685
2024	$1,886,112	$2,100,013	$3,986,125
2025	$1,785,439	$1,993,700	$3,779,139
2026	$1,746,151	$1,968,073	$3,714,223
2027	$2,216,387	$1,942,498	$4,158,885
2028	$1,482,744	$1,912,561	$3,395,305
2029	$1,270,463	$1,912,167	$3,182,629
2030	$2,734,497	$1,778,201	$4,512,698
2031	$3,891,137	$1,698,153	$5,589,289

[5] Does not include costs of charge infrastructure.

[6] Does not include costs of charge infrastructure.

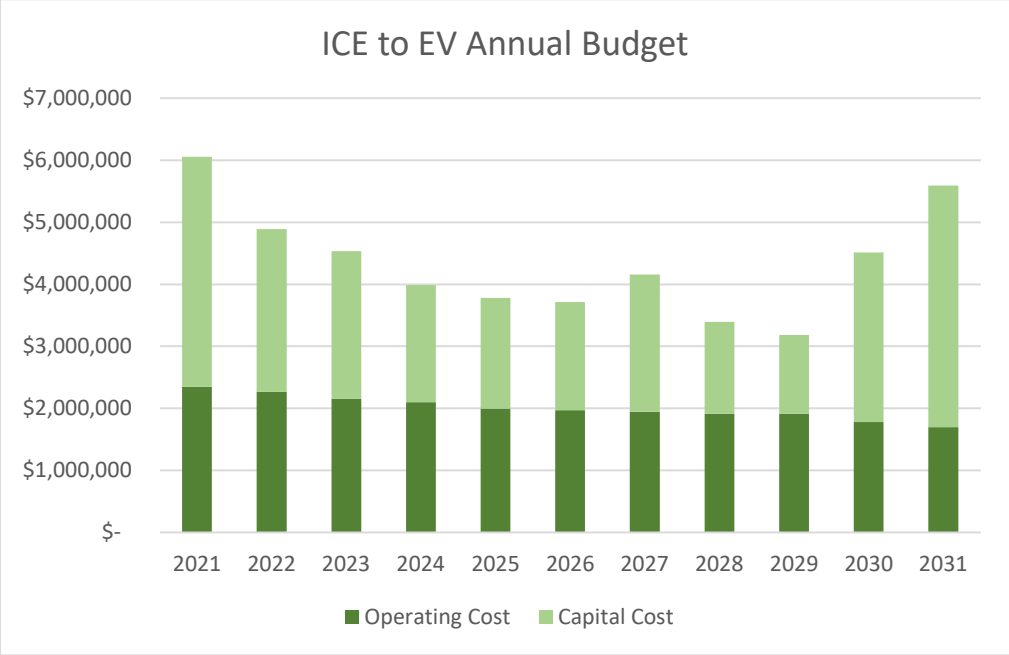


Figure 12: Annual Budget

While the capital costs are expected to increase, this transition will decrease the City's annual fleet operating costs (including fuel and maintenance) by 28% by 2031 compared with 2021. As a result, the life cycle costs after electrifying the fleet is expected to decrease by 2% due to the reduced O&M costs.

Table 10: Fleet Life Cycle Cost

	Fleet Life Cycle Cost (based on 10-year life of asset)
Current State	$49,859,576
All ICE State	$51,559,113
Future EV State	$50,375,974
% Change	-2%

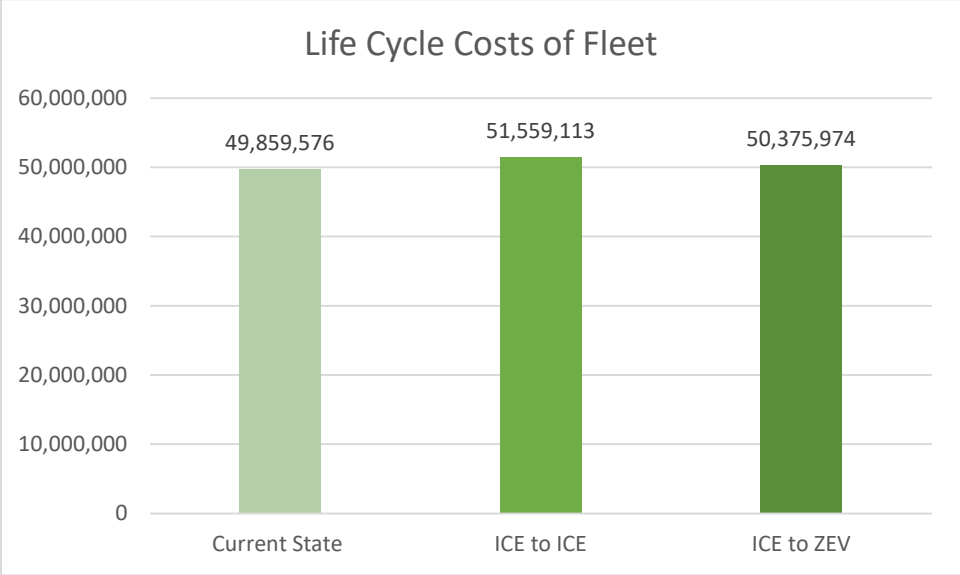


Figure 13: Life Cycle Costs of Fleet

5. EMISSION REDUCTION ALTERNATIVES

5.1 Utilization and Right-Sizing

According to the City's Corporate Fleet Sustainability Policy, the following annual utilization targets have been identified:

Table 11: Annual KMs Targets and % Alignment

Vehicle Class	Annual KMs Target	% Alignment
Car	10,000	47%
SUV	10,000	50%
Van	10,000	20%
LDT	10,000	51%
LMDT	20,000	9%
MDT	20,000	7%
HDT	20,000	20%

The table above provides the alignment rate for each of these duty classes. As we can see, the alignment rate is quite low across the portfolio. There may be good reason for this, however given the overall low alignment, a review of these targets and of those vehicles not aligning is recommended.

As mentioned, the biggest barrier at this time to full electrification is the lack of EV options for light-medium-duty and medium-duty pick-ups. Until such time as these types of vehicles enter the market, the City should evaluate these categories of vehicles with the following questions in mind:

1. Can the existing LMDT or MDT be eliminated from the fleet?
2. Can the existing LMDT or MDT be transitioned to LDTs?

6. CHARGING STRATEGY AND ALIGNMENT WITH INFRASTRUCTURE ASSESSMENT

Struthers Technical Solutions (Mr. Riley Devlin) is conducting an infrastructure assessment at the following City locations:

1. Public Works Yard (City Yard) - 1495 Hardy St.
2. Parks Yard - 1359 KLO Rd.
3. Landfill - 2710 John Hindle Dr.
4. Wastewater Treatment Facility - 951 Raymer Ave.
5. Windsor Rd - 6720 Windsor Rd.
6. Commonage - 565 Commonage Rd.
7. Police Services Building - 1170 Richter St.
8. City Hall Parking Lot - 1435 Water St
9. Field Office - 3235 Gulley Rd.
10. Library Parkade - 1360 Ellis St.

We coordinated our model projections with the EV Infrastructure Assessment findings. We've recommended a charging strategy that will provide sufficient charging capacity for all the planned EV replacements included in this assessment. Details on the number of charging ports and circuits, as well as estimated installation costs, for each location are provided in Section 6.1.

Our coordination with the EV Infrastructure Assessment and based on the estimated demand in Table 12, two locations will require a utility service (Fortis) upgrades to fully implement the recommended charging scenarios. The main service entrance and distribution equipment at the remainder of the facilities is adequate to support the estimated demand, however the utility service may require upgrades to supply the additional load and Fortis will need to be engaged at each location to assess the utility capacity.

The locations and recommended upgrade measures are:

- Parks Yard (1359 KLO Rd.) – Upgrade Fortis transformer from 75 kVA to at least 150 kVA (the secondary distribution was upgraded in 2019/2020 and would not require additional upgrades)
- 6720 Windsor Rd. – Provide a new, separate utility feed and distribution to the fleet parking area exclusively for the new charging infrastructure.

Please refer to the EV Infrastructure Assessment report for further details.

6.1 Vehicle Storage and Infrastructure Requirements

Based on the recommended transition scenario outline in this report, by 2031 electric vehicles would be distributed and stored over night at the locations outlined in Table 12. To ensure each vehicle has the ability to charge overnight, we recommend providing one Level 2 charging port per vehicle being stored overnight at each location. Charging stations typically have either one

or two ports per station. For example, providing one charging port for 10 vehicles can be achieved by using 10 single-port charging stations or five dual-port charging stations.

Furthermore, we analyzed the average daily driving distances for each vehicle, along with the rated range of the EV replacement, and determined that up to four vehicles can share a single 32A rated (40A breaker) Level 2 circuit and recharge sufficiently during a 12-hour overnight period. A charging station load management system will be required at each location with multiple stations to automatically control and optimize the charging rates for each vehicle.

An example of four single-port Level 2 charging stations sharing a 32A rated circuit (40A breaker) is shown in Figure 14.

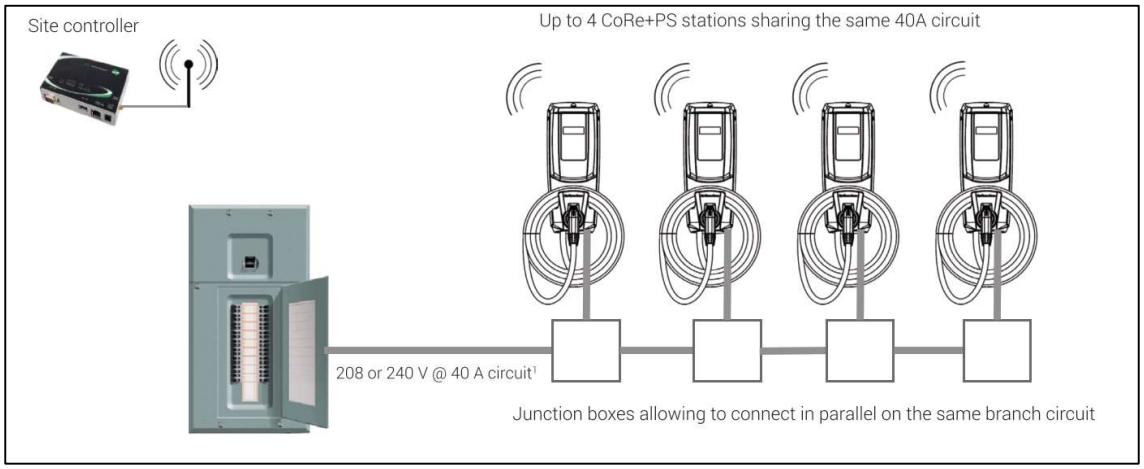


Figure 14: System Diagram for Single Port Load Sharing 4 Stall Configuration

The minimum and maximum charging performances for the recommended configuration are outlined in Table 12. The charging performance for Level 1 (12A, 120V) is also provided for comparison. While the minimum performance values are similar, the load sharing Level 2 configuration has the advantage of four times faster charging rates when only one vehicle is charging. This could be when the other 3 vehicles on the same circuit have finished charging or when they are not plugged in.

Table 12: Charging Performance: Dual Port 16A Level 2 – 2 Stall Load Sharing

Configuration	Minimum Performance		Maximum Performance	
	Power Draw	Range Gained Per Hour*	Power Draw	Range Gained Per Hour*
Level 2 – 32A w/ Load Sharing (40A Breaker)	1.64 kW	10 km	6.67 kW	40 km
Level 1 – 12A (15A Breaker)	1.44 kW	8 km	1.44 kW	8 km

*Estimated range will vary depending on vehicle

The total number of charging circuits and maximum charging demand (kW) for this load sharing configuration are also provided in Table 13. Load sharing will reduce the charging infrastructure costs at each location by reducing the overall electrical demand requirements.

Table 13: Overnight Parking Locations

Overnight Parking Location	Address	No. of EV's	Number of Required Charging Ports	Number of Level 2 Charging Circuits*	Max Charging Demand (kW)*
Police Station	1170 Richter St.	1	1	1	7
Parks yard	1359 KLO Rd.	34	34	9	60
Library Parkade	1360 Ellis St.	15	15	4	27
Administration Building	1450 KLO Rd.	2	2	1	7
Public Works Yard	1495 Hardy St.	28	28	7	47
Recreation Centre	1800 Parkinson Way	7	7	2	13
Fire Hall	2255 Enterprise Way	5	5	2	13
Landfill	2710 John Hindle Dr.	5	5	2	13
Field Office	3235 Gulley Rd.	6	6	2	13
Compost Facility	565 Commonage Rd.	1	1	1	7
Rutland Arena	645 Dodd Rd.	2	2	1	7
Building Services	6720 Windsor Rd.	19	19	5	33
Wastewater Treatment Facility	951 Raymer Ave.	12	12	3	20
Employee's home	At Home	13	N/A	N/A	N/A
	Grand Total	**150**	**137**	**72**	**266**

*Assumes four vehicles sharing a 32A rated circuit with 40A breaker at 208V

The number of charging stations at each location will depend on if single-port or dual-port charging stations are used.

Typical unit cost for a single-port Level 2 charging station is $5,000 while a dual-port charging station is $8,000. Estimated installed costs, which include material and labour costs, for each location are provided in Table 14. Cost estimates and budgets will need to be updated as part of the detailed design phase to reflect actual installation requirements and any limitation of the existing electrical distribution systems.

Table 14: Charging Station Cost Estimates

Overnight Parking Location	Address	Number of Required Charging Ports	Charging Station Cost Estimate (Material and Labour)
Police Station	1170 Richter St.	1	$10,000
Parks yard	1359 KLO Rd.	34	$300,000 - $340,000
Library Parkade	1360 Ellis St.	15	$135,000 - $150,000
Administration Building	1450 KLO Rd.	2	$18,000 - $20,000
Public Works Yard	1495 Hardy St.	28	$250,000 - $280,000
Recreation Centre	1800 Parkinson Way	7	$60,000 - $70,000
Fire Hall	2255 Enterprise Way	5	$45,000 - $50,000
Landfill	2710 John Hindle Dr.	5	$45,000 - $50,000
Field Office	3235 Gulley Rd.	6	$54,000 - $60,000
Compost Facility	565 Commonage Rd.	1	$10,000
Rutland Arena	645 Dodd Rd.	2	$18,000 - $20,000
Building Services	6720 Windsor Rd.	19	$170,000 - $190,000
Wastewater Treatment Facility	951 Raymer Ave.	12	$110,000 - $120,000
Employee's home	At Home	N/A	N/A
	Grand Total	**137**	**$1,215,000 - $1,370,000**

At present time we do not see a need for Level 3 DC fast charging at any locations, though this may change in the future as more electric light-medium-duty and medium-duty pick-up trucks become available, depending on their battery sizes and daily driving ranges. Typical costs to purchase and install a Level 3 DC fast charger are $70,000 to $80,000 assuming there is sufficient spare electrical capacity (minimum 50 kW per charger).

7. REVIEW OF OTHER MUNICIPALITIES

Prism conducted a scan of other municipalities and regional districts' emission targets specific to fleet, as well as policies and strategies in place to support progress towards the targets. The table below summarizes the findings of our research:

Table 15: Fleet Emission Targets, Strategies and Policies

City of Kamloops	
Corporate Fleet Emission Targets	· By 2025, make workplace EV charging available for any City employee who requests this service (provided they work at a City facility where employee parking is provided) · By 2030, reduce fleet GHG emissions by 40% below peak levels. · By 2050, reduce fleet GHG emissions by 100%.
Fleet Strategies	· Green Fleet Plan (to right size and electrify fleet where applicable) · Workplace charging pilot for City employees · Facility assessments for charging stations accommodating fleet, employee, and visitor EV charging · Deploying E-bikes in City fleet
Fleet Policies	· Electric First procurement policy (based on life cycle cost analysis, and including $150/tCO2e carbon price) · Workplace charging policy including user fees
City of Vancouver	
Corporate Fleet Emission Targets	· 30% below 2007 levels by 2020 · 50% below 2007 level by 2030 ("Big Move #3") · 80% below 2007 by 2050 · Committed to 100% renewable energy usage by 2050
Fleet Strategies	· https://vancouver.ca/green-vancouver/green-fleets.aspx · Presentation by Head, Fleet Strategy and Asset Management[7] · Electrifying the fleet (by 2023, transitioning all non-emergency fleet sedans to zero emission vehicles and replacing additional batch of heavy-duty trucks with electric vehicles) · Charging infrastructure strategy for City's EVs · Transitioning small mobile equipment to electric or zero emission

[7] https://www2.gov.bc.ca/assets/gov/environment/climate-change/cng/symposium/2019/20191127_835am_main_session_2_cov_fleet_electrification_business_case.pdf

	· Purchasing 100% renewable diesel (R100) as of 2018 for the 55% of fleet fuelled by diesel · dedicated natural gas compression station allowing City vehicles (including 33 refuse trucks) to be operated on 100% CNG, making up 8% of CoV's fleet fuel use · Efficient driving practices (utilizing telematics to gain insight and implement driver training, idle management, cab heaters) · Car Sharing contract with co-operative auto network · Recycling scrap metal, oil and batteries · Purchasing (central fleet management, right sizing, minimizing idle vehicles) · In-house maintenance repair and fabrication
Fleet related Policies	· Corporate Carbon Pricing Policy ($160/tCO$_2$e in 2021 and rising 6% per year: https://policy.vancouver.ca/ADMIN019.pdf) · Greenest City Action Plan (Green Operations Plan)
Metro Vancouver	
Emission Targets	· Targets aligned with Province and consistent with IPCC and Paris Agreement. (Note: targets are not specific to fleet.) · 45% from 2010 by 2030 · Carbon neutral region by 2050
Fleet Strategies	· Right-Sizing (annual fleet utilization assessment, replacement assessment, new fleet operational need assessment, sized to typical operational requirements) · Low Emission Technologies (develop and annually update a list of vehicles with hierarchy of most preferred based on GHG emissions and incorporate into the life cycle costing tool) · Acquisition (purchase vehicles with greatest reduction in emissions where operationally feasible) · Monitoring and Reporting (establish baseline inventory of fleet assets and annually report on their financial and emission performance)
Fleet Policies	· Fleet planning and acquisition policy No. FN-014 · *Fleet Utilization Procedures* · *Fleet Assessment Procedures* · *Low Emission Vehicle Standard* · *Sustainability Innovation Fund* · Carbon Price policy No. GV-015 ($150/tCO$_2$e in life cycle cost analyses)

City of Kelowna is well aligned with similar approaches in place for addressing their fleet emission and through the City's Fleet Sustainability Policy. Potential additional opportunities to enhance the City's current fleet management procedures and policies include:

1. Setting corporate fleet emission reduction targets. This can be aligned with the City's overall emission targets, or set based on findings of this assessment;
2. Selecting an internal carbon price and utilizing it for emission reduction business case; and,
3. Monitoring and reporting on the fleet telematics data to proactively identify low utilization and/or high emission vehicles to investigate and address as needed.

8. CONCLUSIONS AND RECOMMENDATIONS

Through electrification of the City of Kelowna's fleet over the next 10 years, they could achieve:

- A 49% EV adoption rate;
- A 49% reduction in GHG emissions; and
- A 2% reduction in the life cycle cost of their fleet.

What's more, these number are expected to improve due to anticipated:

- Reductions in EV capital costs;
- Increases in the carbon tax (note we did not model this increase);
- Additional EV replacement options, particularly for LMDT, MDT and HDT vehicles.

Given all this, Prism recommends the following:

a) **Capital Plan Refining and Tracking:** This report provides a roadmap to transition to fleet electrification. However, we expect that this plan will need to be adjusted based on context specifics of the organization. We recommend reviewing the plan and adjusting and tracking on an annual basis against the adoption rates being prescribed.
b) **GHG Targets:** While the City currently does not have a GHG emission target specific to their fleet, as discussed in Section 7, many regions do in the range of 40-50% by 2030. If the City of Kelowna were to adopt a similar target, this strategy would position them comfortable to meet that goal while also demonstrating their commitment to sustainability and climate action.
c) **Fleet Utilization Review:** Annual utilization targets have been identified by vehicle duty class under the City's Corporate Fleet Sustainability Policy. Alignment with these annual targets is 50% or less across the portfolio. There may be good reason for the utilization, however, given the overall low alignment, a review of these targets those vehicle not aligning is recommended.
d) **Fleet Rightsizing Review:** The biggest barrier at this time to full electrification is the lack of EV options for LMDTs and MDTs. Until such time as these types of vehicles enter the market, the City should evaluate these categories of vehicles with the following questions in mind:
    - Can the existing LMDTs or MDTs be eliminated from the fleet (due to low utilization, for example)?
    - Can the existing LMDTs or MDTs be transitioned to LDTs?
e) **Carbon Price:** Our research indicated internal carbon price at rates ranging from $160 - $300 /t$CO_2$e can be used reasonably to support an electrification business case. Given the City's current support for electrification, we understand this lever may not be necessary. However, in future, this could be added into the City's existing Purchasing Policy and would also support the integration of climate into the financial assessment of other capital projects within the City.

In conclusion, the City of Kelowna is in a strong position to play a significant contributing role to the regions transition to electric vehicles, while reducing their organization footprint. Through a combination of EV adoption, and a review of their fleet size and makeup, the City has an opportunity to continue to be a leader in sustainable transportation while also demonstrating fiscal prudence.

APPENDIX A – Glossary

BEV – Battery Electric Vehicle

D – Diesel Vehicle

EV – Electric Vehicle

ZEV – Zero Emission Vehicle

G – Gasoline Vehicle

H – Hybrid Vehicle

ICE – Internal Combustion Engine

SUV – Sport utility vehicle

LDT – Light-duty truck, Class 1 and 2a; i.e. F-150, Ford Ranger.

LMDT – Light/medium-duty truck, Class 2b; i.e. F-250.

MDT – Medium-duty truck, Class 3 – 6; i.e. F-350, F-450.

HDT – Heavy-duty truck, Class 7-8; i.e. F-550, Freightliner, International, Sterling.

APPENDIX B – Transition Profile by Unit

Unit Name	Current Fleet Make-Up			EV Scenario		Current Fleet vs EV Replacement							
	Duty Class	Make and Model	Fuel Type	Make and Model	Fuel Type	Annual Fuel Savings (Litres)	Annual Fuel / Energy Cost Savings	Annual Elec. (kWh)	Annual Elec. Costs	Maint. Savings	Lifetime Cost Savings	Payback Period	Net GHG Savings
V1910 01	Car	Nissan Leaf SV	EV	2020 Chevrolet Bolt EV BEV	EV	-	$2,003	940	$74	$(116)	$11,517	-91	0.06
V1920 01	Van	Ford Transit 150	G	2022 Ford E-Transit	EV	1,721	$1,861	3,512	$277	$2,594	$(16,190)	-64	3.16
V1920 02	Van	Ford Transit 150	G	2022 Ford E-Transit	EV	1,772	$(262)	3,316	$262	$985	$(15,126)	-47	3.33
V1920 04	Van	Ford Transit Connect	G	2022 Ford E-Transit	EV	-	$290	302	$24	$(64)	$(48,192)	9	-0.08
V1930 01	LDT	Ford F150	G	2022 F-150 Lighting	EV	260	$2,330	959	$76	$284	$(40,449)	40	0.37
V1930 02	LDT	Ford F150 4x4	G	2022 F-150 Lighting	EV	1,993	$3,963	8,482	$670	$7,442	$53,575	-3	2.56
V1930 03	LMDT	Ford F250 Crew Cab	G	Ford F-250	G	-	$-	-	$-	$3,456	$(6,271)	0	0.00
V1930 05	LDT	Ford F150	G	2022 F-150 Lighting	EV	838	$810	4,001	$316	$(362)	$(42,333)	32	0.97
V1930 06	LDT	Ford F150 Reg Cab 4x4 w/ Spacekap Canopy	G	2022 F-150 Lighting	EV	933	$(201)	2,544	$201	$2,226	$2,897	-8	1.55
V1940 02	MDT	Ford F550 Superduty	G	Ford F-550	G	-	$-	-	$-	$-	$(44,684)	0	0.00
V1940 03	MDT	Ford F550 Superduty	D	Ford F-550	D	-	$-	-	$-	$4,395	$2,607	0	0.00
V1940 04	MDT	Ford F450	G	Ford F-450	G	-	$-	-	$-	$5,534	$20,527	0	-0.91

Unit Name	Current Fleet Make-Up			EV Scenario		Current Fleet vs EV Replacement							
	Duty Class	Make and Model	Fuel Type	Make and Model	Fuel Type	Annual Fuel Savings (Litres)	Annual Fuel / Energy Cost Savings	Annual Elec. (kWh)	Annual Elec. Costs	Maint. Savings	Lifetime Cost Savings	Payback Period	Net GHG Savings
V197006	MDT	Canadian Electric Vehicles Might-E Truck	EV	2020 Nissan Leaf (62 kW-hr battery pack) BEV	EV	-	$(1)	18	$1	$3,288	$20,422	0	0.00
V201002	Car	Hyundai Kona EV	EV	2020 Chevrolet Bolt EV BEV	EV	-	$131	940	$74	$320	$13,512	-33	0.06
V201004	SUV	Mitsubishi Outlander PHEV	H	2020 Kia Nero BEV	EV	160	$(130)	1,650	$130	$46	$15,082	12	-0.04
V201005	Car	Hyundai Kona EV	EV	2020 Chevrolet Bolt EV BEV	EV	-	$(102)	1,296	$102	$142	$11,447	-25	0.08
V201008	Car	Hyundai Kona EV	EV	2020 Chevrolet Bolt EV BEV	EV	-	$(72)	910	$72	$(398)	$(10,866)	-6	0.06
V202001	Van	Ford Transit T150	G	2022 Ford E-Transit	EV	-	$(63)	797	$63	$(169)	$(35,796)	3	-0.20
V202005	Van	Ford Transit Connect XL	G	2022 Ford E-Transit	EV	-	$(242)	3,069	$242	$(651)	$(52,586)	5	-0.77
V202008	Van	Ford Transit T150	G	2022 Ford E-Transit	EV	-	$(76)	958	$76	$(92)	$(31,165)	6	-0.24
V202009	Van	Ford Transit T250	G	2022 Ford E-Transit	EV	-	$(33)	411	$33	$13	$(37,190)	5	-0.10
V202010	Van	Ford Transit Connect	G	2022 Ford E-Transit	EV	-	$(17)	213	$17	$(45)	$(48,534)	9	-0.05
V202011	Van	Ford Transit Connect	G	2022 Ford E-Transit	EV	-	$(6)	80	$6	$(17)	$(47,281)	9	-0.02
V203002	LDT	Ford F150	G	2022 F-150 Lighting	EV	-	$(193)	2,442	$193	$(104)	$(44,097)	13	-0.61
V203003	LDT	Ford Ranger	G	2022 F-150 Lighting	EV	-	$(92)	1,163	$92	$(263)	$(55,577)	9	-0.29
V203004	LDT	Ford Ranger	G	2022 F-150 Lighting	EV	-	$(131)	1,657	$131	$(374)	$(57,081)	9	-0.41

Unit Name	Current Fleet Make-Up			EV Scenario		Current Fleet vs EV Replacement							
	Duty Class	Make and Model	Fuel Type	Make and Model	Fuel Type	Annual Fuel Savings (Litres)	Annual Fuel / Energy Cost Savings	Annual Elec. (kWh)	Annual Elec. Costs	Maint. Savings	Lifetime Cost Savings	Payback Period	Net GHG Savings
V203005	LDT	Ford Ranger 4x4	G	2022 F-150 Lighting	EV	-	$(66)	841	$66	$(190)	$(54,596)	10	-0.21
V203007	LMDT	Ford F250	G	Ford F-250	G	-	$-	-	$-	$6,604	$(0)	0	0.00
V203013	LDT	Ford F150	G	2022 F-150 Lighting	EV	-	$35	797	$63	$(180)	$(53,843)	10	-0.20
V203015	MDT	Ford F350 Superduty	G	Ford F-350	G	-	$-	-	$-	$9,832	$(5,133)	0	0.00
V203016	MDT	Ford F350	G	Ford F-350	G	-	$-	-	$-	$2,348	$18,491	0	0.00
V203017	LDT	Ford F150	G	2022 F-150 Lighting	EV	119	$(53)	673	$53	$151	$(37,628)	22	0.11
V206002	HDT	Freightliner Vacall AJV1015	D	2021 Volve VNRE62T300	EV	-	$(68)	864	$68	$(207)	$109,082	-49	-0.22
V211004	Car	Nissan Leaf	EV	2020 Chevrolet Bolt EV BEV	EV	-	$-	-	$-	$-	$(4,385)	-8	0.00
V211005	Car	Hyundai Kona EV	EV	2020 Chevrolet Bolt EV BEV	EV	-	$-	-	$-	$-	$(6,391)	-7	0.00
V211006	Car	Hyundai Kona EV	EV	2020 Chevrolet Bolt EV BEV	EV	-	$5,837	-	$-	$-	$(6,391)	-7	0.00
V6039	HDT	Spartan 1250 GPM Pump	D	Spartan 1250 GPM Pump	D	-	$-	-	$-	$21,117	$142,659	0	0.00
V6257	Van	Ford Econoline E150 XL Wagon	G	2022 Ford E-Transit	G	-	$-	966	$76	$354	$(39,067)	49	0.52
V6259	LDT	Mazda B2300	G	2022 F-150 Lighting	EV	693	$3,924	1,979	$156	$157	$(57,092)	61	1.13
V6292	HDT	Sterling L7500	D	Sterling L7500	D	-	$-	-	$-	$9,841	$-	0	0.00
V6297	MDT	Ford F550	D	Ford F-550	D	-	$-	-	$-	$6,214	$16,097	0	0.00
V6300	MDT	Ford F350	D	Ford F-350	D	-	$-	-	$-	$813	$(13,566)	0	0.38

Unit Name	Current Fleet Make-Up			EV Scenario		Current Fleet vs EV Replacement							
	Duty Class	Make and Model	Fuel Type	Make and Model	Fuel Type	Annual Fuel Savings (Litres)	Annual Fuel / Energy Cost Savings	Annual Elec. (kWh)	Annual Elec. Costs	Maint. Savings	Lifetime Cost Savings	Payback Period	Net GHG Savings
V6301	LDT	Ford Ranger	G	2022 F-150 Lighting	EV	597	$157	1,664	$131	$675	$(53,511)	131	0.98
V6351	MDT	Ford F550 4x4	D	Ford F-550	D	-	$-	-	$-	$3,148	$139	0	0.00
V6361	Van	Ford E150	G	2022 Ford E-Transit	EV	1,005	$4,889	1,918	$152	$223	$(38,163)	96	1.88
V6363	MDT	Ford F450	D	Ford F-550	D	-	$-	-	$-	$4,669	$(7,133)	0	0.00
V6364	HDT	International 7600	D	2021 Volve VNRE62T300	D	-	$-	709	$56	$18,197	$99,584	-7	27.39
V6374	HDT	International 4100	D	International 4100	D	-	$-	-	$-	$4,292	$-	0	0.00
V6395	LDT	Ford Ranger XL Supercab 2wd	G	2022 F-150 Lighting	EV	1,926	$14,885	4,433	$350	$754	$(38,000)	-45	3.41
V6396	MDT	Ford F550	G	Ford F-550	G	-	$-	-	$-	$8,563	$35,369	0	-3.82
V6406	Van	Ford E150	G	2022 Ford E-Transit	EV	1,671	$232	2,484	$196	$1,087	$(21,924)	-27	3.30
V6407	HDT	Freightliner MM154042S	D	Freightliner MM154042S	D	-	$-	-	$-	$1,826	$18,680	0	0.00
V6417	Car	Ford Focus	G	2020 Chevrolet Bolt EV BEV	EV	325	$571	711	$56	$231	$(17,901)	13	0.59
V6419	LDT	Ford Ranger RC	G	2022 F-150 Lighting	EV	520	$380	2,611	$206	$61	$(62,519)	44	0.57
V6423	LDT	Ford F150 XL Reg Cab 2wd	G	2022 F-150 Lighting	EV	486	$1,604	1,310	$103	$141	$(61,993)	37	0.81
V6424	LDT	Ford Ranger	G	2022 F-150 Lighting	EV	1,414	$1,783	3,078	$243	$(48)	$(51,854)	219	2.55
V6426	MDT	Ford F350	G	Ford F-350	G	-	$-	-	$-	$1,061	$4,409	0	0.00
V6427	HDT	Sterling 5500 Bullet	D	Sterling 5500 Bullet	D	-	$-	-	$-	$11,821	$-	0	0.00
V6428	HDT	International AJV1015	D	2021 Volve VNRE62T300	D	-	$-	775	$61	$39,652	$433,287	-2	25.72

Unit Name	Current Fleet Make-Up			EV Scenario		Current Fleet vs EV Replacement							
	Duty Class	Make and Model	Fuel Type	Make and Model	Fuel Type	Annual Fuel Savings (Litres)	Annual Fuel / Energy Cost Savings	Annual Elec. (kWh)	Annual Elec. Costs	Maint. Savings	Lifetime Cost Savings	Payback Period	Net GHG Savings
V6432	LDT	Ford F150 XL Reg Cab 2wd	G	2022 F-150 Lighting	EV	1,111	$2,529	2,345	$185	$1,190	$(44,777)	-118	2.02
V6437	LDT	Ford F150 XL Reg Cab 2wd	G	2022 F-150 Lighting	EV	2,249	$2,232	3,597	$284	$42	$(39,639)	-58	4.38
V6438	LDT	Ford F150 XL Reg Cab 2wd	G	2022 F-150 Lighting	EV	2,085	$1,787	2,725	$215	$1,528	$(26,963)	-24	4.21
V6440	LDT	Ford F150 XL Reg Cab 2wd	G	2022 F-150 Lighting	EV	1,659	$3,097	3,579	$283	$442	$(42,744)	-92	3.00
V6443	LDT	Ford F150 XL Reg Cab 2wd	G	2022 F-150 Lighting	EV	2,800	$1,853	4,542	$359	$1,112	$(10,615)	-14	5.43
V6444	Van	Ford E150	G	2022 Ford E-Transit	EV	1,833	$9,503	3,502	$277	$937	$(22,161)	-28	3.42
V6446	HDT	Spartan Gladiator GA41M-2142	D	Spartan Gladiator GA41M-2142	D	-	$-	-	$-	$30,968	$214,844	0	0.00
V6449	MDT	Ford LCF655A	D	Ford LCF655A	D	-	$-	-	$-	$3,819	$-	0	0.00
V6471	MDT	Ford F550	H	Ford F-550	H	-	$-	-	$-	$7,985	$17,066	0	-0.73
V6474	LDT	Ford Ranger Sport Supercab	G	2022 F-150 Lighting	EV	553	$271	1,326	$105	$509	$(41,219)	62	0.97
V6476	Car	Ford Focus Sedan S	G	2020 Chevrolet Bolt EV BEV	EV	311	$1,744	829	$66	$(31)	$(22,924)	12	0.52
V6482	LDT	Ford Ranger	G	2022 F-150 Lighting	EV	1,499	$1,707	2,182	$172	$2,008	$(32,261)	-26	2.97
V6488	MDT	Ford F350	G	Ford F-350	G	-	$-	-	$-	$4,624	$(4,210)	0	0.00
V6490	MDT	Ford F350 SD XL Reg Cab 2wd	G	Ford F-350	G	-	$-	-	$-	$2,333	$(32,728)	0	0.00
V6493	HDT	International SA625	D	International SA625	D	-	$-	-	$-	$16,492	$-	0	0.00
V6496	Van	Ford E150	G	2020 Nissan Leaf (62 kW-hr battery pack) BEV	EV	1,044	$21,207	990	$78	$138	$(13,563)	32	2.20

Unit Name	Current Fleet Make-Up			EV Scenario		Current Fleet vs EV Replacement							
	Duty Class	Make and Model	Fuel Type	Make and Model	Fuel Type	Annual Fuel Savings (Litres)	Annual Fuel / Energy Cost Savings	Annual Elec. (kWh)	Annual Elec. Costs	Maint. Savings	Lifetime Cost Savings	Payback Period	Net GHG Savings
V6497	HDT	International 7600	D	2021 Volve VNRE62T300	D	-	$-	17,109	$1,352	$34,452	$304,018	-4	39.60
V6498	LDT	Ford Ranger	G	2022 F-150 Lighting	EV	1,114	$1,691	3,740	$295	$(166)	$(43,702)	48	1.68
V6500	Van	Ford E150	G	2022 Ford E-Transit	EV	1,645	$978	2,648	$209	$2,508	$(10,013)	-14	3.20
V6501	LDT	Ford Ranger	G	2022 F-150 Lighting	EV	984	$963	2,462	$194	$(45)	$(56,736)	72	1.69
V6502	LDT	Ford Ranger	G	2022 F-150 Lighting	EV	959	$971	2,357	$186	$328	$(53,222)	145	1.66
V6503	LDT	Ford Ranger	G	2022 F-150 Lighting	EV	959	$3,153	2,303	$182	$(121)	$(57,363)	63	1.67
V6512	LMDT	Ford F250 4x4 XL Reg Cab 4wd	G	Ford F-250	G	-	$-	-	$-	$2,580	$(13,475)	0	0.00
V6518	LDT	Ford Ranger 4x4 Sport Supercab	G	2022 F-150 Lighting	EV	1,040	$2,089	3,457	$273	$(137)	$(55,759)	60	1.57
V6519	LDT	Ford Ranger Super Cab	G	2022 F-150 Lighting	EV	1,957	$1,402	4,329	$342	$610	$(40,649)	-51	3.51
V6522	LDT	Ford F150 XL Reg Cab 2wd	G	2022 F-150 Lighting	EV	1,445	$2,005	2,524	$199	$(42)	$(35,858)	245	2.76
V6523	LDT	Ford F150 XL Reg Cab 2wd	G	2022 F-150 Lighting	EV	1,826	$1,894	3,580	$283	$2,227	$(21,226)	-18	3.39
V6524	LDT	Ford F150 XL Reg Cab 2wd	G	2022 F-150 Lighting	EV	1,804	$3,573	2,521	$199	$2,763	$(15,304)	-15	3.60
V6525	MDT	Ford F550	G	Ford F-550	G	-	$-	-	$-	$4,319	$(6,472)	0	-0.95
V6526	HDT	International 7600	D	2021 Volve VNRE62T300	D	-	$-	16,062	$1,269	$25,437	$126,148	-7	28.59
V6530	HDT	Allianz M4000	D	Allianz M4000	D	-	$-	-	$-	$54,766	$-	0	0.00
V6532	LDT	Dodge Ram 1500	G	2022 F-150 Lighting	EV	2,383	$15,215	3,353	$265	$829	$(32,037)	-31	4.75
V6534	HDT	International 7600	D	2021 Volve VNRE62T300	D	-	$-	15,276	$1,207	$27,015	$157,393	-6	28.09

Unit Name	Current Fleet Make-Up			EV Scenario		Current Fleet vs EV Replacement							
	Duty Class	Make and Model	Fuel Type	Make and Model	Fuel Type	Annual Fuel Savings (Litres)	Annual Fuel / Energy Cost Savings	Annual Elec. (kWh)	Annual Elec. Costs	Maint. Savings	Lifetime Cost Savings	Payback Period	Net GHG Savings
V6535	Van	Ford E150	G	2020 Nissan Leaf (62 kW-hr battery pack) BEV	EV	1,785	$1,050	1,237	$98	$151	$718	-9	3.88
V6539	Van	Ford Transit Connect	G	2022 Ford E-Transit	EV	951	$1,771	3,141	$248	$2,670	$(13,647)	-17	1.45
V6540	LDT	Dodge Ram 1500	G	2022 F-150 Lighting	EV	1,673	$1,551	3,672	$290	$615	$(42,996)	-114	3.01
V6541	MDT	Ford F550	G	Ford F-550	G	-	$-	-	$-	$9,672	$(6,352)	0	-0.46
V6542	Van	Nissan NV 2500 S V6 Cargo Van	G	2022 Ford E-Transit	EV	1,303	$1,101	2,385	$188	$742	$(26,155)	-96	2.46
V6543	Van	Nissan NV 2500 S V6 Cargo Van	G	2022 Ford E-Transit	EV	1,068	$2,901	2,055	$162	$413	$(28,898)	97	1.99
V6544	MDT	Ford F350	G	Ford F-350	G	-	$-	-	$-	$1,685	$(16,705)	0	0.00
V6548	MDT	Ford F350 SD XL Reg Cab 2wd	G	Ford F-350	G	-	$-	-	$-	$1,266	$(3,048)	0	0.00
V6552	HDT	International 7400	D	International 7400	D	-	$-	-	$-	$20,681	$-	0	0.00
V6557	HDT	International Durastar 4400	H	International Durastar 4400	H	-	$-	-	$-	$9,748	$-	0	-1.39
V6565	HDT	International 7600	D	2021 Volve VNRE62T300	D	-	$-	19,337	$1,528	$28,661	$217,841	-5	34.29
V6566	Van	Ford Transit	G	2022 Ford E-Transit	EV	1,473	$10,506	4,169	$329	$659	$(21,970)	-39	2.41
V6567	HDT	Allianz M4000	D	Allianz M4000	D	-	$-	-	$-	$47,938	$-	0	0.00
V6571	Van	Ford Transit Connect	G	2022 Ford E-Transit	EV	673	$3,988	1,819	$144	$376	$(38,895)	63	1.13
V6576	MDT	Ford F550	G	Ford F-550	G	-	$-	-	$-	$7,399	$(45,112)	0	-1.04
V6581	LDT	Ford Ranger XL Supercab 2wd	G	2022 F-150 Lighting	EV	610	$2,050	1,252	$99	$351	$(57,509)	56	1.12
V6583	LDT	Ford Ranger 4x4 Sport Supercab	G	2022 F-150 Lighting	EV	1,781	$11,668	3,891	$307	$799	$(34,735)	-45	3.20

Unit Name	Current Fleet Make-Up			EV Scenario		Current Fleet vs EV Replacement							
	Duty Class	Make and Model	Fuel Type	Make and Model	Fuel Type	Annual Fuel Savings (Litres)	Annual Fuel / Energy Cost Savings	Annual Elec. (kWh)	Annual Elec. Costs	Maint. Savings	Lifetime Cost Savings	Payback Period	Net GHG Savings
V6590	HDT	Rosen GA40M-214Z	D	Rosen GA40M-214Z	D	-	$-	-	$-	$45,083	$303,627	0	0.00
V6614	HDT	International 7500 6x4	D	2021 Lio8 Tractor	EV	11,540	$15,209	649	$51	$36,382	$497,383	-0	30.41
V6615	HDT	International 7500 6x4	D	2021 Lio8 Tractor	EV	11,876	$3,135	657	$52	$33,067	$456,830	-0	31.29
V6618	SUV	Ford Escape 2WD	G	2020 Kia Nero BEV	EV	2,640	$3,917	2,340	$185	$2,478	$27,368	-4	5.61
V6619	LDT	Ford F150 XL Reg Cab 2wd	G	2022 F-150 Lighting	EV	3,398	$3,683	5,021	$397	$934	$(5,940)	-12	6.72
V6620	LMDT	Dodge Ram 2500	G	Ford F-250	G	-	$-	-	$-	$5,311	$(17,652)	0	0.00
V6621	Van	Ford Transit Connect	G	2022 Ford E-Transit	EV	1,002	$1,611	3,792	$300	$(30)	$(41,060)	49	1.40
V6626	MDT	Ford F550 SD 4x4	D	Ford F-550	D	-	$-	-	$-	$5,431	$4,119	0	0.00
V6632	LDT	Ford Ranger XL Supercab 2wd	G	2022 F-150 Lighting	EV	1,157	$19,374	2,456	$194	$(73)	$(52,752)	93	2.10
V6644	HDT	International 7600	D	Ford F-650	D	-	$-	-	$-	$36,085	$(8,734)	0	0.00
V6647	MDT	Ford F350 4x4 Dually	G	Ford F-350	G	-	$-	-	$-	$2,030	$(12,923)	0	0.00
V6648	LDT	Ford F150 4x4 XL Reg Cab	G	2022 F-150 Lighting	EV	1,944	$1,129	3,718	$294	$69	$(34,991)	-59	3.63
V6649	LDT	Ford F150XL Reg Cab 2wd	G	Ford F-150	G	-	$-	-	$-	$388	$(9,761)	0	0.46
V6650	LMDT	Ford F250	D	Ford F-250	D	-	$-	-	$-	$1,645	$(14,495)	0	0.61
V6651	LDT	Ford F150XL Reg Cab 2wd	G	Ford F-150	G	-	$-	-	$-	$1,250	$(8,822)	0	0.39
V6652	LDT	Ford F150 XL Reg Cab 2wd	G	2022 F-150 Lighting	EV	1,500	$2,109	2,719	$215	$(107)	$(43,004)	-835	2.84
V6653	LDT	Ford F150 XL Reg Cab 2wd	G	2022 F-150 Lighting	EV	1,926	$1,118	3,485	$275	$14	$(37,267)	-70	3.65

Unit Name	Current Fleet Make-Up			EV Scenario		Current Fleet vs EV Replacement							
	Duty Class	Make and Model	Fuel Type	Make and Model	Fuel Type	Annual Fuel Savings (Litres)	Annual Fuel / Energy Cost Savings	Annual Elec. (kWh)	Annual Elec. Costs	Maint. Savings	Lifetime Cost Savings	Payback Period	Net GHG Savings
V6654	LDT	Ford F150 XL Reg Cab 2wd	G	Ford F-150	G	-	$-	-	$-	$840	$(8,822)	0	0.25
V6655	LDT	Ford F150 XL Reg Cab 2wd	D	2022 F-150 Lighting	EV	1,987	$2,067	4,051	$320	$(57)	$(31,888)	-58	4.25
V6656	LDT	Ford F150 XL Reg Cab 2wd	G	Ford F-150	G	-	$-	-	$-	$394	$(9,864)	0	1.64
V6657	LMDT	Ford F250 SD XL Reg Cab 2wd	G	Ford F-250	G	-	$-	-	$-	$1,556	$(17,475)	0	0.00
V6658	LDT	Ford F150XL Reg Cab 2wd	D	2022 F-150 Lighting	EV	1,696	$2,304	3,224	$255	$71	$(37,933)	-78	3.69
V6659	LDT	Ford F150 XL Reg Cab 2wd	G	2022 F-150 Lighting	EV	2,120	$744	4,837	$382	$(77)	$(36,509)	-65	3.76
V6660	LDT	Ford F150 XL Reg Cab 2wd	G	2022 F-150 Lighting	EV	933	$2,077	1,515	$120	$24	$(50,217)	85	1.81
V6661	LDT	Ford F150 XL Reg Cab 2wd	G	2022 F-150 Lighting	EV	1,820	$519	3,727	$294	$(111)	$(38,950)	-106	3.34
V6662	Van	Nissan NV 200 S Cargo Van	G	2022 Ford E-Transit	EV	674	$2,234	2,189	$173	$26	$(38,730)	38	1.03
V6663	LDT	Ford F150 XL Reg Cab 2wd	D	2022 F-150 Lighting	EV	1,873	$2,655	3,544	$280	$(217)	$(37,463)	-89	4.08
V6664	LDT	Ford F150 XL Supercab 4wd	D	2022 F-150 Lighting	EV	2,284	$1,850	4,818	$381	$(225)	$(27,379)	-38	4.85
V6665	HDT	Mitsubishi Fuso Canter	D	Mitsubishi Fuso Canter	D	-	$-	-	$-	$3,336	$-	0	0.00
V6666	LDT	Ford F150 XL Reg Cab 4wd	G	2022 F-150 Lighting	EV	1,380	$2,520	2,253	$178	$2,710	$(12,876)	-15	2.67
V6667	LMDT	Ford F250 4x4 SD XL Supercab	D	Ford F-250	D	-	$-	-	$-	$1,432	$7,990	0	0.64
V6668	LMDT	Ford F250 4x4 SD XL Supercab	G	Ford F-250	G	-	$-	-	$-	$1,285	$7,990	0	0.00
V6670	Car	Ford CMax	H	2020 Chevrolet Bolt EV BEV	EV	849	$945	2,029	$160	$371	$3,095	3	1.48

Unit Name	Current Fleet Make-Up			EV Scenario		Current Fleet vs EV Replacement							
	Duty Class	Make and Model	Fuel Type	Make and Model	Fuel Type	Annual Fuel Savings (Litres)	Annual Fuel / Energy Cost Savings	Annual Elec. (kWh)	Annual Elec. Costs	Maint. Savings	Lifetime Cost Savings	Payback Period	Net GHG Savings
V6671	HDT	Mitsubishi FUSO Canter Cab-Over	G	Mitsubishi FUSO Canter Cab-Over	G	-	$-	-	$-	$914	$20,721	0	-0.28
V6672	Van	GMC Savana 1500	G	2022 Ford E-Transit	EV	5,685	$1,391	8,875	$701	$2,499	$45,398	-4	11.12
V6673	LMDT	Ford F250 4x4 Crew Cab	G	Ford F-250	G	-	$-	-	$-	$2,325	$(10,846)	0	0.00
V6679	Van	Ford Transit XLT	D	2022 Ford E-Transit	EV	649	$345	2,012	$159	$386	$(40,116)	68	1.22
V6680	HDT	Freightliner M2106	D	Freightliner M2106	D	-	$-	-	$-	$3,154	$27,954	0	0.00
V6681	HDT	Spartan GA40M-3164	D	Spartan GA40M-3164	D	-	$-	-	$-	$9,103	$73,794	0	0.00
V6699	HDT	International 7600 SBA	D	2021 Volve VNRE62T300	D	-	$-	15,387	$1,216	$17,242	$87,912	-7	21.44
V6700	Car	Ford Fusion Hybrid SE	H	2020 Chevrolet Bolt EV BEV	H	-	$-	2,306	$182	$1,425	$7,930	1	-0.07
V6703	LMDT	Ford F250 4x4	G	Ford F-250	G	-	$-	-	$-	$670	$10,108	0	0.00
V6704	LDT	Ford F150	G	2022 F-150 Lighting	EV	2,570	$2,301	3,745	$296	$162	$(26,160)	-26	5.09
V6705	LDT	Ford F150	G	2022 F-150 Lighting	EV	2,152	$466	4,746	$375	$(607)	$(39,689)	-138	3.86
V6706	Van	Ford Connect	G	2022 Ford E-Transit	EV	696	$9,315	2,046	$162	$(69)	$(37,638)	37	1.12
V6707	LMDT	Ford F250 XL 4X4 REG CAB	G	Ford F-250	G	-	$-	-	$-	$3,478	$(13,486)	0	0.00
V6709	LDT	Ford F150	G	2022 F-150 Lighting	EV	1,958	$632	4,117	$325	$(495)	$(40,418)	-180	3.56
V6710	LDT	Ford F150 XL Reg Cab 2wd	G	Ford F-150	G	-	$-	-	$-	$877	$(11,068)	0	0.43
V6711	SUV	Ford Explorer XLT 4DR 4X4	G	2020 Nissan Leaf (62 kW-	EV	5,782	$1,250	5,388	$426	$2,596	$91,297	1	12.22

Unit Name	Current Fleet Make-Up			EV Scenario		Current Fleet vs EV Replacement							
	Duty Class	Make and Model	Fuel Type	Make and Model	Fuel Type	Annual Fuel Savings (Litres)	Annual Fuel / Energy Cost Savings	Annual Elec. (kWh)	Annual Elec. Costs	Maint. Savings	Lifetime Cost Savings	Payback Period	Net GHG Savings
				hr battery pack) BEV									
V6712	Van	Ford Transit Connect	G	2022 Ford E-Transit	EV	1,388	$4,556	4,086	$323	$85	$(27,966)	-792	2.24
V6714	Car	Ford Taurus SEL 4DR	G	2020 Chevrolet Bolt EV BEV	EV	4,042	$(110)	3,301	$261	$2,458	$76,418	3	8.66
V6725	Car	Toyota Matrix 4A	G	2020 Chevrolet Bolt EV BEV	EV	125	$3,030	305	$24	$40	$(36,977)	34	0.22
V6727	HDT	International Terrastar 4x4	D	International Terrastar 4x4	D	-	$-	-	$-	$9,996	$-	0	0.00
V6746	HDT	Spartan Cab-over	D	Spartan Cab-over	D	-	$-	-	$-	$9,725	$82,548	0	0.00
V6750	LDT	Ford F150 4x4 Lariat	G	2022 F-150 Lighting	EV	1,852	$1,046	5,988	$473	$860	$(54,094)	-49	2.85
V6751	Van	Ford Transit Van	G	2022 Ford E-Transit	EV	1,258	$540	2,971	$235	$48	$(32,513)	624	2.21
V6752	Van	Ford Transit Van	G	2022 Ford E-Transit	EV	641	$1,838	2,362	$187	$1,059	$(29,372)	-122	0.91
V6758	LDT	Ford F150 XL Reg Cab 2wd	G	2022 F-150 Lighting	EV	1,677	$916	4,276	$338	$(666)	$(46,998)	49	2.87
V6759	SUV	Ford Edge SE AWD 4DR	G	2020 Kia Nero BEV	G	-	$-	1,605	$127	$114	$1,198	-22	2.04
V6760	SUV	Ford Edge SE AWD	G	2020 Kia Nero BEV	EV	2,051	$5,036	3,195	$252	$132	$12,340	2	4.01
V6761	MDT	Ford F550	G	Ford F-550	G	-	$-	-	$-	$2,723	$(22,402)	0	-1.33
V6763	LMDT	Ford F250 Reg Cab 4x2	G	Ford F-250	G	-	$-	-	$-	$705	$(22,522)	0	0.00
V6764	MDT	Ford F350 Crew Cab 4x4	G	Ford F-350	G	-	$-	-	$-	$2,458	$(16,679)	0	0.00
V6766	LDT	Ford F150 XLT Reg Cab 4x2	G	2022 F-150 Lighting	EV	1,159	$1,596	3,350	$265	$(601)	$(51,873)	30	1.88

Unit Name	Current Fleet Make-Up			EV Scenario		Current Fleet vs EV Replacement							
	Duty Class	Make and Model	Fuel Type	Make and Model	Fuel Type	Annual Fuel Savings (Litres)	Annual Fuel / Energy Cost Savings	Annual Elec. (kWh)	Annual Elec. Costs	Maint. Savings	Lifetime Cost Savings	Payback Period	Net GHG Savings
V6767	LDT	Ford F150 XLT Reg Cab 4x2	G	2022 F-150 Lighting	EV	1,541	$4,602	3,913	$309	$1	$(20,446)	81	2.64
V6768	LMDT	Ford F250 XL Reg Cab 4x2	G	Ford F-250	G	-	$-	-	$-	$1,966	$(22,522)	0	0.00
V6769	LDT	Ford F150 Reg Cab 2wd	G	2022 F-150 Lighting	EV	2,256	$2,167	4,788	$378	$(592)	$(39,683)	571	4.09
V6770	LMDT	Ford F250 Reg Cab 4x2 XL	G	Ford F-250	G	-	$-	-	$-	$711	$(191)	0	0.00
V6771	MDT	Ford F350 XL 4X4 SD Crew Cab	G	Ford F-350	G	-	$-	-	$-	$3,365	$(20,953)	0	0.00
V6772	LDT	Ford F150 XL Reg Cab 4x4	G	2022 F-150 Lighting	EV	1,502	$192	3,285	$260	$(366)	$(36,971)	49	2.70
V6773	Van	Ford Transit Connect XL	G	2022 Ford E-Transit	EV	374	$319	1,108	$88	$612	$(29,484)	69	0.60
V6775	Car	Toyota Highlander LE	G	2020 Chevrolet Bolt EV BEV	EV	337	$3,338	883	$70	$123	$(33,290)	61	0.57
V6781	MDT	Ford F350 XL SD Super Cab	G	Ford F-550	G	-	$-	-	$-	$1,840	$(49,123)	0	0.00
V6785	HDT	Spartan Gladiator	D	Spartan Gladiator	D	-	$-	-	$-	$17,414	$(56,871)	0	0.00
V6812	LDT	Toyota Tacoma	G	2022 F-150 Lighting	EV	883	$2,160	2,664	$210	$958	$(36,318)	-88	1.41
V6815	MDT	Ford F350 XL 4x4 SD Crew Cab	G	Ford F-350	G	-	$-	-	$-	$1,093	$(14,674)	0	0.00
V6816	HDT	Freightliner S/A Water Tank/Sander	D	Freightliner S/A Water Tank/Sander	D	-	$-	-	$-	$8,764	$-	0	0.00
V6817	HDT	International HV607 Bucket Truck	D	2021 Volve VNRE62T300	EV	2,802	$19,993	468	$37	$2,285	$(137,721)	-70	7.31

Unit Name	Current Fleet Make-Up			EV Scenario		Current Fleet vs EV Replacement							
	Duty Class	Make and Model	Fuel Type	Make and Model	Fuel Type	Annual Fuel Savings (Litres)	Annual Fuel / Energy Cost Savings	Annual Elec. (kWh)	Annual Elec. Costs	Maint. Savings	Lifetime Cost Savings	Payback Period	Net GHG Savings
V6818	HDT	Freightliner 114SD	D	2021 Volve VNRE62T300	D	-	$-	22,988	$1,816	$8,328	$85,186	-7	35.54
V6819	HDT	Freightliner 114SD	D	2021 Volve VNRE62T300	D	-	$-	24,044	$1,899	$13,310	$146,556	-5	38.04
V6820	Car	Ford S 4DR SDN	G	2020 Chevrolet Bolt EV BEV	EV	378	$1,297	672	$53	$426	$(6,622)	50	0.72
V6821	Car	Ford CMax Hybrid	H	2020 Chevrolet Bolt EV BEV	EV	1,051	$952	3,376	$267	$(372)	$(5,227)	62	1.62
V6824	Car	Ford Cmax Hybrid	H	2020 Chevrolet Bolt EV BEV	EV	949	$19,781	2,791	$220	$625	$3,895	-5	1.53
V6826	HDT	Western Star WD110064S	D	2021 Volve VNRE62T300	D	-	$-	22,218	$1,755	$6,516	$118,396	-5	35.68
V6832	HDT	Freightliner 114SD Chassis Ramvac HX12 triaxle	D	2021 Volve VNRE62T300	EV	10,177	$10,429	956	$76	$35,575	$537,547	1	26.72
V6834	HDT	Spartan Gladiator	D	Spartan Gladiator	D	-	$-	-	$-	$14,996	$(71,374)	0	0.00
V6836	HDT	Spartan Metrostar X	D	Spartan Metrostar X	D	-	$-	-	$-	$7,015	$67,448	0	0.00
V6839	Car	Ford CMax	H	2020 Chevrolet Bolt EV BEV	EV	698	$557	3,163	$250	$189	$(6,893)	202	0.85
V6840	Car	Ford CMax	H	2020 Chevrolet Bolt EV BEV	EV	628	$856	2,246	$177	$(713)	$(16,091)	7	0.91
V6841	Car	Ford CMax	H	2020 Chevrolet Bolt EV BEV	EV	804	$1,129	4,014	$317	$(952)	$(17,616)	6	0.88

Unit Name	Current Fleet Make-Up			EV Scenario		Current Fleet vs EV Replacement							
	Duty Class	Make and Model	Fuel Type	Make and Model	Fuel Type	Annual Fuel Savings (Litres)	Annual Fuel / Energy Cost Savings	Annual Elec. (kWh)	Annual Elec. Costs	Maint. Savings	Lifetime Cost Savings	Payback Period	Net GHG Savings
V6842	Car	Ford CMax	H	2020 Chevrolet Bolt EV BEV	EV	1,126	$498	4,170	$329	$(501)	$(9,098)	26	1.60
V6843	Car	Ford CMax	H	2020 Chevrolet Bolt EV BEV	EV	644	$425	2,774	$219	$(537)	$(14,553)	8	0.82
V6844	Car	Ford CMax	H	2020 Chevrolet Bolt EV BEV	EV	502	$956	2,061	$163	$(150)	$(14,447)	8	0.66
V6846	Car	Ford CMax	H	2020 Chevrolet Bolt EV BEV	EV	871	$2,581	3,232	$255	$(949)	$(16,114)	7	1.24
V6852	MDT	Ford F550 Service Truck w/ Crane	G	Ford F-550	G	-	$-	-	$-	$13,277	$65,895	0	-0.71
V6853	HDT	International 7500	D	2021 Lion8 Refuse REL	EV	12,560	$549	1,312	$104	$18,719	$97,307	-7	32.94
V6854	Van	Ford Transit 350	G	2022 Ford E-Transit	EV	541	$2,408	1,220	$96	$781	$(14,122)	-373	0.96
V6857	MDT	Ford F350 w/Service body	G	Ford F-350	G	-	$-	-	$-	$479	$16,436	0	0.00
V6858	Van	Ford Transit 350	G	2022 Ford E-Transit	EV	1,489	$847	2,874	$227	$(120)	$(6,024)	3	2.78
V6860	Van	Ford Connect	G	2022 Ford E-Transit	EV	890	$1,390	3,205	$253	$454	$(23,291)	-85	1.29
V6861	MDT	Ford F350 4X4	G	Ford F-350	G	-	$-	-	$-	$6,929	$7,042	0	0.00
V6862	HDT	Freightliner CT108042SD	D	2021 Volve VNRE62T300	EV	4,497	$4,111	593	$47	$8,807	$(29,912)	-12	11.77
V6864	MDT	Ford F350 XL 4x4 SD Regular Cab	G	Ford F-350	G	-	$-	-	$-	$11,954	$(19,405)	0	0.00
V6865	LDT	Ford F150	G	2022 F-150 Lighting	EV	745	$1,915	1,627	$128	$(84)	$(32,675)	22	1.34

Unit Name	Current Fleet Make-Up			EV Scenario		Current Fleet vs EV Replacement							
	Duty Class	Make and Model	Fuel Type	Make and Model	Fuel Type	Annual Fuel Savings (Litres)	Annual Fuel / Energy Cost Savings	Annual Elec. (kWh)	Annual Elec. Costs	Maint. Savings	Lifetime Cost Savings	Payback Period	Net GHG Savings
V6866	Van	Ford T350 Cargo Van	G	Ford F-350	G	-	$-	-	$-	$735	$(1,448)	0	-0.51
V6867	LMDT	Ford F250 with Service Body	G	Ford F-250	G	-	$-	-	$-	$156	$7,375	0	0.00
V6869	Car	Ford C-Max	H	2020 Chevrolet Bolt EV BEV	EV	850	$1,793	1,296	$102	$173	$4,213	-58	1.67
V6870	LDT	Ford F150 Reg Cab	G	2022 F-150 Lighting	EV	1,570	$3,203	3,325	$263	$486	$(29,257)	-115	2.85
V6871	MDT	Ford F350 w/service body	G	Ford F-350	G	-	$-	-	$-	$296	$(1,708)	0	0.00
V6872	Car	Ford SE 4 dr hatchback	H	2020 Chevrolet Bolt EV BEV	H	-	$-	944	$75	$(229)	$(6,143)	-5	0.58
V6873	SUV	Ford Escape 4x4	G	2020 Kia Nero BEV	EV	1,337	$1,230	2,155	$170	$(493)	$(6,026)	-100	2.60
V6874	LDT	Ford F150	G	2022 F-150 Lighting	EV	1,160	$707	4,578	$362	$(544)	$(39,836)	56	1.58
V6875	Car	Ford Cmax Hybrid	H	2020 Chevrolet Bolt EV BEV	EV	832	$1,027	2,299	$182	$262	$4,077	-50	1.38
V6877	Van	Ford Transit Connect	G	2022 Ford E-Transit	EV	1,002	$1,288	2,515	$199	$1,863	$(7,310)	-14	1.72
V6878	LDT	Ford F150 4X4	G	2022 F-150 Lighting	EV	1,232	$2,280	2,219	$175	$215	$(27,239)	91	2.34
V6890	MDT	Ford F350 4X4	G	Ford F-350	G	-	$-	-	$-	$279	$(11,256)	0	0.00
V6898	SUV	Toyota Rav 4 LE	G	2020 Kia Nero BEV	EV	1,043	$135	1,318	$104	$(41)	$(34,573)	-153	2.12
V6904	LMDT	Ford XL 4x4 SD Crew Cab	G	2022 F-150 Lighting	EV	198	$777	227	$18	$2,435	$6,464	-5	0.41
V6905	LMDT	Ford XL 4x4 SD Crew Cab	G	Ford F-150	G	-	$-	-	$-	$3,860	$28,804	0	0.86

Unit Name	Current Fleet Make-Up			EV Scenario		Current Fleet vs EV Replacement							
	Duty Class	Make and Model	Fuel Type	Make and Model	Fuel Type	Annual Fuel Savings (Litres)	Annual Fuel / Energy Cost Savings	Annual Elec. (kWh)	Annual Elec. Costs	Maint. Savings	Lifetime Cost Savings	Payback Period	Net GHG Savings
V6919	SUV	Ford SE	G	2020 Kia Nero BEV	EV	1,043	$1,083	1,501	$119	$(438)	$(39,285)	162	2.07
V6920	SUV	Ford SE	G	2020 Kia Nero BEV	G	-	$-	1,503	$119	$(143)	$(37,024)	12,975	1.96
V6925	MDT	Ford F550 Supercab 4x4	G	Ford F-550	G	-	$-	-	$-	$4,437	$35,092	0	-0.92
V6926	MDT	Ford F550	G	Ford F-550	G	-	$-	-	$-	$1,159	$19,344	0	-0.46
V6928	LMDT	Ford F250 4x4	G	Ford F-250	G	-	$-	-	$-	$5,729	$5,529	0	0.00
V6929	Car	Nissan Leaf SV	EV	2020 Chevrolet Bolt EV BEV	EV	-	$(32)	405	$32	$(22)	$7,587	-23	0.03
V6930	Car	Ford e-Fusion	EV	2020 Chevrolet Bolt EV BEV	EV	-	$835	854	$67	$(235)	$7,797	-21	0.05
V6931	Car	Ford Fusion Hybrid	H	2020 Chevrolet Bolt EV BEV	EV	702	$15,728	2,710	$214	$2,223	$21,946	2	0.97
V6932	HDT	International HV613	D	2021 Volve VNRE62T300	D	-	$-	18,276	$1,444	$16,201	$201,423	-3	28.30
V6933	HDT	International Hooklift HV613	D	2021 Volve VNRE62T300	D	-	$-	18,085	$1,429	$13,295	$164,657	-4	26.73
V6934	LDT	Ford F150 reg cab long box	G	2022 F-150 Lighting	EV	811	$675	2,353	$186	$909	$(27,958)	-58	1.31
V6935	LDT	Chevrolet Colorado	G	2022 F-150 Lighting	EV	713	$2,928	8,954	$707	$870	$(45,546)	376	-0.57
V6936	MDT	Ford F450 w/ Flat Deck	G	Ford F-450	G	-	$-	-	$-	$7,432	$(30,933)	0	-0.91
V6937	LDT	Ford F150 XL Supercab	G	2022 F-150 Lighting	EV	1,111	$1,969	3,550	$280	$993	$(18,136)	-33	1.72
V6938	LMDT	Ford F250 w/ Service Body	G	Ford F-250	G	-	$-	-	$-	$1,260	$5,014	0	0.00
V6939	LMDT	Ford F250 XL w/ Service Body	G	Ford F-250	G	-	$-	-	$-	$1,737	$3,057	0	0.00

Unit Name	Current Fleet Make-Up			EV Scenario		Current Fleet vs EV Replacement							
	Duty Class	Make and Model	Fuel Type	Make and Model	Fuel Type	Annual Fuel Savings (Litres)	Annual Fuel / Energy Cost Savings	Annual Elec. (kWh)	Annual Elec. Costs	Maint. Savings	Lifetime Cost Savings	Payback Period	Net GHG Savings
V6940	MDT	Ford F350 Super Cab	G	Ford F-350	G	-	$-	-	$-	$2,444	$(15,176)	0	0.00
V6941	MDT	Ford F350 Crew Cab w/service body	G	Ford F-350	G	-	$-	-	$-	$4,844	$20,826	0	0.00
V6942	LDT	Ford F150 Reg Cab Long Box	G	2022 F-150 Lighting	EV	1,278	$952	3,988	$315	$(422)	$(36,212)	138	2.00
V6943	LDT	Ford F150 Reg Cab, 8' Box	G	2022 F-150 Lighting	EV	1,050	$969	2,998	$237	$1,651	$(22,554)	-36	1.71
V6944	SUV	Ford SE 4 dr	G	2020 Kia Nero BEV	G	-	$-	2,386	$188	$647	$668	-8	1.75
V6945	MDT	Ford F350 4WD Reg Cab	G	Ford F-350	G	-	$-	-	$-	$817	$(17,248)	0	0.00
V6946	MDT	Ford F350	G	Ford F-350	G	-	$-	-	$-	$883	$(59,500)	0	0.00
V6956	HDT	Freightliner AJV1015 Vacall Triple Combination	D	2021 Volve VNRE62T300	EV	7,613	$4,417	806	$64	$7,177	$287,485	8	19.96
V6959	HDT	Freightliner M2 / Elgin Broom Bear	D	Freightliner M2 / Elgin Broom Bear	D	-	$-	-	$-	$10,562	$-	0	0.00
V6961	Car	Nissan Leaf SV	EV	2020 Chevrolet Bolt EV BEV	EV	-	$793	857	$68	$(375)	$(14,197)	-5	0.05
V6962	Car	Ford Fusion Hybrid	H	2020 Chevrolet Bolt EV BEV	EV	670	$874	2,704	$214	$1,839	$17,706	3	0.90
V6966	LMDT	Ford F250 4x4 Super Cab	G	Ford F-250	G	-	$-	-	$-	$1,383	$10,822	0	0.00
V6967	LMDT	Ford F250	G	Ford F-250	G	-	$-	-	$-	$2,972	$15,340	0	0.00
V6968	LDT	Ford F150 reg cab XL	G	2022 F-150 Lighting	EV	296	$6,022	833	$66	$1,337	$(28,705)	-67	0.49

Unit Name	Current Fleet Make-Up			EV Scenario		Current Fleet vs EV Replacement							
	Duty Class	Make and Model	Fuel Type	Make and Model	Fuel Type	Annual Fuel Savings (Litres)	Annual Fuel / Energy Cost Savings	Annual Elec. (kWh)	Annual Elec. Costs	Maint. Savings	Lifetime Cost Savings	Payback Period	Net GHG Savings
V6969	HDT	Spartan Gladiator	D	Spartan Gladiator	D	-	$-	-	$-	$16,614	$109,605	0	0.00
V6986	LDT	Chevrolet Colorado	G	2022 F-150 Lighting	EV	1,155	$1	6,197	$490	$(428)	$(71,764)	181	1.16
V6993	MDT	GMC C5500 4x4	D	GMC C5500 4x4	D	-	$-	-	$-	$1,185	$(108,000)	0	0.00
V7801	HDT	Freightliner Fire Truck	D	Freightliner Fire Truck	D	-	$-	-	$-	$1,592	$14,718	0	0.00
V7810	HDT	Western Star 4864F	D	Western Star 4864F	D	-	$-	-	$-	$3,070	$23,163	0	0.00
V7816	MDT	Ford F350 SD XL Reg Cab 4wd	G	Ford F-350	G	-	$-	-	$-	$999	$(27,935)	0	0.00
V7850	HDT	Freightliner FL106	D	Freightliner FL106	D	-	$-	-	$-	$3,275	$17,626	0	0.00
V7852	HDT	Spartan Gladiator	D	Spartan Gladiator	D	-	$-	-	$-	$11,049	$73,809	0	0.00
V7858	HDT	Freightliner FL80 4x4	D	Freightliner FL80 4x4	D	-	$-	-	$-	$2,832	$22,283	0	0.00

APPENDIX C – Assumptions

Energy Costs

Electricity cost per kilowatt-hour (kWh) = $0.079 blended rate (provided by City)

Fuel prices based average 2019 to present from Natural Resource Canada[8]

- Gasoline (litre) = $1.285
- Diesel (litre) = $1.207

Emission Factors

Electricity (tCO2e / kWh) = 0.00025

Gasoline (tCO2e / litre) = 0.002346

Diesel (tCO2e / litre) = 0.002649

Source: CleanBC Fleet Assessment without Telematics guidance document[9]

EV Assumptions

EV (make, model, year)	Range	MSRP	Maintenance Cost ($/kms)[10]	kWh / 100 kms	Combined BC and Federal Incentive
2020 Nissan Leaf (62 kW-hr battery pack)	364	$41,898	$0.07	17	$8,000
2020 Hyundai Kona Electric	415	$37,190	$0.07	20	$8,000
2022 F-150 Lighting	370	$68,000	$0.07	31	-
2020 Chevrolet Bolt EV	417	$36,620	$0.07	16	$8,000
2020 Hyundai Ioniq Electric	274	$41,449	$0.07	20	$8,000
2020 Tesla Model 3 Standard Range Plus	402	$39,990	$0.07	20	$8,000

[8] https://www2.nrcan.gc.ca/eneene/sources/pripri/prices_bycity_e.cfm?productID=5&locationID=6&frequency=M&priceYear=2021&Redisplay=

[9] Provided by the City of Kelowna

[10] Atlas Public Policy – Fleet Procurement Analysis Tool (Canadian Markets): https://atlaspolicy.com/rand/fleet-procurement-analysis-tool/

EV (make, model, year)	Range	MSRP	Maintenance Cost ($/kms)[10]	kWh / 100 kms	Combined BC and Federal Incentive
2020 Kia Soul Electric	248	$42,595	$0.07	20	$8,000
2020 Kia Nero	385	$44,995	$0.07	17	$8,000
2021 Volvo XC40 Recharge	335	$64,950	$0.07	20	-
2022 Ford E-Transit	203	$60,000	$0.07	33	-
2021 Lio8 Tractor	208	$450,000	$0.19	68	$100,000
2021 Volve VNRE62T300	193	$557,000	$0.19	79	$100,000
2021 Lion8 Refuse REL	275	$555,000	$0.19	79	$100,000