University Fleet
Fleet Electrification Assessment

Fleet advisory services provided by ICF

Consumers Energy
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Glossary of Terms

BEV: Battery Electric Vehicle

DCFC: Direct Current Fast Charger

EV: Electric Vehicle

EVSE: Electric Vehicle Supply Equipment

L2 Charger: Level Two Charger

PHEV: Plug-In Hybrid Electric Vehicle

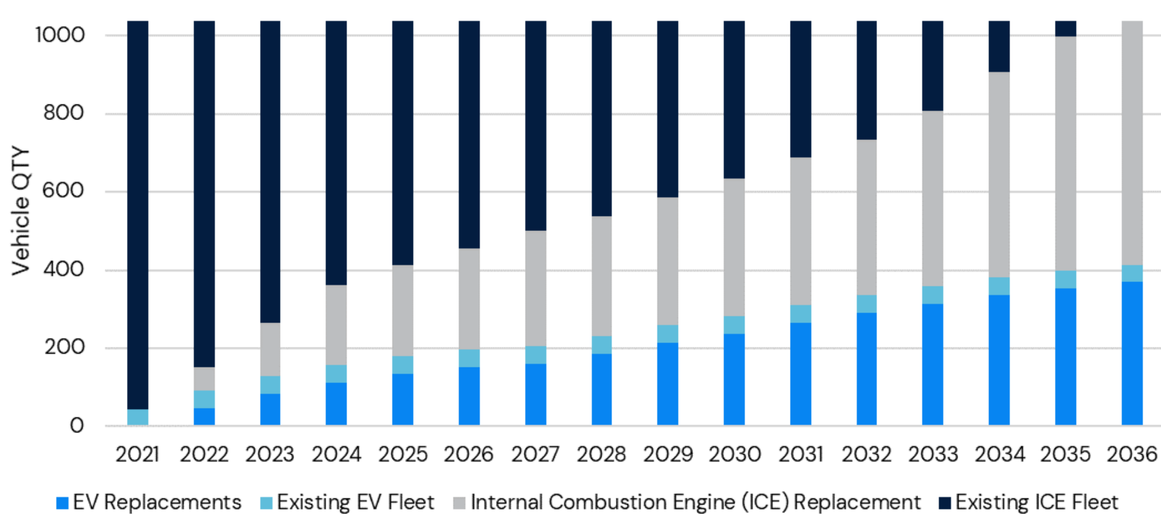
TCO: Total Cost of Ownership

Executive Summary

ICF, on behalf of Consumers Energy's PowerMIFleet Program, provides fleet electrification recommendations and objective guidance from our team of electric vehicle (EV) experts. We are here to help you, CUSTOMER NAME (CUSTOMER), understand the impacts and benefits of shifting your fleet to EVs. This custom report identifies the vehicles that would be most cost-effective to convert to electric and summarizes the associated financial and environmental benefits.

The timeframe identified for the vehicle replacements is 2022 to 2036, which accounts for a maximum vehicle life of 15 years. However, the fleet total cost of ownership (TCO) analysis extends to 2050 to account for the ongoing fuel and maintenance costs from the vehicles acquired in 2036. We assessed the economic feasibility of 1,116 vehicles in CUSTOMER's fleet, including 1,037 on-road vehicle and 79 non-road vehicles. We identified 974 on-road vehicles that have EV options available and 369 of those that would be beneficial to convert over the next 15 years. Chart A illustrates the phasing in of these on-road EVs as you replace your existing fleet vehicles. These 369 vehicles would result in a net present value (NPV) TCO savings of $5,045,595 over the next 29 years, which accounts for the savings across the vehicles' full lifespans.

Chart A: Recommended EV Replacement Timeline: Fuel Types



The report also details the analysis assumptions, specific vehicle recommendations, financial and environmental impacts, and next steps. Please review this report and reach out to ICF or powermifleet@cmsenergy.com with any questions.

Based on our analysis, converting 369 on-road vehicles to EVs is estimated to produce the following impacts:

$ 5,045,595
TCO savings over 29 years*

$ 3,694,766
fuel cost savings over 29 years*

$ 3,379,351
maintenance savings over 29 years*

18,945
metric tons (MT) of CO2 eliminated over 29 years

*NPV assumes a 5% discount rate

Over 29 years, those estimated CO_2 reductions equate to:

eliminating **2,179** homes' energy use for one year, or:

switching **719,891** incandescent lamps to LEDs, or:

recycling **6,441** tons of waste instead of landfilling it, or:

planting **312,584** trees.

Project Information

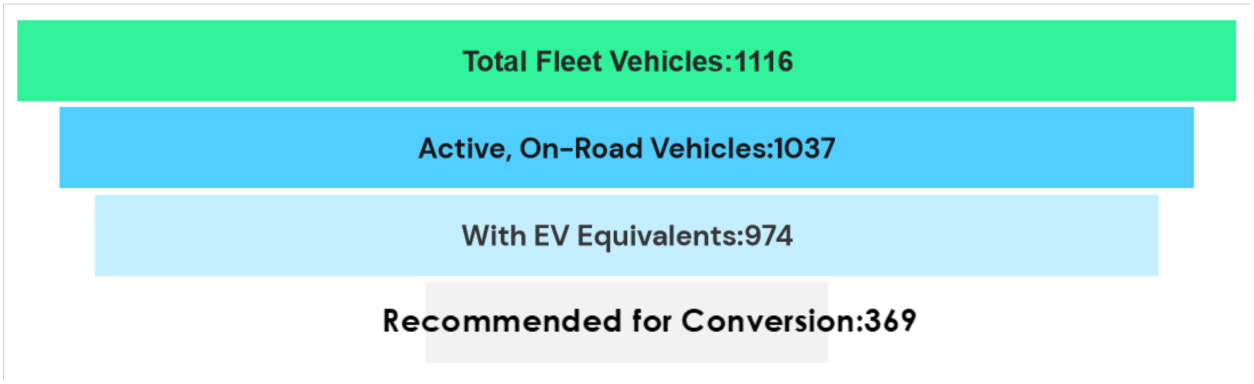
On November 23, 2021, CUSTOMER CONTACT NAMES met with the ICF Account Manager and other program staff for an initial intake call. The discussion covered topics including an overview of the PowerMIFleet program, fleet data availability, fleet usage characteristics, and the fleet's motivation for exploring EV options. A key takeaway of the intake call was that the primary motivation of EV adoption for CUSTOMER is the potential to reduce greenhouse gas (GHG) emissions in pursuit of their climate neutrality goal. Their main barrier to electric vehicle (EV) deployment is high initial capital costs, so we worked with CUSTOMER to ensure our EV acquisition recommendations align with their 9-year annual vehicle replacement budget.

CUSTOMER provided an initial fleet dataset on October 26, 2021. The Account Manager provided follow up questions on November 23, 2021. Additional data was provided on December 13, 2021, and CUSTOMER indicated they were comfortable with us moving forward with the assumptions we outlined. CUSTOMER's fleet dataset was used to establish a fleet baseline in the model and we presented the intial results for feedback on January 27, 2022. CUSTOMER provided additional data and requested that we incorporate their 9-year vehicle replacement budget into the analysis. Updated results that align with CUSTOMER's vehicle replacement budget were presented on March 9, 2022.

There are 1,116 vehicles in CUSTOMER's current fleet, 1,037 on-road vehicles and 79 pieces of non-road equipment. However, only 974 of the on-road vehicles have EV equivalents available, 369 of which would be cost beneficial to convert to EVs at this time. This breakdown is illustrated in Chart B.

Please note that non-road vehicles are included in the total vehicle counts, but are excluded from the Electric Vehicle Acquisition Recommendations and Fleet Environmental Impact Analysis sections of this report. Non-road vehicles are discussed separately in the Non-Road Equipment section.

Chart B: Fleet Assessment Vehicle Breakdown



Existing On-Road Fleet Makeup

There are 1,116 vehicles in CUSTOMER's current fleet, most of which are gasoline- and diesel-powered as shown in Table A. More than half of the fleet is made up of light-duty vehicles which is illustrated in Chart C below. About one-third of the SUVs are police patrol vehicles. Police vehicles are assessed separately due to their significantly different duty cycles and applications. The estimated retirement schedule for the existing fleet, provided by CUSTOMER, is represented in Chart D.[1] There are a high number of vehicles estimated for retirement in 2022 due to the high number of older vehicles within the existing fleet (16% of the on-road vehicles are over 15 years old), and the shorter lifespans associated with motor pool and police patrol vehicles. Due to this methodology, we estimate that 443 on-road vehicles may be up for retirement in 2022, but we are only recommending 47 of these vehicles for conversion in 2022. This schedule, and CUSTOMER's 9-year vehicle replacement budget, informs the recommended EV replacement schedule, which is shown later in Chart G.

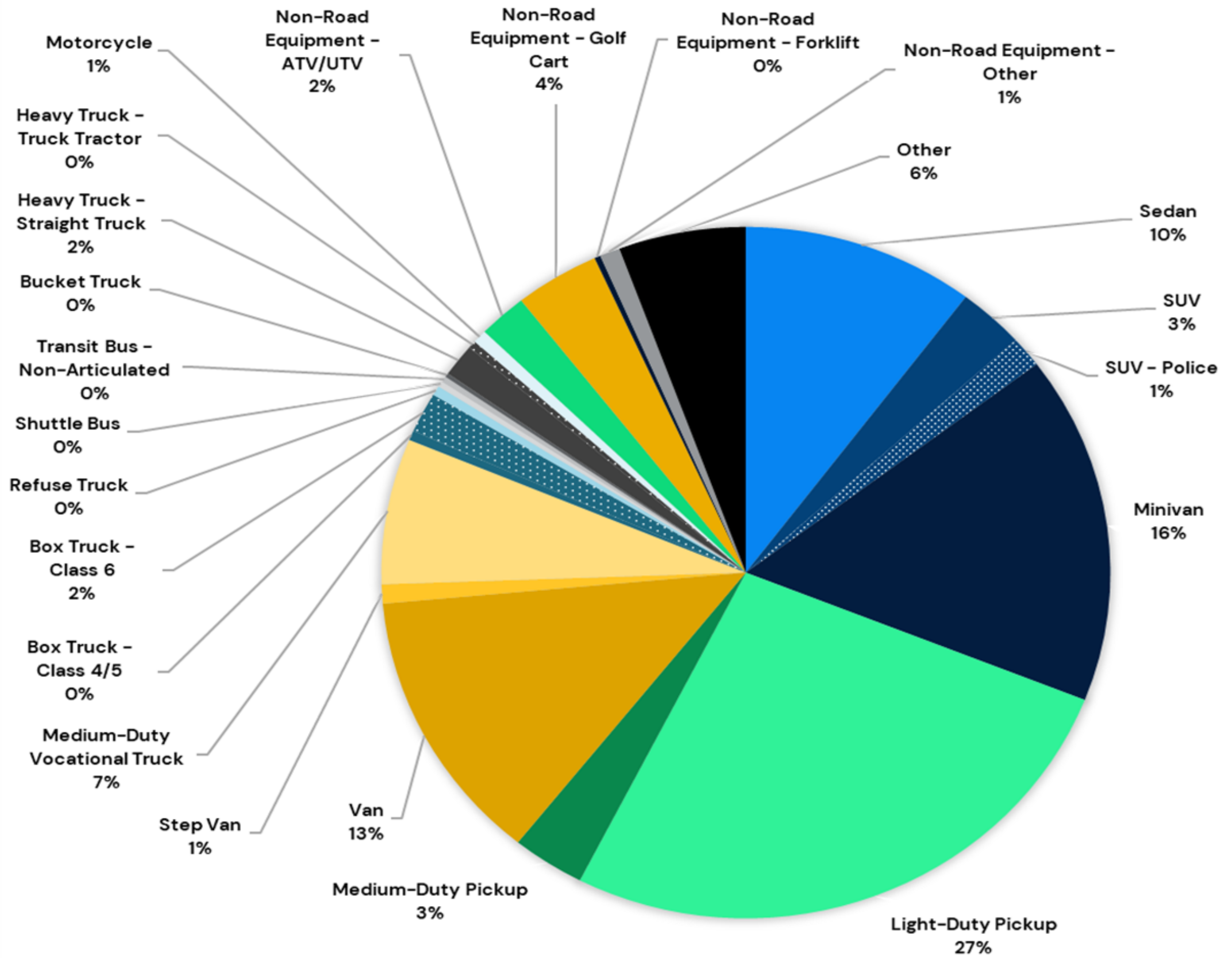
[1] The existing retirement schedule has been adjusted to start in 2022 and does not consider CUSTOMER's 9-year vehicle replacement budget, which was accounted for when we developed our recommended EV replacement timeline, shown in Chart G.

Table A: Existing Fleet Fuel Type Distribution

Vehicle Type	Gasoline	Diesel	BEV	Propane	N/A
Sedan	102	0	13	0	0
SUV	43	0	6	0	0
Minivan	182	0	0	0	0
Light-Duty Pickup	289	3	4	0	0
Medium-Duty Pickup	23	13	0	0	0
Van	92	33	18	0	0
Step Van	8	2	0	0	0
Medium-Duty Vocational Truck	53	23	0	0	0
Box Truck	7	19	0	0	0
Refuse Truck	0	5	0	0	0
Shuttle Bus	0	3	0	0	0
Transit Bus	0	3	0	0	0
Bucket Truck	2	0	0	0	0
Heavy Truck	2	19	0	0	0
Motorcycle	7	0	0	0	0
Non-Road Equipment	24	11	44	0	0
Other	20	7	4	6	26[2]
TOTAL	**854**	**141**	**89**	**6**	**26**

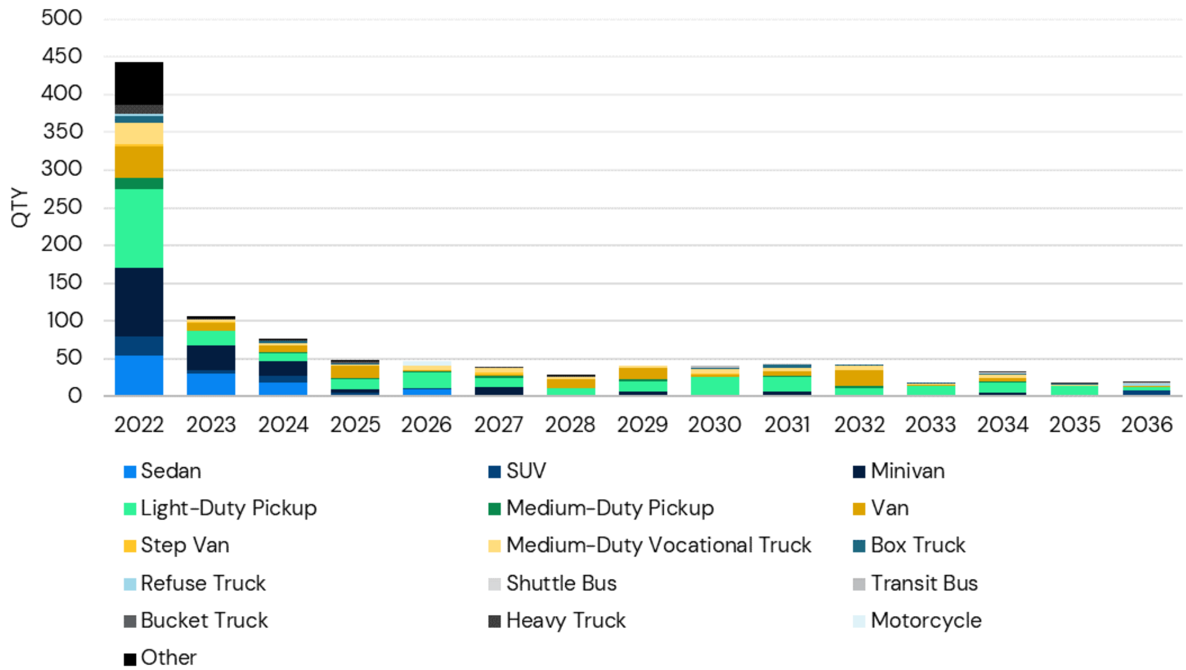
[2] 17 vehicles were identified as inactive, and 9 vehicles are trailers without a fuel type.

*Chart C: Existing Fleet – Vehicle Types**



*Vehicle types showing 0% contain between 1-5 existing fleet vehicles.

Chart D: Existing Fleet - Retirement Schedule



The 59 vehicles identified as "Other," 45 existing EVs, and 79 pieces of non-road equipment are summarized in Table B below and were excluded from this analysis for 1 of 6 reasons.

Table B: Vehicle Types Excluded from Analysis

Vehicle Type	Quantity	Reason for Exclusion
Non-Road Equipment	79	79 vehicles are non-road Equipment (See Non-Road Equipment Section)
Sedan	3	19 vehicles were identified as inactive
SUV	4	
Minivan	5	
Van	7	
Heavy Truck – Snowplow	5	8 vehicles do not have commercial EV equivalents currently available
Armored Truck	2	
Motorhome	1	
Sedan	13	45 vehicles are already electric
SUV	6	
Light-Duty Pickup	4	
Van	18	
Low Speed Electric Vehicle	4	
Van (Propane)	2	

Medium-Duty Vocational Truck (Propane)	1	15 vehicles are outside the scope of this analysis
Box Truck – Class 4/5 (Propane)	1	
Box Truck – Class 6 (Propane	1	
Trailer	9	
Antique Vehicle (1936 Ford)	1	
Light Duty Pickup	12	17 vehicles are outside of Consumers Energy territory
Van	1	
Medium-Duty Pickup	2	
Medium-Duty Vocational Truck	1	
Heavy Truck (Tractor)	1	
TOTAL	**183**	

Key Assumptions

Key assumptions and data sources that were used in this analysis include the following. The Electric Vehicle Acquisition Recommendations section below provides additional detail on the financial assumptions in the model.

- **Recommendation Threshold**: EVs are recommended only when the EV TCO is less than the TCO of the comparable internal combustion engine (ICE) vehicle and when annual EV capital costs align with CUSTOMER's 9-year annual fleet replacement budget.
- **Vehicle Pricing**: The model uses adjusted manufacturer suggested retail prices (MSRPs) for EVs where available. Per CUSTOMER's request, all MSRPs were reduced by 1.3% to account for CUSTOMER's volume discounts. When MSRP pricing is unavailable, the model uses average pricing based on vehicle and fuel type, based on Argonne National Laboratory's Alternative Fuel Life Cycle Environmental and Economic Transportation (AFLEET) Tool and ICF's *Comparison of Medium- and Heavy-Duty Technologies in California* (ICF CalETC Report) report for the California Electric Transportation Coalition (CalETC). Vehicle pricing was escalated annually using the same ICF CalETC Report and the U.S. Energy Information Administration's (EIA) 2020 Annual Energy Outlook (AEO). The model assumes all vehicles are owned and not leased.
- **Fuel:** The model uses the U.S. EIA's average gasoline and diesel prices in Michigan for the past five years, which is $2.62 per gallon of gasoline and $3.02 per gallon of diesel. The model determines the average annual fuel use for each vehicle based on its average annual mileage and average fuel economy (miles per gallon), and then multiplies the fuel use value by the price per gallon of fuel. ICF uses annual mileage and fuel efficiency assumptions by vehicle and fuel type from Argonne National Laboratory's AFLEET Tool and ICF's *CalETC Report*. E85-powered vehicles were assigned a fuel type using AFLEET assumptions by vehicle type.
- **Maintenance**: ICF uses dollar per mile maintenance cost assumptions by vehicle and fuel type from Argonne National Laboratory's AFLEET Tool and ICF's *CalETC Report*. Maintenance costs were escalated 2% annually.
- **Electricity Pricing**: This analysis uses Consumer Energy's General Service Secondary Time of Use Rate (which is an average of $0.12/kWh) for electricity pricing, escalated annually using projections from the U.S. EIA's 2020 AEO Reference Case for Transportation: Electricity. See the Rate Analysis Section for a comparison of other electric rate options.
- **Vehicle Replacements**: The model uses CUSTOMER's existing retirement schedule for the 551 vehicles that had a replacement schedule provided. For the remaining 486 vehicles, the model uses AFLEET's vehicle lifespan assumptions by vehicle type to estimate the vehicle retirement schedule. The vehicle lifespan was added to the model year to determine the

replacement year, with the minimum being 2022. The existing retirement schedule, AFLEET vehicle lifespan assumptions, and CUSTOMER's 9-year fleet replacement budget guided replacement recommendations.

- **Timeframe**: This analysis focuses on vehicle replacements for 2022 through 2036, with TCO calculations extending out across the vehicle lifespans to 2050.
- **Discount Rate**: 5% was used for NPV calculations.
- **Vehicle Ranges**: The EV mileage ranges per charge were accounted for when recommending vehicle replacements. The analysis used an average temperature range of 17 to 82°F to assess the potential impact temperatures can have on EV ranges; this reduced EV model ranges to 80% of their maximum mileage range. We assumed CUSTOMER's current year-round vehicles are in operation 250 days per year, and assumed CUSTOMER's current seasonal vehicles are in operation 125 days per year, to estimate typical mileage per day based off of each vehicle's annual mileage. Vehicles for which mileage data were not provided used AFLEET assumptions by vehicle type to estimate the range required each day.
- **Electric Vehicle Supply Equipment (EVSE) Pricing and Incentives**: The EVSE pricing assumptions and incentive program amounts applied in the analysis are detailed further in the Incentives and Funding Source Assumptions Applied section below.

Electric Vehicle Acquisition Recommendations

There are 974 eligible CUSTOMER on-road vehicles scheduled for retirement between 2022 and 2036, and 369 of them will be cost effective to convert to battery electric vehicles (BEVs) or plug-in hybrid electric vehicles (PHEVs). Chart E below shows the Total Cost of Ownership (TCO) for the 369 recommended vehicles each year if they were replaced with conventional, ICE vehicles versus with the recommended EVs. This timeline is based on the recommended fleet retirement schedule, with CUSTOMER's 9-year vehicle replacement budget incorporated, outlined in Chart G below. Based on these estimates, you may see financial payback as early as 2027. While initial annual EV costs are higher than ICE costs, the overall cumulative EV TCO is lower due to incentives and reduced operational costs, as shown in Chart F.

Chart E: Fleet Recommended Replacements TCO Comparison – Annual

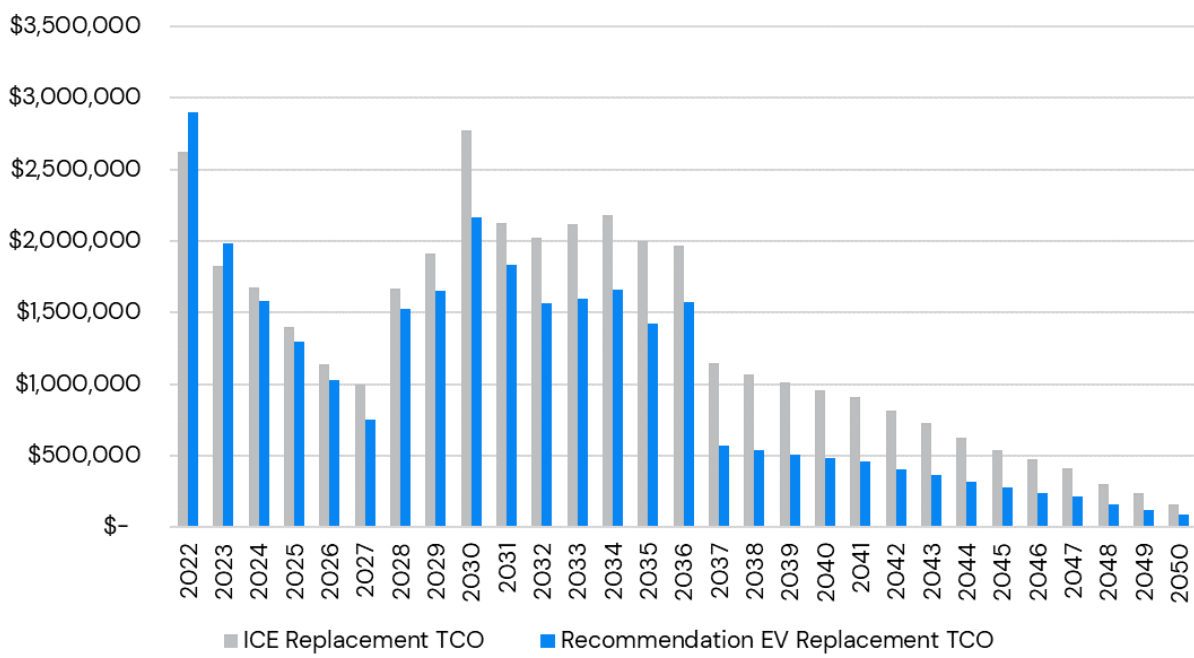


Chart F: Fleet Recommended Replacements TCO Comparison – Cumulative

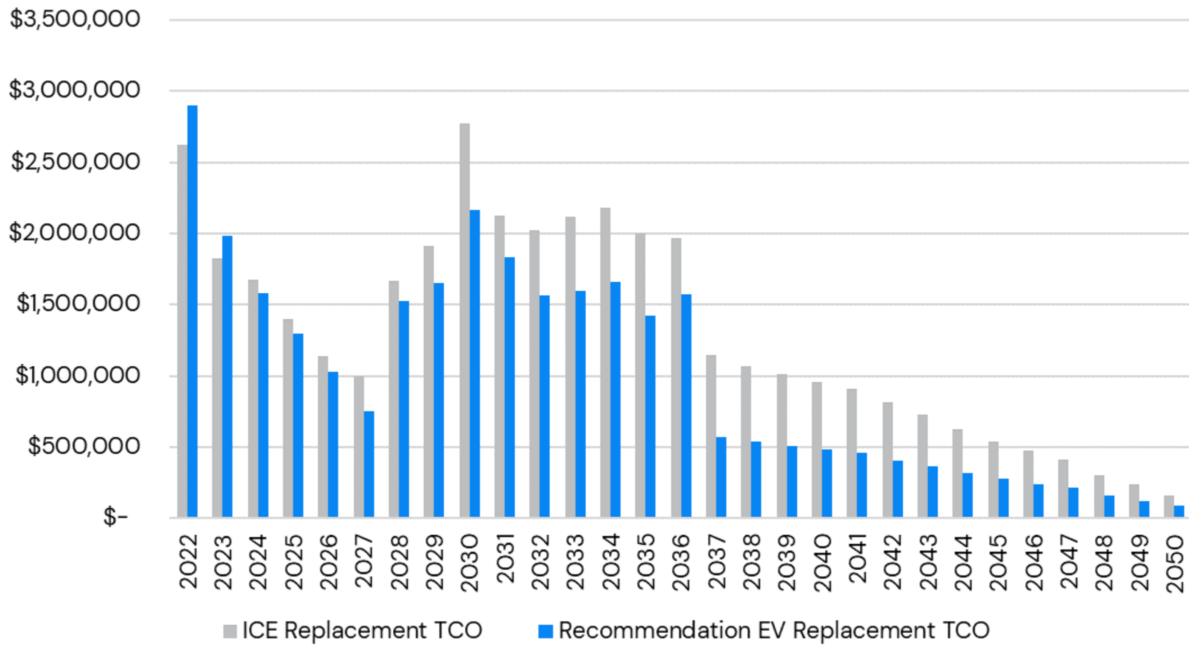


Table C on the next page identifies the vehicles that will be cost effective to convert to electric within the next 15 years. Chart G illustrates the recommended replacement timeline for these vehicles, and Chart H shows the timeline broken down by each of CUSTOMER's internal fleets. Each vehicle within your fleet has been assessed to identify the lowest cost option, while also accounting for potential mileage and charging time restrictions. Please note that there are limited EV options available through the Michigan MiDEAL State Contract. Table G in the model comparison section of this report highlights EVs that can be procured through the Michigan MiDEAL State Contract.

The financial savings and GHG emission reductions represent the difference between replacing the recommended vehicles with EVs compared to replacing them with ICE vehicles. The TCO used in the financial savings accounts for the following, as applicable:

- Capital costs
- Charging infrastructure hardware costs
- Charging infrastructure installation costs
- Annual fuel costs
- Annual maintenance costs
- Potential EV or EVSE incentives or grants

There are 605 vehicles with EV equivalents that are not recommended for conversion because they are already electric (41 BEVs), the EV model mileage range is too low (1 heavy truck), or the TCO of the ICE vehicle is lower than any of the EV options' TCO (563 vehicles). Future EV model options or incentive program availability may open opportunities for these to be converted.

Table C: 15-Year Electrification Recommendations

Vehicle Type	Quantity Up for Retirement (in 15 Years)	Quantity Recommended to Convert to Electric	Recommended Make/ Model/ EV Type	Financial Savings (across 29 years)	GHG Emission Reductions (across 29 years, MT)	EVSE	
						L2	DCFC
Sedans	115	2	Nissan/ LEAF S/ BEV[3]	$4,719	56	2	0
SUVs	49	9	Chevrolet/Bolt EUV LT/ BEV[4]	$39,041	389	9	0
Minivans	182	0	N/A	-	-	-	-
Light-Duty Pickups	296	151	Ford/ F-150 Lightning/ BEV	$1,390,847	8,712	145	6
Vans	143	116	Maxwell Vehicles/ ePro LR High/ BEV[5]	$1,141,014	1,775	114	2
Medium-Duty Pickups	36	24	Atlis/ XT (300mi Crew Cab)/ BEV[6]	$493,716	1,793	20	4
Medium-Duty Vocational Truck	76	57	Ford/ E-Transit (Cab Chassis)/ BEV[7]	$616,688	1,239	52	5
Box Trucks	26	1	BYD/ 6F Cab-Forward Truck/ BEV [8]	$22,740	386	0	1
Refuse Trucks	5	2	Peterbilt/ 520EV/ BEV	$188,202	984	0	2
Shuttle Bus	3	1	Lightning eMotors/ Ford E-450 Cutaway Bus	$110,494	298	0	1

[3] Chevrolet Bolt is the only electric sedan on Michigan's MiDEAL State Contract. See EV Model Comparison section for more options.
[4] Ford Mustang Mach-E is the only electric SUV on Michigan's MiDEAL State Contract. See EV Model comparison section for more options.
[5] Ford E-Transit 350 is the only electric van on Michigan's MiDEAL State Contract. See EV Model comparison section for more options.
[6] 2 Atlis XTs are recommended to replace snowplows. According to Atlis, the XT will be compatible with snowplows when it is available.
[7] 6 Ford E-Transit Cab Chassis are recommended to replace existing snowplows. However, the Ford E-Transit is not compatible with snowplows. See the model comparison section of the report for additional electric snowplow options.
[8] 6 Ford E-Transit Cab Chassis are recommended to replace existing snowplows. However, the Ford E-Transit is not compatible with snowplows. See the model comparison section of the report for additional electric snowplow options.

			(120 mi) LEV120E/ BEV[8]				
		1	Lightning eMotors/ Ford F-550 Shuttle Bus (80 mi) LEV80CL5/ BEV	$53,035	242	0	1
Transit Bus	3	2	Lightning eMotors/ Electric City Bus Repower/ BEV[9]	$617,371	475	1	1
Bucket Truck	2	0	N/A	-	-	-	-
Step Van	10	0	N/A	-	-	-	-
Heavy Truck	21	1	Kenworth/ K370E/ BEV	$98,934	1,420	0	1
		1	Tesla/ Semi/ BEV	$255,092	1,129	0	1
Motorcycle	7	1	Zero Motorcycles/ FXS ZF7.2/ BEV	$13,700	47	0	1
TOTAL	**974**	**369**		**$5,045,595**	**18,945**	**343**	**26**

[9] Lightning eMotors Electric City Bus Repower is a retrofit for an existing bus. Retrofits help reduce waste, emissions, and capital costs by repurposing existing ICE vehicles as EVs with new electric battery packs, drive units, and electronics.

Chart G: Recommended EV Replacement Timeline: Vehicle Types

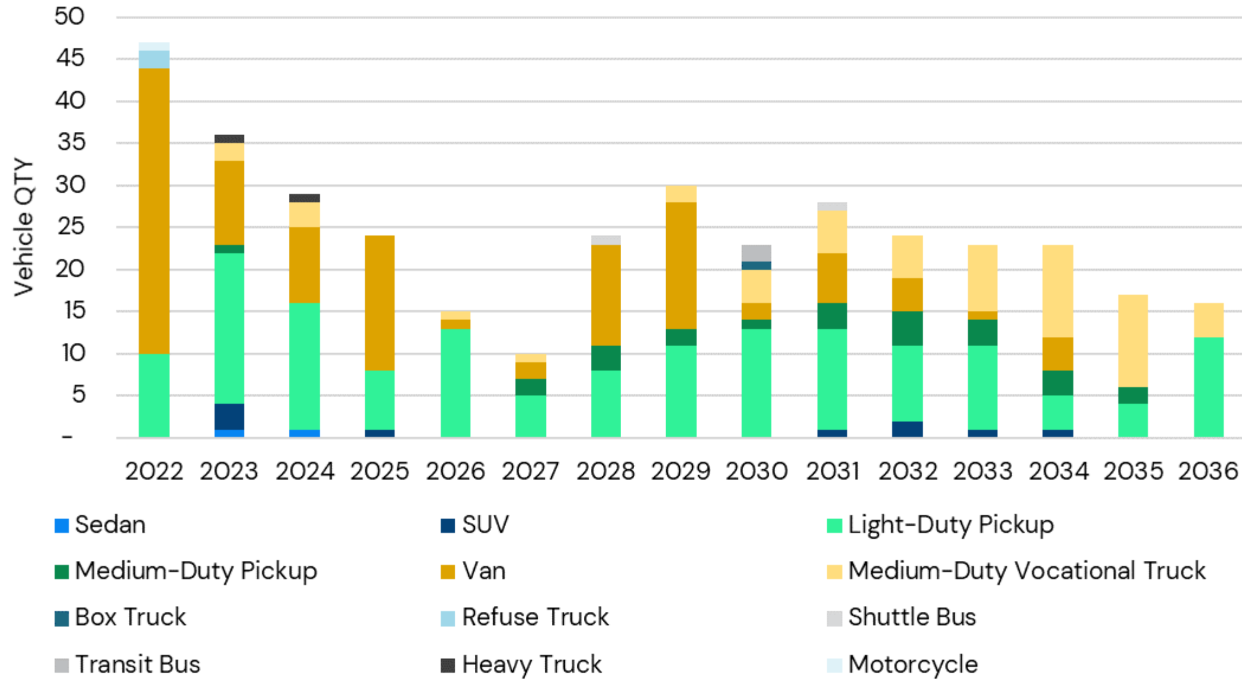
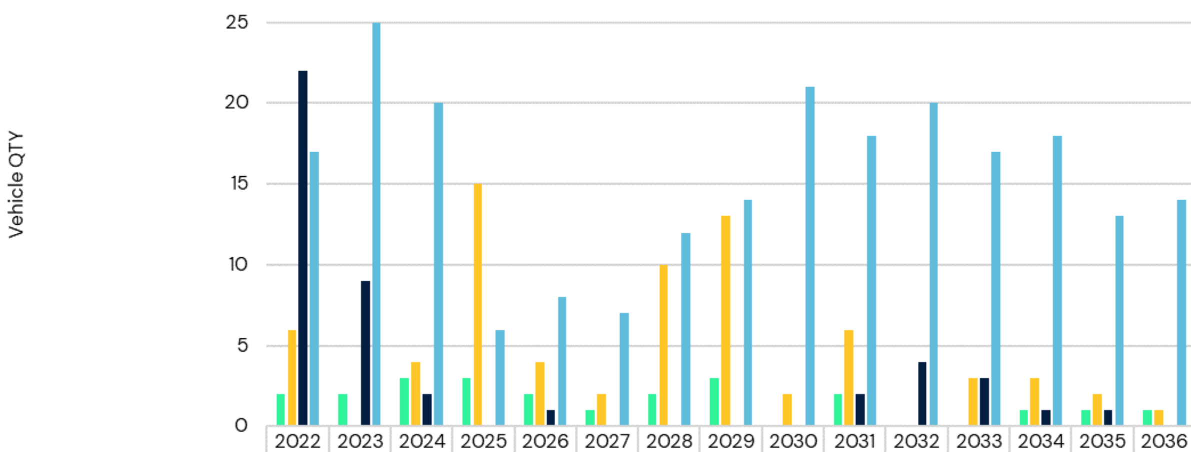


Chart H. Recommended EV Replacement Timeline – Internal CUSTOMER Fleets



	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
IPF Landscaping Services	2	2	3	3	2	1	2	3	0	2	0	0	1	1	1
IPF Maintenance Services	6	0	4	15	4	2	10	13	2	6	0	3	3	2	1
Motor Pool	22	9	2	0	1					2	4	3	1	1	0
Other	17	25	20	6	8	7	12	14	21	18	20	17	18	13	14

EV Charging Infrastructure Assumptions Applied

About EV Charging Infrastructure

EVs require access to chargers, also known as Electric Vehicle Supply Equipment (EVSE). In a fleet application, the majority of charging is typically done at the fleet facility – overnight or between shifts. Facility-based charging can be supplemented with periodic charging at workplaces, idle locations, and public destinations as needed.

There are three types of EV chargers: Level 1, Level 2, and Direct Current (DC) Fast.

> **Level 1** chargers provide charging through a 120-volt (V) AC plug. A Level 1 charger plugs directly into a household outlet on one end, and into the vehicle's SAE J1772 charge port on the other end. Level 1 chargers are the slowest category of EVSE and provide 2 to 5 miles of range per hour of charging.
>
> **Level 2** chargers provide charging through 240 V or 208 V electrical service. Level 2 charging equipment is common for home, public, and workplace charging. The large majority of public chargers in the United States are Level 2. Level 2 chargers can operate at up to 80 Amperes (Amps) and 19.2 kilowatts (kW), and provide faster charging than Level 1 EVSE. Typically, a Level 2 charger provides 10 to 20 miles of range per hour of charging.
>
> **DC Fast** chargers enable rapid charging through 208/480 V three-phase input. Installing DC Fast chargers may require infrastructure upgrades and these high-powered chargers cost significantly more than a Level 2 charger. DC Fast chargers will typically add 75-150 miles of range for every 30 minutes spent charging. The range of miles added depends on various factors, such the vehicle type and the DC Fast charger capacity. For example, the Chevrolet Bolt can add about 85 miles per 30 minutes charging and the Nissan LEAF Plus can add about 150 miles per 30 minutes charging. A transit bus will be able to add 60-125 miles for every 30 minutes spent charging, depending on the capacity of the DC Fast charger.

The charger equipment and installation cost assumptions used for your analysis is summarized in Table D below:

Table D: Charger Equipment Cost Assumptions

Vehicle Type	L2 Charger Cost Assumptions		DC Fast Charger Cost Assumptions	
	Equipment Cost	Installation Cost	Equipment Cost	Installation Cost
Sedan	$3,450	$6,650	$24,000	$27,500
Minivan	$3,450	$6,650	$24,000	$27,500
SUV	$3,450	$6,650	$24,000	$27,500
SUV - Police	$3,450	$6,650	$24,000	$27,500
Light-Duty Pickup	$3,450	$6,650	$24,000	$27,500
Medium-Duty Pickup	$3,450	$6,650	$24,000	$27,500
Van	$3,450	$6,650	$24,000	$27,500
Medium-Duty Vocational Truck	$5,000	$20,000	$29,000	$37,500
Step Van	$3,450	$6,650	$24,000	$27,500
Box Truck	$5,000	$20,000	$29,000	$37,500
Bucket Truck	$5,000	$20,000	$29,000	$37,500
Shuttle Bus	$5,000	$20,000	$29,000	$37,500
Transit Bus	$5,000	$20,000	$29,000	$37,500
Refuse Truck	$5,000	$20,000	$29,000	$37,500
Heavy Truck	$5,000	$20,000	$29,000	$37,500
Motorcycle	$3,450	$6,650	$24,000	$27,500

Vehicle-to-Grid (V2G) Charging

Vehicle-to-grid (V2G) charging is the bi-directional flow of energy and data between an EV and the grid. V2G strengthens resilience by enabling EVs to be used as energy storage assets that provide on-demand back-up power to a building or to the grid. V2G can also help users optimize energy consumption by charging only when energy rates are low and exporting stored power back to the grid only when energy rates are high. A bidirectional charger is required for V2G capability. It relies on the presence of an AC current in the vehicle's battery to reverse the direction of charge. Only CHAdeMO charger adapters currently support bi-directional charging, but V2G-capable CCS charger adapters are in development now and expected to be available to consumers by 2025.

Most V2G projects are still in pilot stages, such as the school bus pilot in Beverly, MA. School buses are particularly well-suited for V2G because they have large batteries and remain parked for many hours at a time. Available battery electric vehicles that are capable of V2G charging include:

- Blue Bird Vision Electric Type C School Bus
- Micro Bird G5 Electric Type A School Bus
- Nissan Leaf S/SL/SV

- Phoenix Zeus Medium-Duty Shuttle/School Bus
- Thomas Built Buses Saf-T Liner C2 Jouley Type C School Bus

V2X refers to the applications that EVs batteries can support for purposes other than powering the car. It is a collective term for referring to capabilities such as V2G, vehicle-to-home, and vehicle-to-vehicle. As an example of vehicle-to-vehicle capabilities, the Hyundai Ioniq 5 EV can charge other EVs using its battery. If you are interested in learning more about V2G and V2X, refer to a recent report from the U.S. Department of Transportation Federal Highway Administration or reach out to your ICF Account Manager.

Site Assessment

CUSTOMER will need a maximum of 26 DCFC and 343 Level 2 chargers to support the recommended 369 EVs. This conservatively assumes a one-to-one charger-to-vehicle ratio and does not account for any existing chargers at CUSTOMER's fleet facilities. This will result in an estimated incremental 1,218 kW total power demand and 959,220 annual kWh across the 45 identified CUSTOMER sites, summarized in Table E below. Depending on the scheduled duty cycles of the vehicles, it may be possible to reduce the number of chargers.

Table E: Site Load Impact Study

Charging Site	L2 (QTY)	DCFC (QTY)	Estimated Total Power Demand (kW)
SITE 1[10]	83	10	362
SITE 2[11]	48	2	131
SITE 3	15	2	75
SITE 4	47	1	69
SITE 5	10	2	58
SITE 6	8	1	56
SITE 7	6	2	55
SITE 8	11	2	55
SITE 9	15	0	49
SITE 10	13	0	46
SITE 11	13	1	32
SITE 12	4	0	21
SITE 13	1	1	19
SITE 14	1	1	16
SITE 15	1	1	16
SITE 16	4	0	15
SITE 17	10	0	15

10 Existing CUSTOMER vehicles for which base sites were not provided were assumed to be in Consumers Energy territory at SITE 1.

11 16 existing vehicles that CUSTOMER plans to use for a bi-directional charging pilot program at SITE 2 were not recommended for conversion because they are already electric or the ICE TCO is lower than that of the equivalent EV.

SITE 18	8	0	14
SITE 19	3	0	13
SITE 20	2	0	12
SITE 21	3	0	11
SITE 22	2	0	9
SITE 23	2	0	9
SITE 24	3	0	9
SITE 25	1	0	5
SITE 26	1	0	5
SITE 27	2	0	5
SITE 28	1	0	4
SITE 29	1	0	4
SITE 30	3	0	4
SITE 31	2	0	3
SITE 32	2	0	3
SITE 33	1	0	3
SITE 34	1	0	2
SITE 35	1	0	2
SITE 36	1	0	2
SITE 37	1	0	2
SITE 38	1	0	2
SITE 39	1	0	1
SITE 40	2	0	1
SITE 41	3	0	0.8
SITE 42	1	0	1
SITE 43	1	0	1
SITE 44	2	0	1
SITE 45	1	0	0.1
TOTAL	**343**	**26**	**1,218**

Electric Rate Analysis

The ICE and EV TCO comparison used Consumers' General Service Secondary Time of Use rate to calculate incremental electricity bills. The electric rate analysis identified this rate as the most cost-effective rate option to support the recommended 369 EVs at CUSTOMER's sites. The rate analysis also compared this rate against Consumers' General Service Secondary rate. Chart I below summarizes the fleet annual fuel costs across each rate, and Chart J summarizes the cumulative fuel costs across each scenario over time

Chart I: Rate Analysis Fleet Annual Fuel Cost Comparison

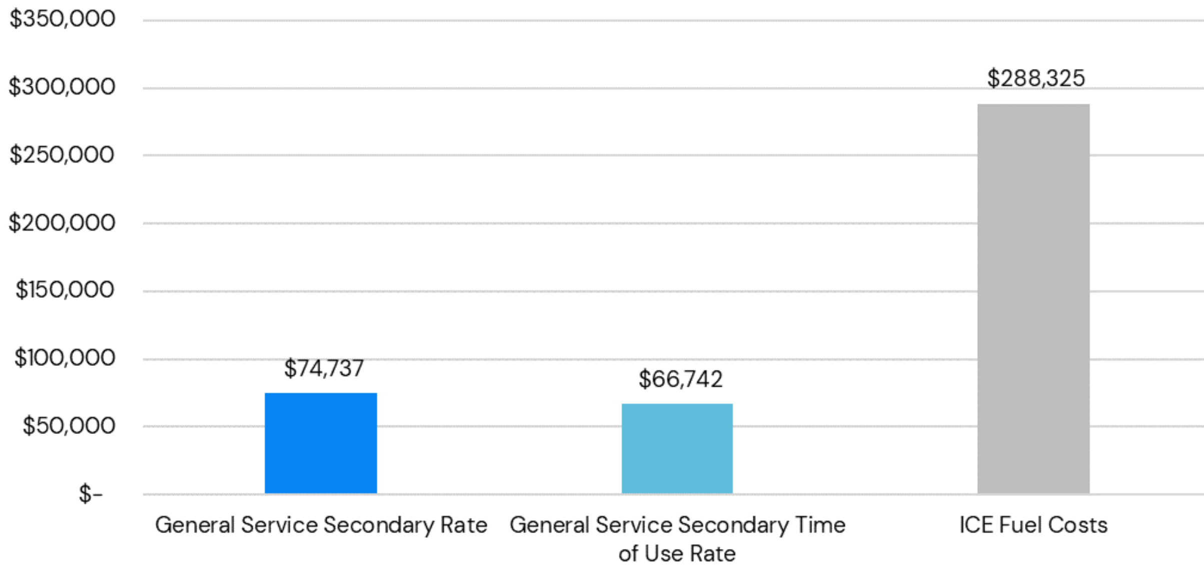
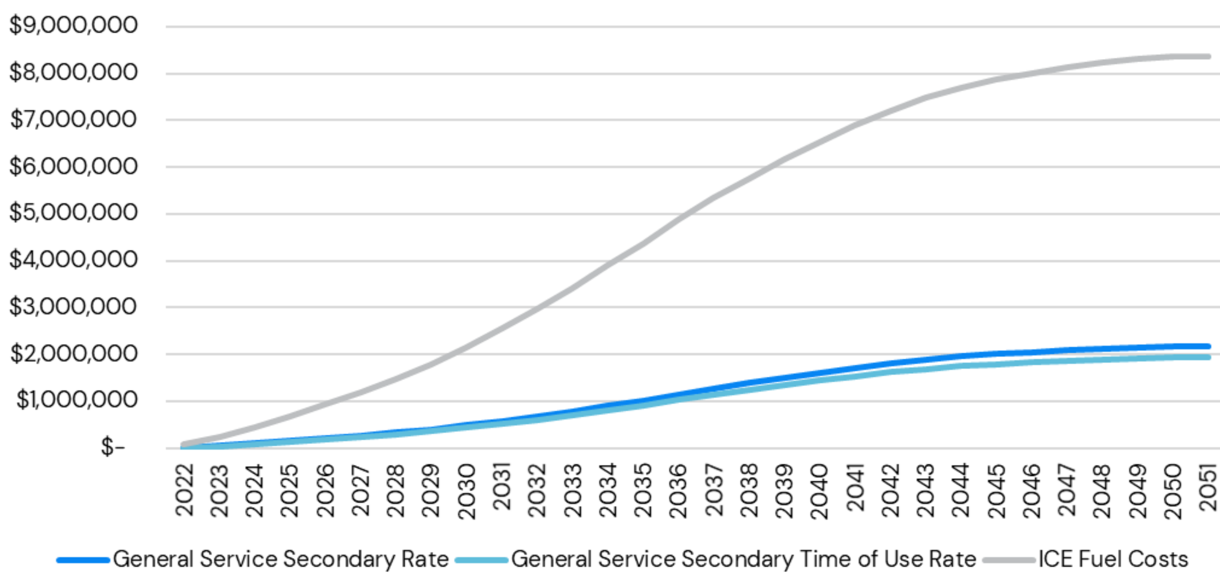


Chart J: Rate Analysis Fleet Cumulative Fuel Cost Comparison



Incentives and Funding Source Assumptions Applied

Incentives are available for the purchase of EVs and EVSE. Table F summarizes the incentives included in your fleet analysis, as well as additional information about how to capitalize on these incentives. Incentives in the analysis are capped at 100% of the vehicle capital and EVSE costs, so the table identifies how the incentives were prioritized and specifically applied through the TCO analysis.

Table F: Incentive and Funding Sources

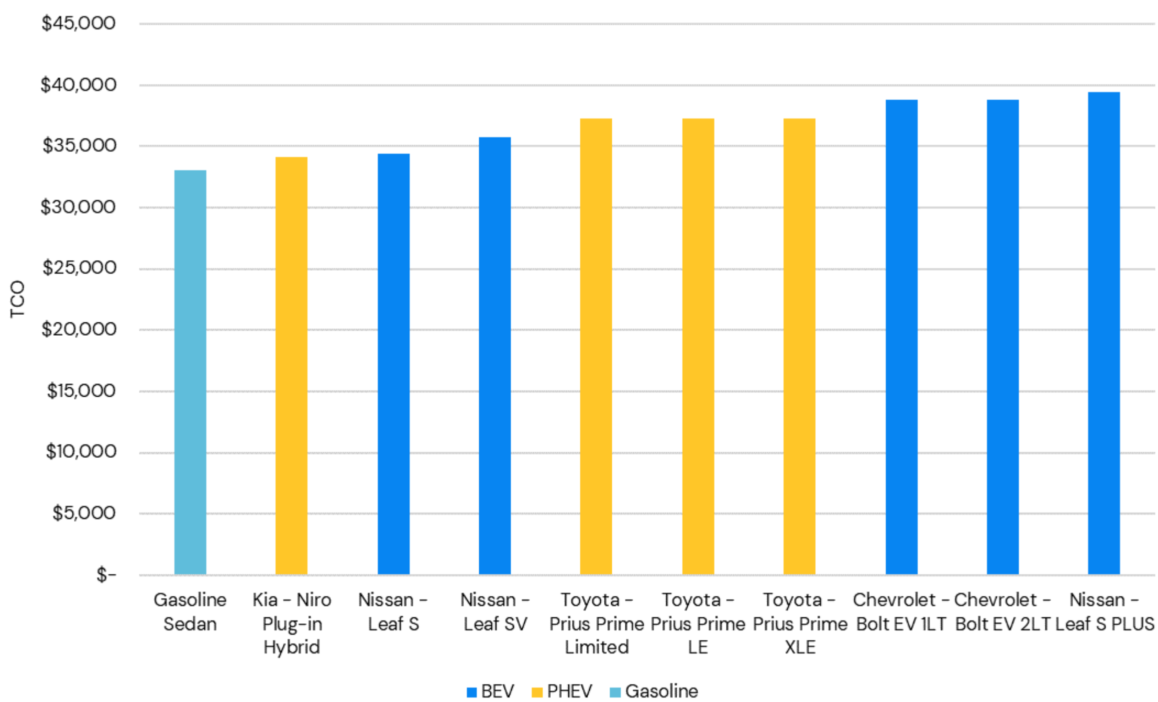
Program	Light Duty	Medium Duty	Heavy Duty	Administrator	Vehicle Costs	EVSE Installation	EVSE Hardware	Program Offerings	Upcoming Deadlines	TCO Funding Assumptions
Medium- and Heavy-Duty Grant Program		✓	✓	Michigan Department of Environment, Great Lakes, and Energy	✓		✓	Up to 50% of incremental capital costs, must replace a pre-2009 diesel vehicle with 3,000+ annual miles	Round 3: October 19, 2021 to December 17, 2021	N/A – existing fleet vehicles do not meet program requirements
PowerMIFleet Program: Commercial Electric Supply Equipment (EVSE) Rebates	✓	✓	✓	Consumers Energy			✓	Up to $5,000 per Level 2 Charge Port (limit 10 per site); Up to $35,000 per non-public DC Fast Charger; Up to $70,000 per public use DC Fast Charger	3-year voluntary pilot	$5,000 for L2 chargers, $35,000 per DCFCs installed before 2025
PowerMIFleet Program: Make Ready Upgrades	✓	✓	✓	Consumers Energy		✓		Funding of "reasonable costs" for the construction of infrastructure to power charging stations purchased through the PowerMIFleet Program	3-year voluntary pilot	EVSE installation costs for vehicles replaced before 2025
Diesel Emission Reduction Act (National)		✓	✓	EPA	✓			Up to 45% of EV and EVSE costs, must replace a diesel vehicle with 7,000+ annual miles	TBD[12]	45% of capital costs with 7,000+ annual miles

[12] Most recent deadline was 3/16/2021, but the Consolidated Appropriations Act passed on 12/22/2020 included reauthorization of the DERA Program through 2024

EV Model Comparison

There are over 500 EV models in our EV library that were assessed across your fleet's vehicle types and range requirements to compare TCOs and recommend replacement models. While our EV acquisition recommendations are based on the model with the lowest TCO available that fits your fleet's needs, there may be additional EV models within the same price range. Chart K through Chart W highlight the lowest TCOs for each vehicle type within your fleet. This analysis uses the fleet provided average annual mileage, miles driven per day, and vehicle life by vehicle type. If the vehicle life was not provided, this analysis incorporates AFLEET vehicle life assumptions by vehicle type. This simple comparison across EV model types does not include any charging infrastructure costs or apply any potential grants or incentives for EVs, however that level of detail is included in the sample financial analysis on the following pages.

Chart K: Sedan EV Model TCO Comparison[13]



[13] The lowest TCO electric sedan in this comparison differs from the EV recommendations because this comparison does not include grants, incentives, or charging infrastructure costs.

Chart L: SUV EV Model TCO Comparison[14,15]

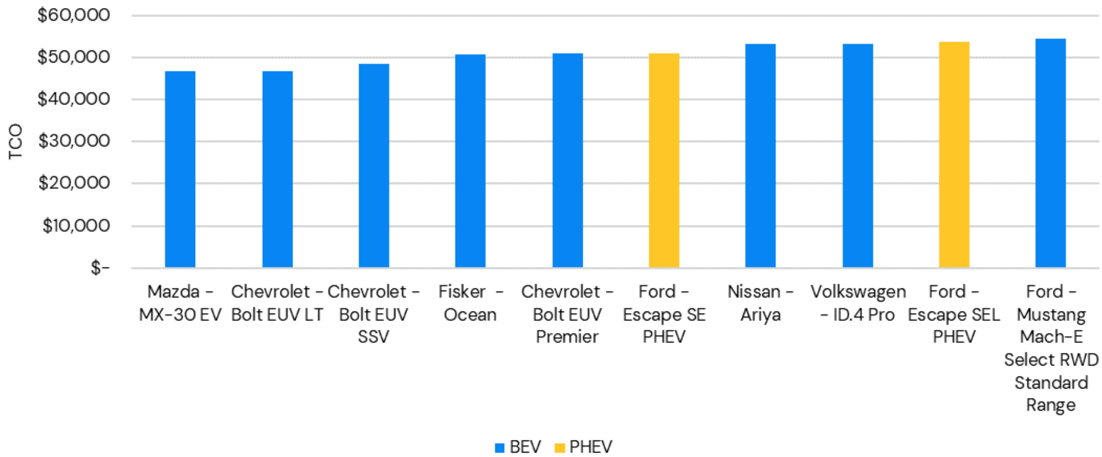
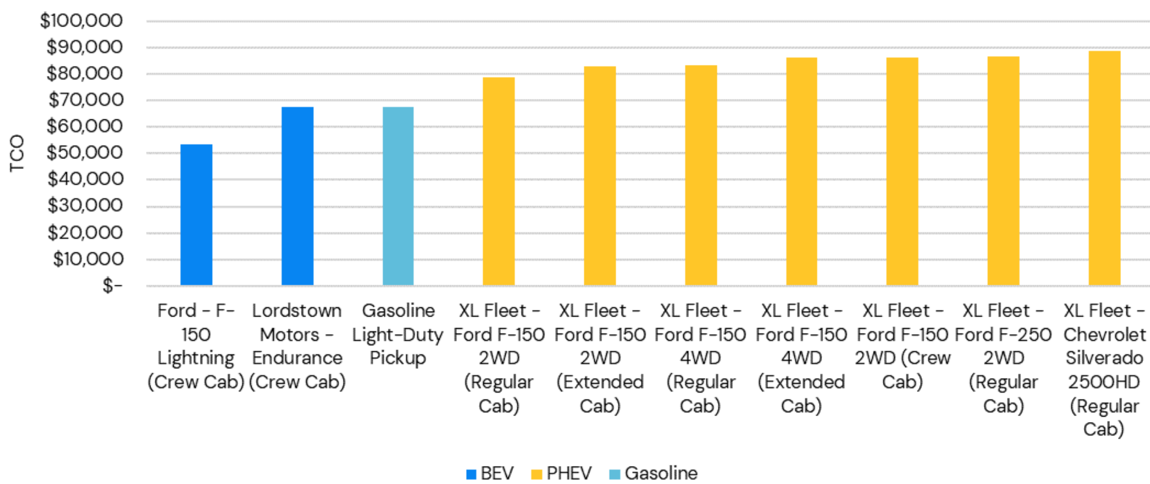


Chart M: Light-Duty Pickup EV Model TCO Comparison



[14] The lowest TCO electric SUV in this comparison differs from the EV recommendations because this comparison does not include grants, incentives, charging infrastructure costs, or daily mileage requirements.
[15] A comparable gasoline SUV TCO is $55,832.

Chart N: Medium-Duty Pickup EV Model TCO Comparison

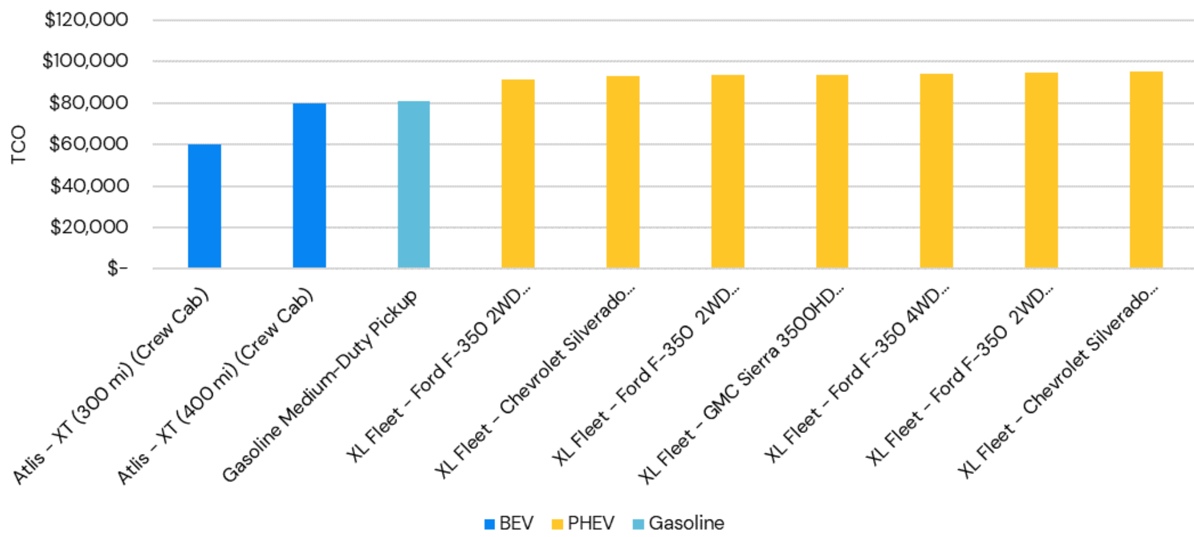


Chart O: Van EV Model TCO Comparison[16]

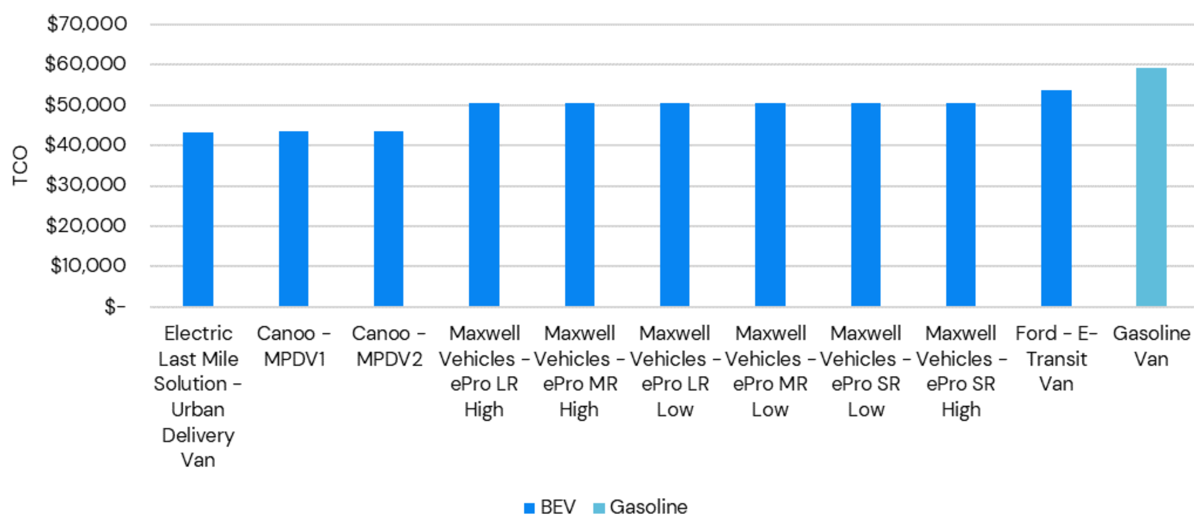
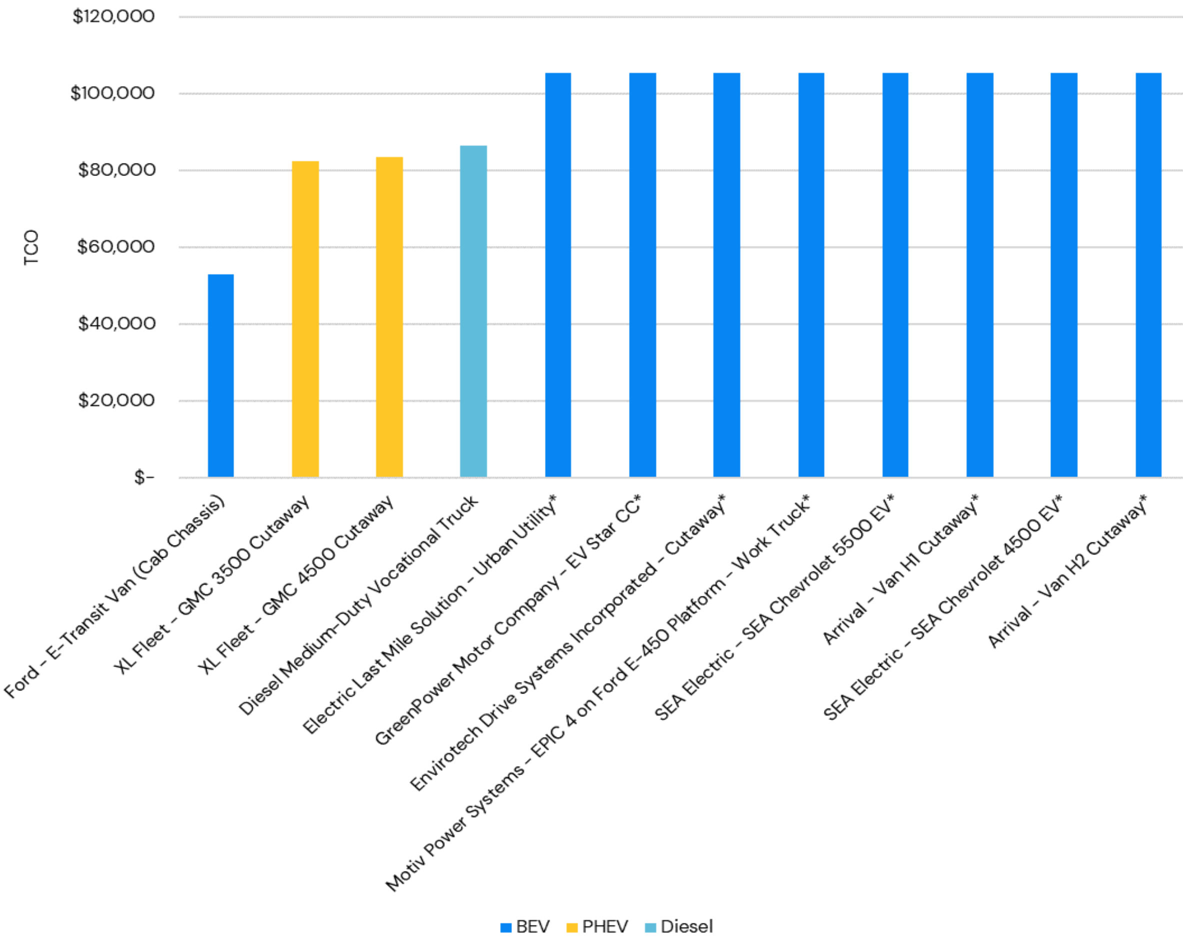


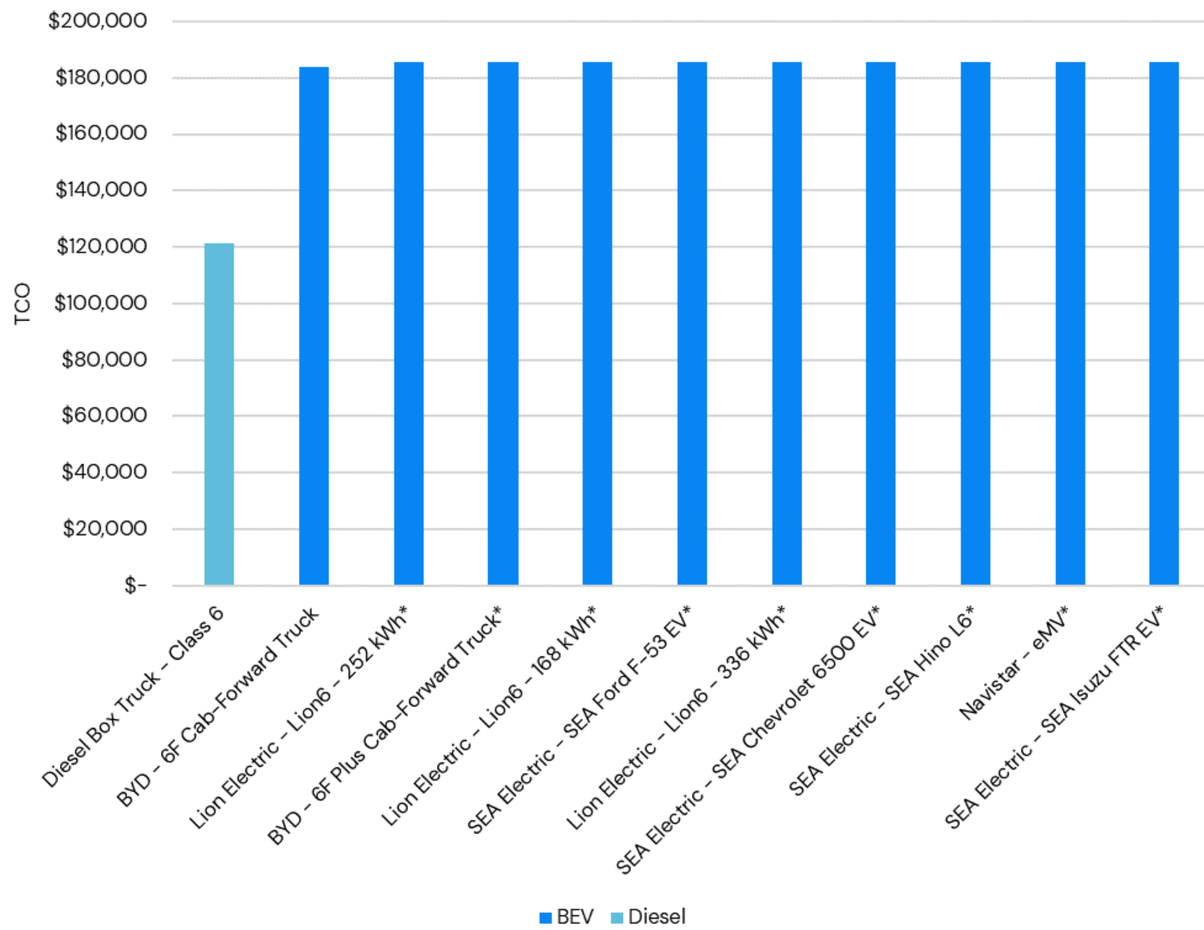
*Chart P: Medium-Duty Vocational Truck EV Model TCO Comparison**



*Actual MSRP unavailable. Price assumptions are outlined in the Key Assumptions section of this report.

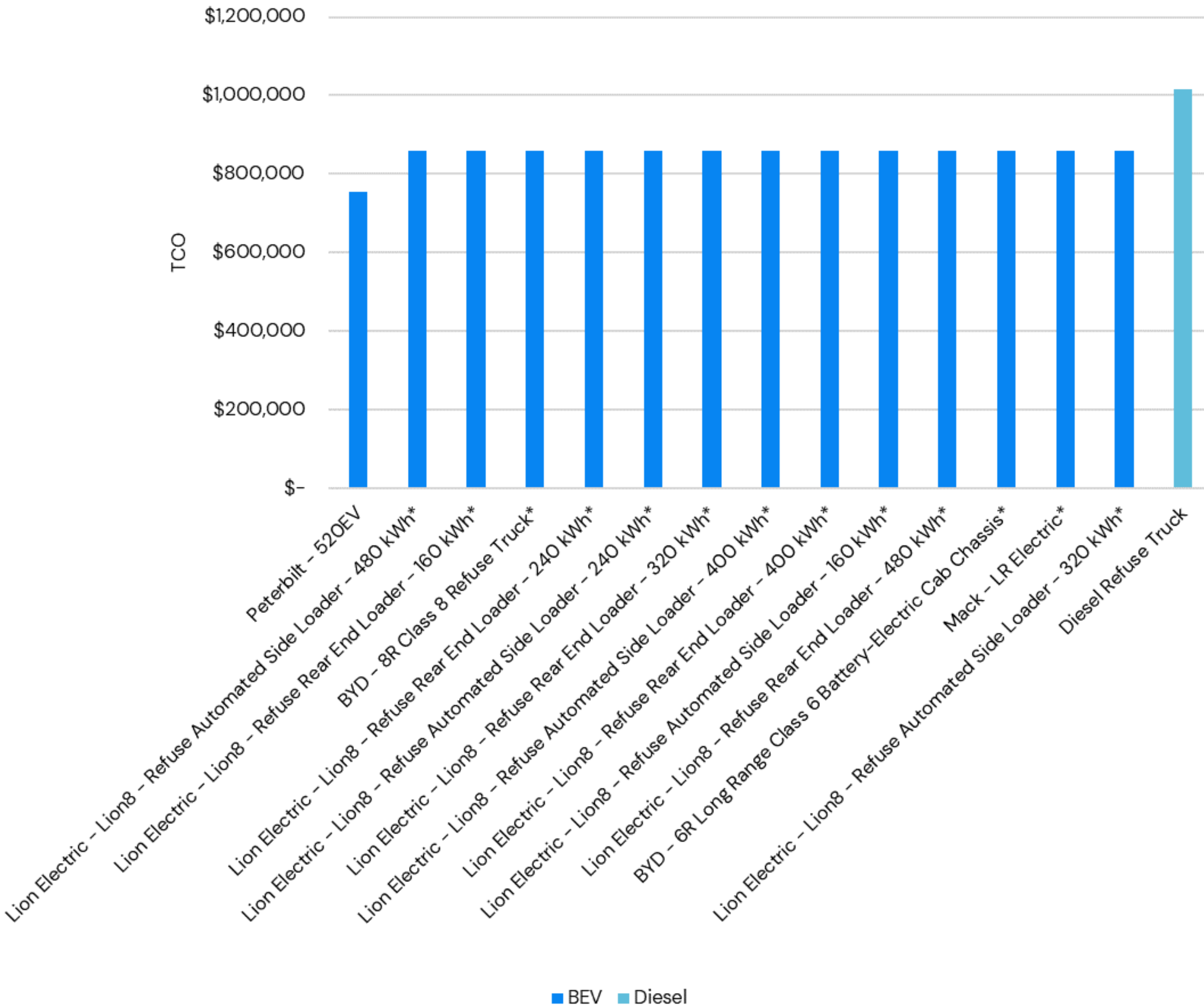
[16] The lowest TCO van in this comparison differs from the EV recommendations because this comparison does not include grants, incentives, charging infrastructure costs, or daily mileage requirements.

CHART Q: Box Truck EV Model TCO Comparison



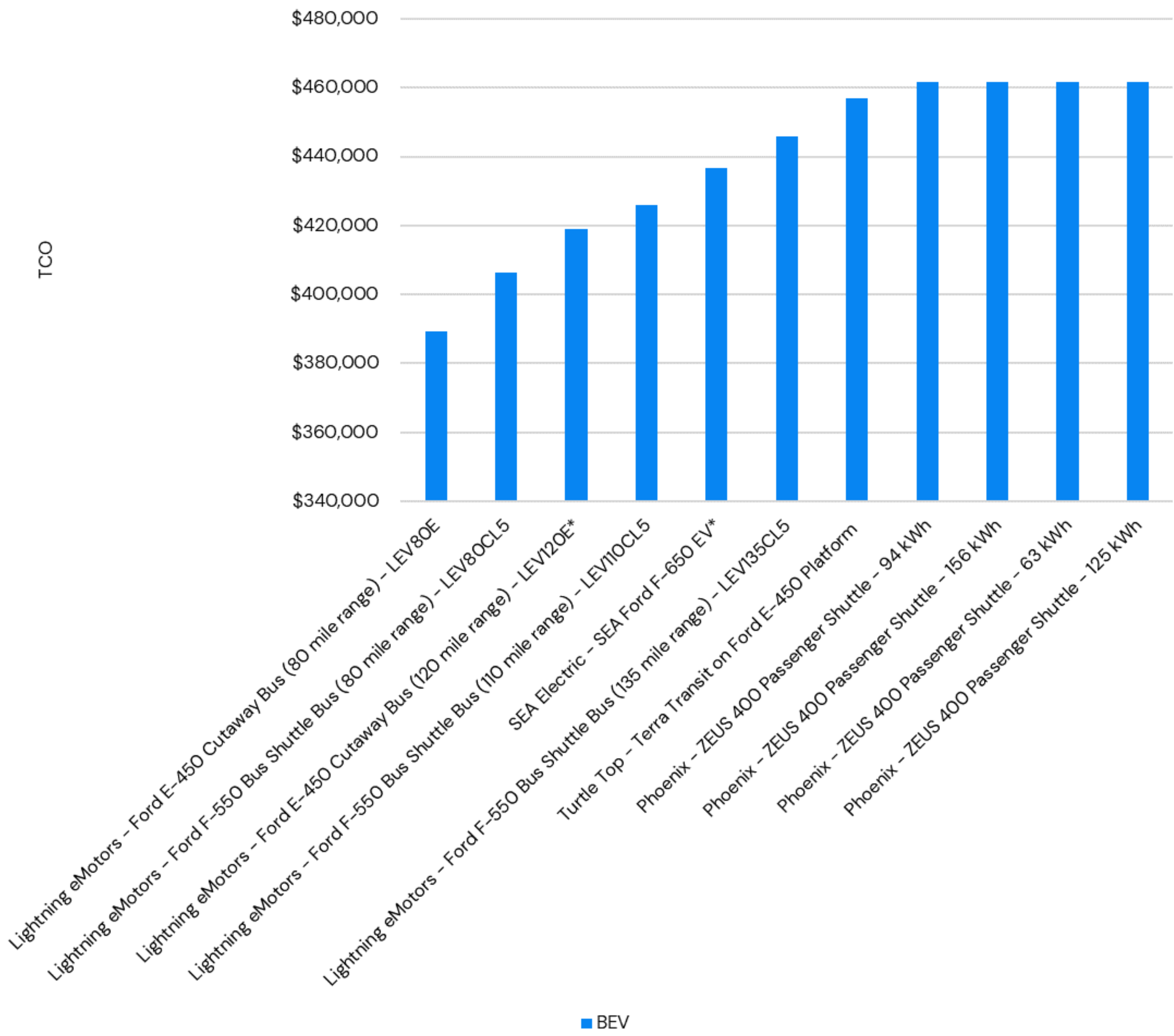
*Actual MSRP unavailable. Price assumptions are outlined in the Key Assumptions section of this report

CHART R: Refuse Truck EV Model TCO Comparison



*Actual MSRP unavailable. Price assumptions are outlined in the Key Assumptions section of this report.

CHART S: Shuttle Bus EV Model TCO Comparison[17]



*Actual MSRP unavailable. Price assumptions are outlined in the Key Assumptions section of this report.

[17] A comparable diesel shuttle bus is $521,450

CHART T: Transit Bus (Non-Articulated) EV Model TCO Comparison

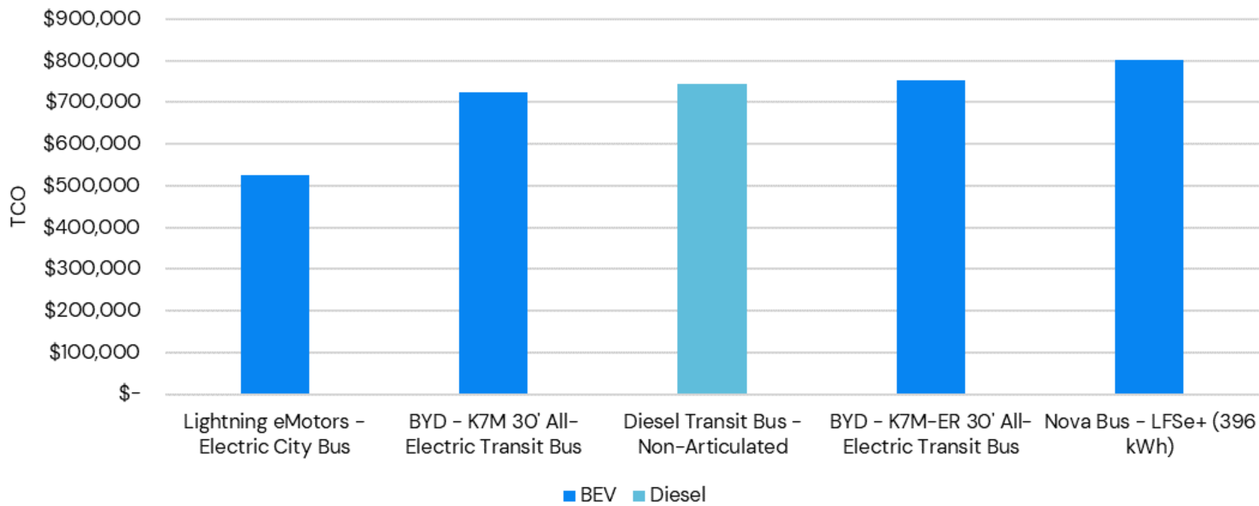


CHART U: Heavy Truck (Straight Truck) EV Model TCO Comparison

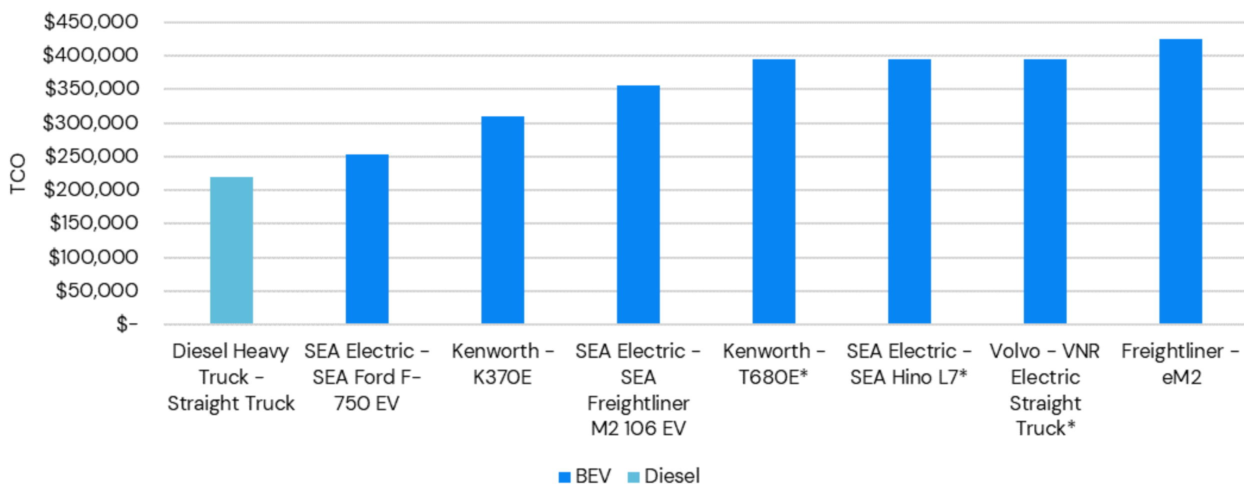


Chart V: Heavy Truck (Truck Tractor) EV Model TCO Comparison

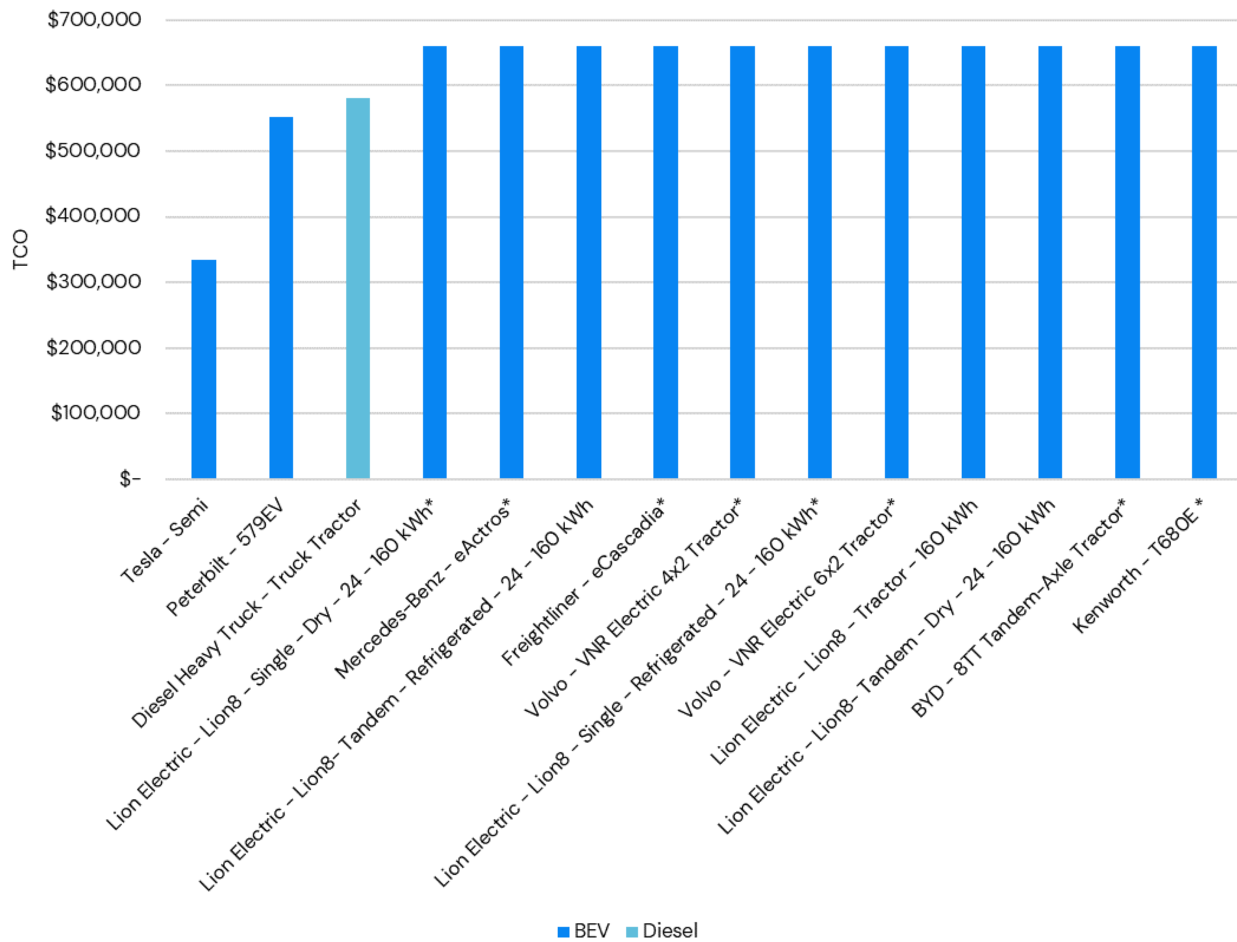
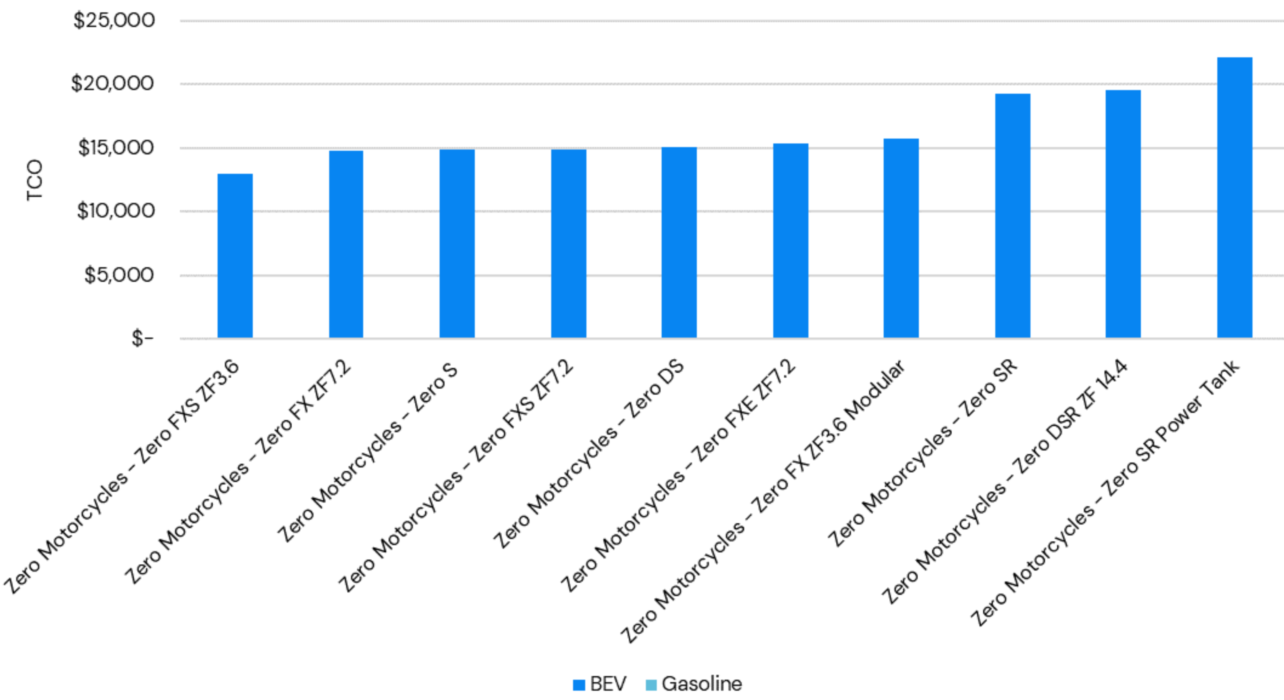


CHART W: Motorcycle EV Model TCO Comparison[18, 19]



Electric Police Patrol Vehicles

Currently, only five EV models, including three sedans and two SUVs, are being used as police patrol vehicles in a handful of police fleets in the United States. These models have been considered in CUSTOMER's fleet analysis. Additionally, the Hyundai Kona Electric SUV is being piloted by some police fleets in Europe and could be included in future analyses if deemed suitable for CUSTOMER's police fleet. The models that are currently in use by police fleets in the United States are listed below and have a TCO range between $49,039 and $71,197 based on CUSTOMER's average annual milage (11,073), average miles driver per day (44), and average vehicle life (4 years).

- Chevrolet Bolt (sedan)
- Tesla Model 3 (sedan)
- Tesla Model S (sedan)
- Ford Mustang Mach-E (SUV)
- Tesla Model Y (SUV)

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[18] Lowest TCO electric motorcycle differs from the EV recommendations because this comparison does not include grants, incentives, charging infrastructure costs, or daily mileage requirements.

[19] A comparable gasoline motorcycle TCO is $54,215

Electric Snowplows

There are no commercially available electric vehicles that are compatible with snowplows. [20] However, several plug-in hybrid electric vehicle aftermarket conversions are capable of plowing. These PHEVs are equipped with more torque and longer range than their ICE counterparts, making them especially capable of pushing heavy loads for many hours at a time. Available plug-in hybrid electric vehicles that are compatible with snowplows are:

XL Fleet Ford F-Series

XL Fleet GM 2500/3500 HD

XL Fleet GMC 3500/4500 Cutaway

MiDEAL EV Procurement

The 6 electric vehicle model options that are currently available on Michigan's MiDEAL State Contract are summarized in Table G, below.

TABLE G. Michigan MiDEAL State Contract Model Options

Vehicle Type	Make	Model	MiDEAL Price
Sedan	Chevy	Bolt	$32,335
SUV	Ford	Mustang Mach-E	$41,325
Light-Duty Pickup	Ford	F-150 Lightning	$37,400
Van	Ford	E-Transit 350 (130"/148")	$43,108/$44,245
Medium-Duty Vocational Truck	Ford	E-Transit Chassis Cab	$39,815
Shuttle Bus	Ford	E-Transit Cutaway[22]	$39,385

Sample Duty Pickup Financial Analysis

Table H provides a sample TCO comparison for a single, purchased Light-Duty Pickup. This analysis uses a 15-year vehicle life and 6,757 annual miles driven based on AFLEET vehicle life assumptions and CUSTOMER's fleet-provided annual mileage.

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[21] According to ATLIS Motor Vehicles, the ATLIS XT medium-duty pickup is compatible with snowplows and will be commercially available in 2023.

20 The Ford E-Transit Cutaway is an incomplete vehicle that requires upfitting.

Table H: Light-Duty Pickup TCO Comparison

	Gasoline	**PHEV** (XL Fleet – Ford F-150 2WD Reg. Cab)	**BEV** (Ford – F-150 Lightning Crew Cab)
Capital Cost	$37,000	$55,124	$39,454
Charging Infrastructure Hardware (L2)	N/A	$3,450	$3,450
Charging Infrastructure Installation	N/A	$6,650	$6,650
Incentives6F	N/A	N/A	N/A
Annual Fuel/Energy Costs	$1,092	$570	$234
Annual Maintenance Costs	$1,101	$1,007	$694
15-Year Total Costs7F[23]	$58,008	$78,489	$56,827

Charts X and Y provide a visual representation of the annual and cumulative cost comparisons across a gasoline, PHEV, and BEV light-duty pickup. While initial capital costs are higher for the BEV and PHEV options, lower operational costs result in lower annual costs for the BEV and PHEV options and lower overall TCO costs for the BEV option.

CHART X: Light-Duty Pickup 15-Year Annual Cost Comparison

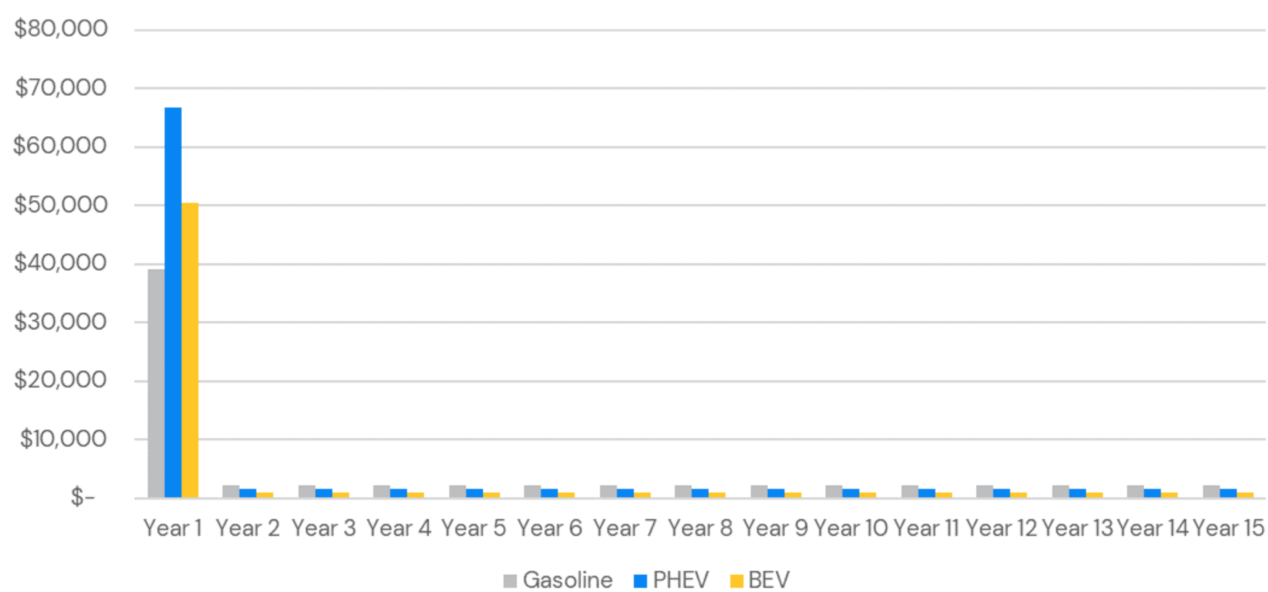
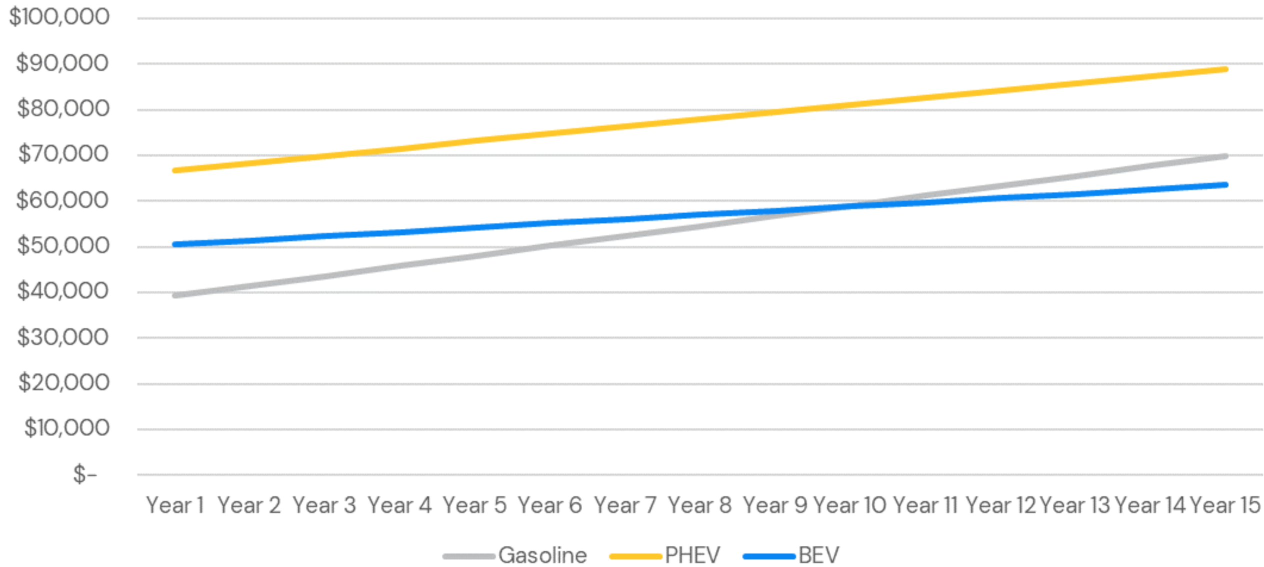


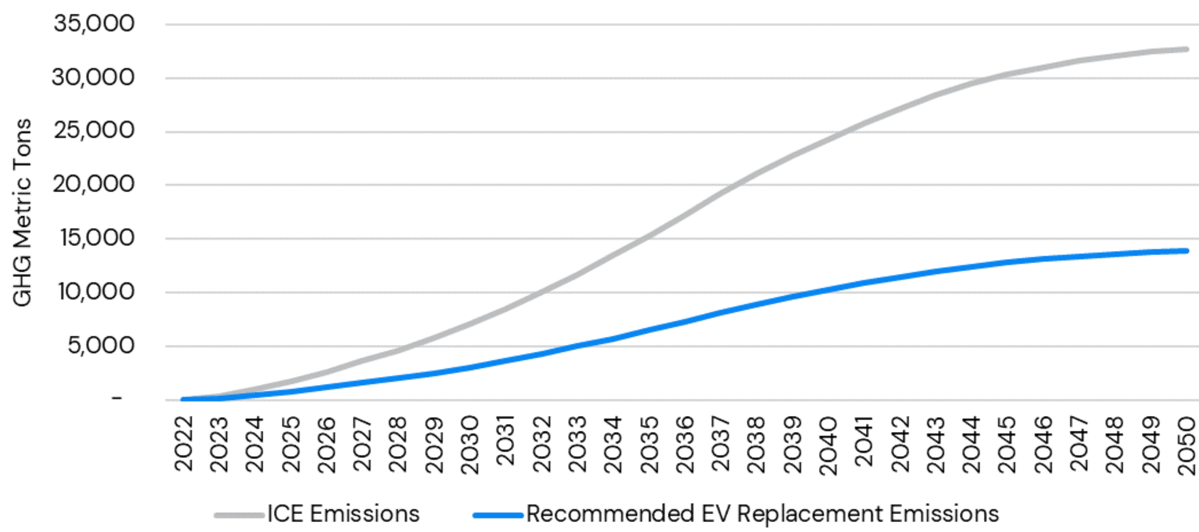
CHART Y: Light-Duty Pickup 15-Year Cumulative Cost Comparison



Fleet Environmental Impact Analysis

By converting the 369 recommended vehicles to EVs, you could reduce GHG emissions by 18,945 MT and NOx emissions by 96,225 pounds (lbs) over 29 years. Chart Z below illustrates the cumulative GHG emissions for ICE replacements compared to EV replacements. The GHG emissions included in this analysis account for both tailpipe and source (fuel production) emissions, while the NOx emissions account for only tailpipe emission reductions.

Chart Z: Cumulative Fleet Green House Gas Emissions



18,945 GHG Emission Reductions (MT over 29 years)

4,092 Equivalent to removing passenger vehicles from the road for one year

96,225 NOx Emission Reductions (Lbs. over 29 years)

312,584 Equivalent to tree seedlings grown for 10 years

Non-Road Equipment

There are 79 vehicles in CUSTOMER's fleet identified as non-road equipment, summarized in Table I below. Of the 79 vehicles, 24 all-terrain vehicles/utility-task vehicles (ATVs/UTVs) and 3 forklifts have been identified as cost-beneficial opportunities to convert to electric. Electric non-road equipment could help CUSTOMER further reduce fuel costs, maintenance costs, and site emissions.

Table I: Non-Road Equipment

Vehicle Type	**Fleet Total Quantity**	**Quantity already Electric**	**Quantity Recommended to Convert to Electric**	**Financial Savings** (across equipment lifespan)	**GHG Emission Reductions** (MT, across equipment lifespan)
Golf Cart	42	42	0	N/A	N/A
ATV/UTV	24	0	24	$264,483	523
Forklift	3	0	3	$19,602	83
Other (Zamboni, generators, farm equipment, etc.)	10	2	0	N/A	N/A
TOTAL	**79**	**44**	**27**	**$284,085**	**606**

Golf Carts

CUSTOMER currently owns 42 golf carts, all of which are already electric. Electric golf carts are quiet, require little maintenance, and produce no site emissions. Replacing CUSTOMER's pre-2013 electric golf carts with new electric models could produce additional total cost of ownership savings because new 48 Volt electric golf carts operate more efficiently than old 36 Volt models. Electric golf cart manufacturers include: Yamaha, Club Car, and EZ-GO.

Forklifts

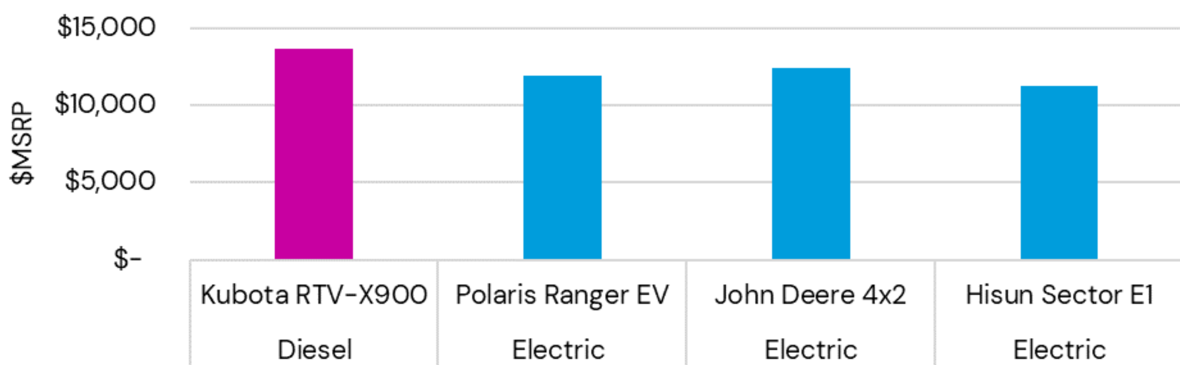
CUSTOMER currently owns 3 diesel forklifts. We recommend CUSTOMER explore electric forklift options when looking to replace their forklift fleet. Electric forklifts can help reduce fuel and maintenance costs by up to 60%. Transitioning your fleet to electric forklifts could produce estimated lifetime savings of about $19,602 across the 3 CUSTOMER units. Electric forklift manufacturers include:

Toyota, BYD, Hyster, Crown, Jungheinrich, Caterpillar, Kalmar, Mitsubishi, Unicarrier, Yale, Clark, Doosan, Linde, Drexel, Carer and Bendi.

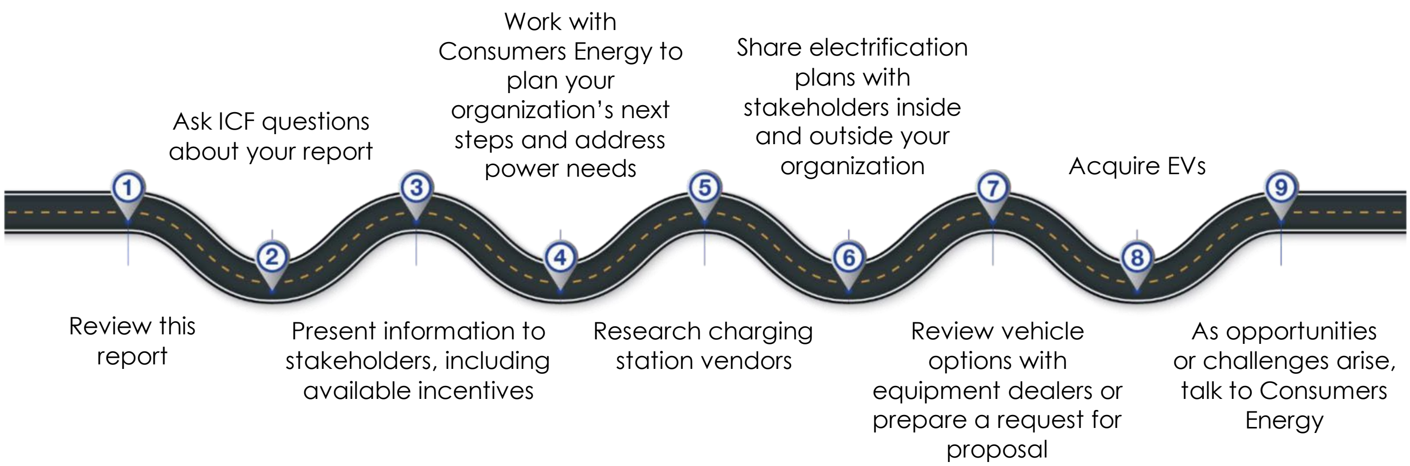
ATVs/UTVs

CUSTOMER currently owns 24 gasoline powered ATVs and UTVs, including models from Kubota, Can-Am, Toro, and Yamaha. We recommend CUSTOMER explore electric ATV/UTV options when looking to replace these ATVs and UTVs. Electric UTVs are cost competitive with ICE UTVs, as seen in Chart AA, and can help reduce fuel and maintenance costs by up to 60%. Transitioning to your ATVs and UTVs to electric could produce estimated lifetime savings of about $264,483 across the 24 CUSTOMER units.

Chart AA: Comparable UTV Capital Costs



Next Steps: Your Roadmap to Fleet Electrification



We're here to help.

Contact us for help with your report, support navigating next steps, or just to speak with an expert.

WEB: PowerMIFleet™ | Consumers Energy

EMAIL: PowerMIFleet@cmsenergy.com

Frequently Asked Questions

Will additional training be needed for our drivers or maintenance staff?

Driving an EV is very similar to an ICE, but there are a few differences that your team may need help with, such as charging the vehicle and how to shift it into "drive." The level of training needed may vary depending on the vehicle type.

What is the impact of cold weather on electric vehicle (EV) operation?

This assessment accounts for potential regional temperature impacts on range prior to identifying recommended vehicle replacements. Extreme outside temperatures do reduce range, because more energy must be used to heat or cool the cabin. In Michigan, this can equate to small range reductions in the fall and spring, and up to 30-50% in the winter. The higher end of that spectrum would be during extreme cold.

How long do EVs last?

A manufacturer's warranty of a light-duty EV typically covers 8 years or 100,000 miles, and the expected battery lifetime is 10 to 12 years. Batteries in newer EV models should be capable of longer miles and lifetimes. On average, EV battery degradation is about 2% per year. An EV reaches the end of its useful life when the battery has less than 80% of its initial capacity remaining.

What electrical infrastructure upgrades will be needed to install chargers for my fleet? What are the associated costs?

While the specifics around electrical upgrades are not the focus of this analysis, Consumers Energy can help connect you with vetted charging station installers to better understand the costs of upgrades. We will also estimate the cost of charging infrastructure in the TCO calculation in this report

If my fleet doesn't have the budget to purchase vehicles right now, how should we proceed?

This report provides 15-year recommendations for EV purchases. It also identifies applicable incentives and funding that may help cover some of the costs. Future EV models, pricing reductions, and grant programs may open up additional opportunities for electrification.