Business Fleet
Fleet Electrification Assessment

Fleet advisory services provided by ICF

Consumers Energy
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Glossary of Terms

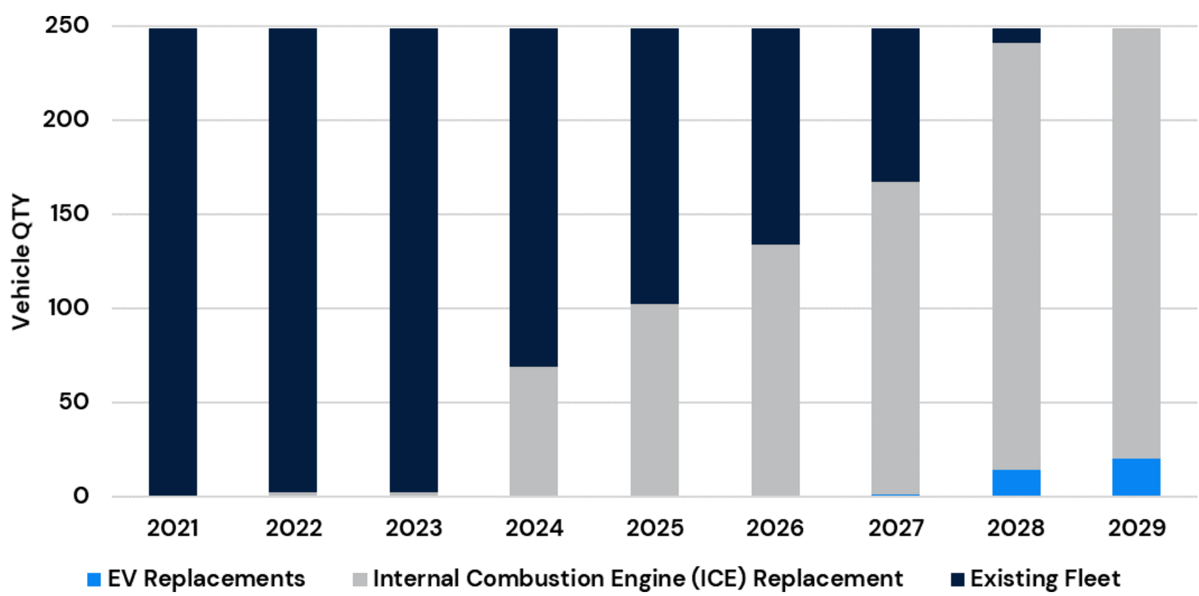
BEV: Battery Electric Vehicle
DCFC: Direct Current Fast Charger
EV: Electric Vehicle
EVSE: Electric Vehicle Supply Equipment
L2 Charger: Level Two Charger
PHEV: Plug-In Hybrid Electric Vehicle
TCO: Total Cost of Ownership

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 2029, which accounts for a maximum vehicle life of 7 years. However, the fleet total cost of ownership (TCO) analysis extends to 2035 to account for the ongoing fuel and maintenance costs from the vehicles acquired in 2029. We assessed the economic feasibility of 249 vehicles in the CUSTOMER's fleet and identified 249 that have EV options available and 20 of those that would be financially beneficial to convert over the next 7 years. Chart A illustrates the phasing in of these EVs as you replace your existing fleet vehicles. These 20 vehicles would result in a net present value (NPV) TCO savings of $541,930 over the next 14 years, which accounts for the savings across the vehicles' full lifespans.

Chart A: Recommended EV Replacement Timeline: Fuel Types



Based on our analysis, converting 20 on-road vehicles to EVs is estimated to produce the following impacts:

$541,930

TCO savings over 14 years*

$951,526

fuel cost savings over 14 years*

$240,834

maintenance savings over 14 years*

3,542

metric tons (MT) of CO2 eliminated over 14 years

*NPV assumes a 5% discount rate

Over 14 years, those estimated CO_2 reductions equate to:

eliminating **407** homes' energy use for one year, or:

switching **134,606** incandescent lamps to LEDs, or:

recycling **1,204** tons of waste instead of landfilling it, or:

planting **58,447** trees.

Project Information

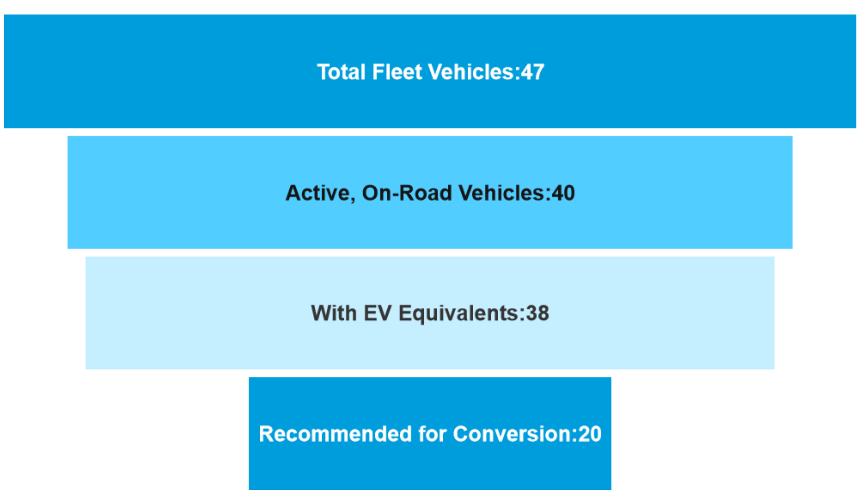
On August 5, 2021, CUSTOMER met with the ICF Account Manager and other program staff for an initial intake call. The discussion covered topics including an overview of the PowerMIFleet program, fleet data availability, fleet usage characteristics, and the fleet's motivation for exploring EV options. 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. Their main barrier to electric vehicle (EV) deployment is insufficient EV range

CUSTOMER provided an initial fleet dataset on September 22, 2021. The Account Manager provided follow up questions and key assumptions for missing fields. On October 20, 2021 CUSTOMER indicated they were comfortable with us moving forward with the analysis. CUSTOMER's fleet dataset was used to establish a fleet baseline in the model and we presented the initial results for feedback on November 3, 2021.

There are 249 on-road vehicles in CUSTOMER's current fleet. All of the 249 vehicles have EV equivalents available, but only 20 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.

Chart B: Fleet Assessment Vehicle Breakdown



Existing On-Road Fleet Makeup

There are 249 vehicles in CUSTOMER's current fleet, all of which are diesel-powered heavy trucks as shown in Table A. We used a 7-year vehicle lifespan to estimate the vehicle retirement schedule, illustrated in Chart D.

Table A: Existing Fleet Fuel Type Distribution

Vehicle Type	Gasoline	Diesel
Heavy Truck	0	249
TOTAL	**0**	**249**

Chart C: Existing Fleet – Vehicle Types

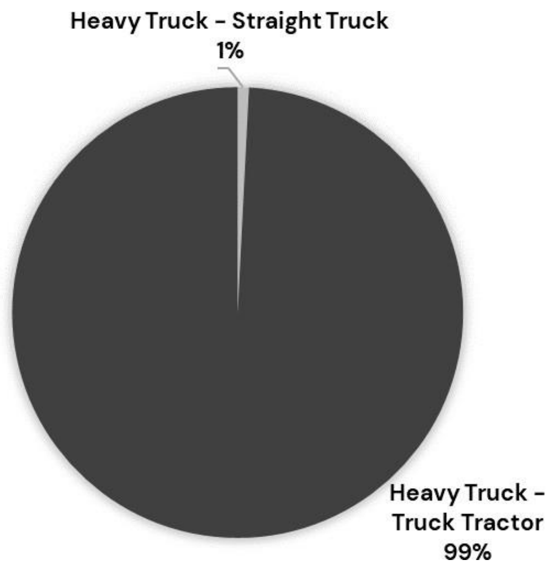
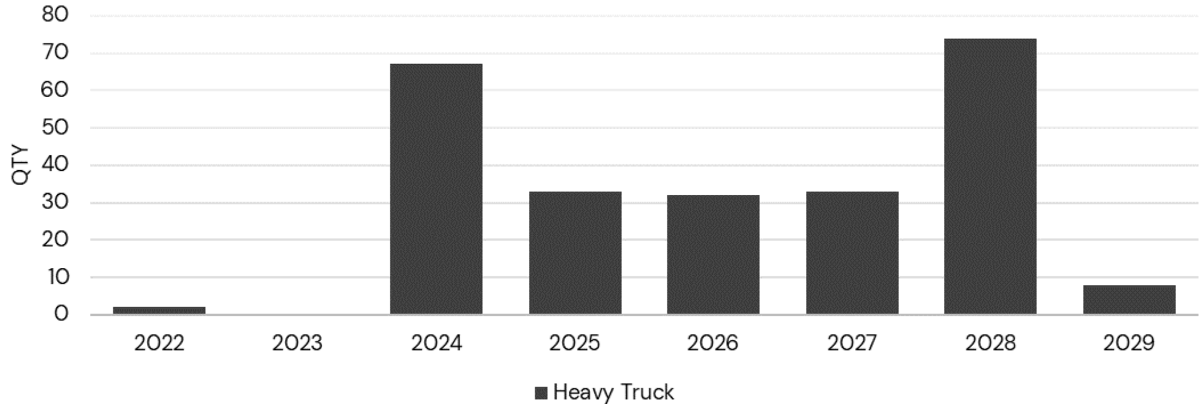


***Chart D: Existing Fleet - Retirement Schedule*[1]**



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.
- **Vehicle Pricing:** The model uses manufacturer suggested retail prices (MSRPs) for EVs where available. 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).
- **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

[1] Two trucks have a model year of 2012 and are projected for retirement in 2022. All other trucks have a model year of 2017 or later, which is why there are no vehicle replacements projected for 2023.

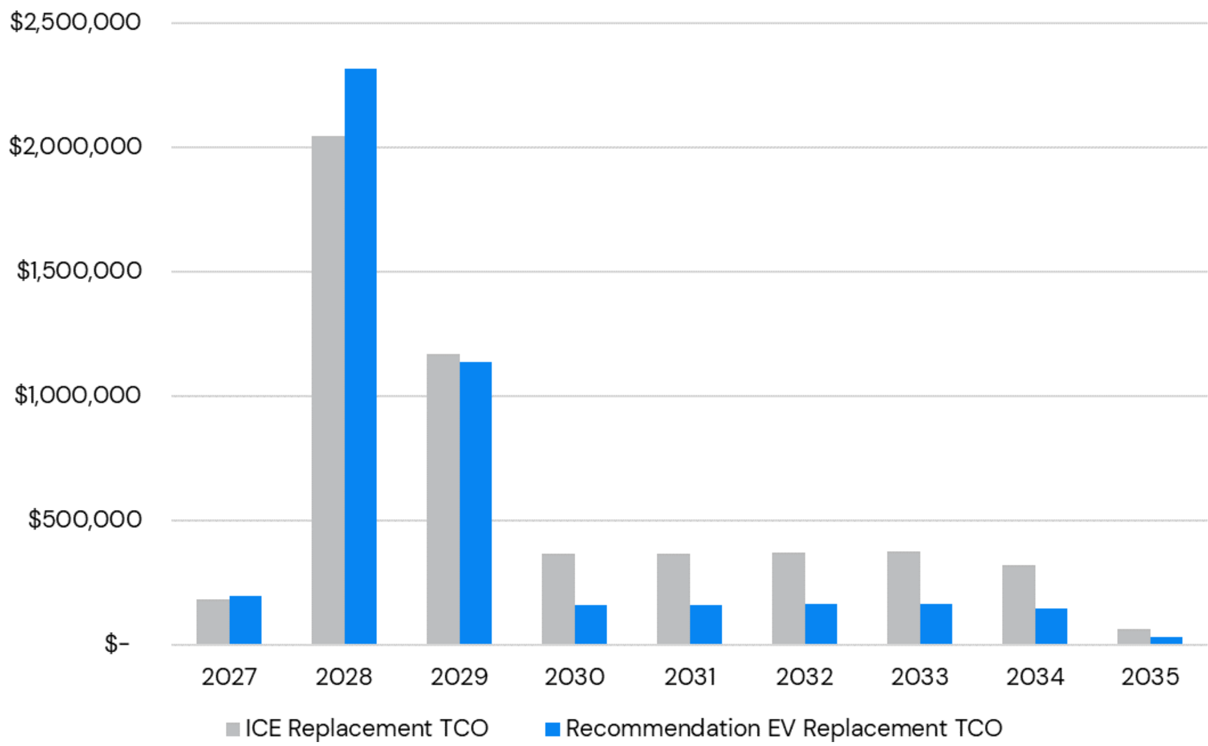
assumptions by vehicle and fuel type from Argonne National Laboratory's AFLEET Tool and ICF's *CalETC Report.*

- **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**: For all vehicles, the model uses a 7-year vehicle lifespan assumption to estimate the retirement schedule. The vehicle lifespan was added to the model year to determine the replacement year, with the minimum being 2022.
- **Timeframe**: This analysis focuses on vehicle replacements for 2022 through 2029, with TCO calculations extending out across the vehicle lifespans to 2035.
- **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. For CUSTOMER's current vehicles, the model uses CUSTOMER's provided data to estimate the range required each day; this varies from 17 to 741 miles per 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 249 eligible CUSTOMER on-road vehicles scheduled for retirement between 2022 and 2036, and 20 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 20 recommended vehicles each year if they were replaced with conventional, ICE vehicles versus with the recommended EVs. This timeline is based on the existing fleet retirement schedule outline in Chart D above.[2] Based on these estimates, you may see a financial payback early as 2030. 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[2]



[2] All vehicles projected for retirement prior to 2027 have daily mileage requirements that exceed current EV model ranges, therefore recommended EV replacements and the total cost of ownership comparison begins in 2027.

Chart F: Fleet Recommended Replacements TCO Comparison - Cumulative

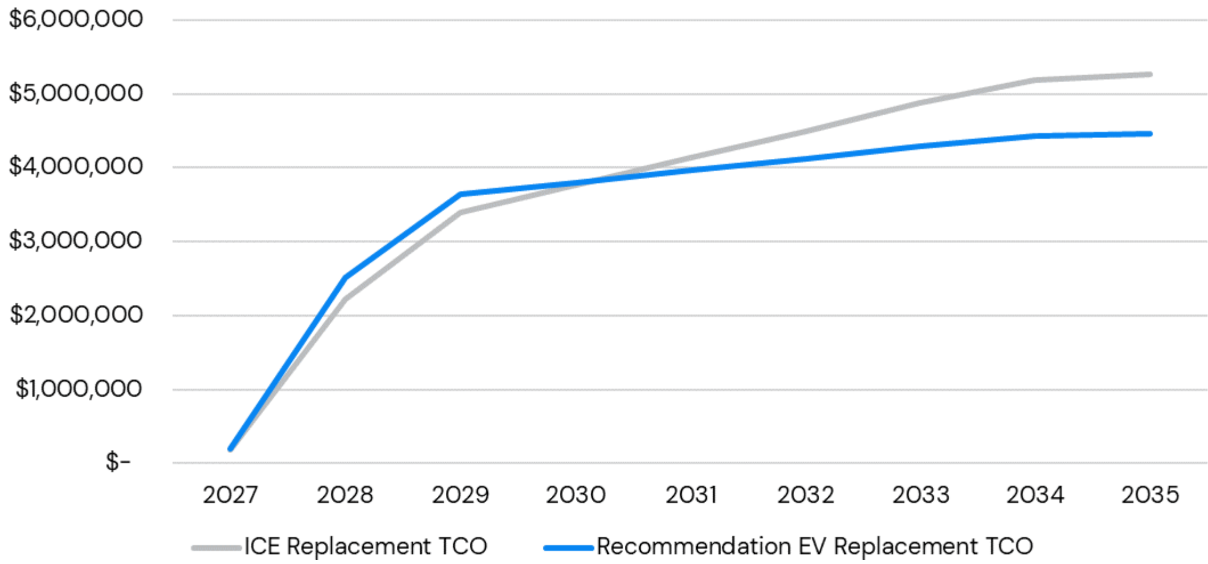


Table B on the next page identifies the vehicles that will be cost effective to convert to electric within the next 7 years. Chart G illustrates the recommended replacement timeline for these vehicles. Each vehicle within your fleet has been assessed to identify the lowest cost option, while also accounting for potential mileage and charging time restrictions.

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:

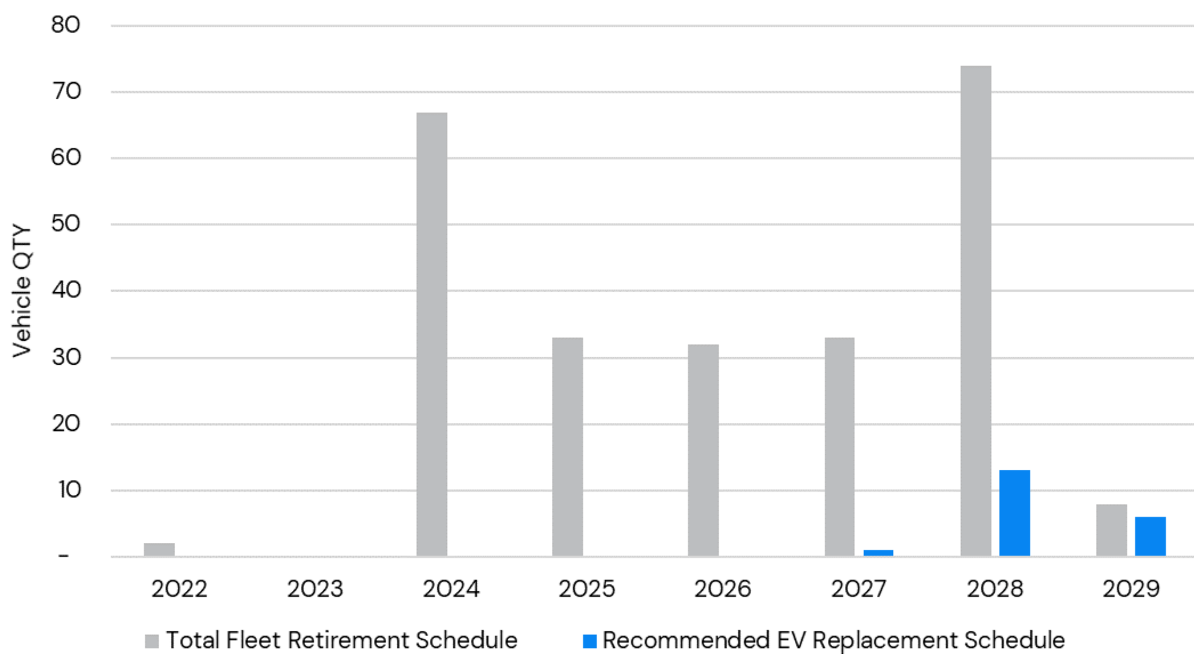
- Capital costs
- Charging infrastructure hardware costs
- Charging infrastructure installation costs
- Annual fuel costs
- Annual maintenance costs
- Potential EV or EVSE incentives or grants

There are 229 vehicles with EV equivalents that are not recommended for conversion because the EV options are not cost-effective (29 vehicles) or EV range is insufficient (198 vehicles). Future EV model options or incentive program availability may open opportunities for these to be converted.

Table B: 7-Year Electrification Recommendations

Vehicle Type	Quantity Up for Retirement (in 7 Years)	Quantity Recommended to Convert to Electric	Recommended Make/ Model/ EV Type	Financial Savings (across 14 years)	GHG Emission Reductions (across 14 years, MT)	EVSE	
						L2	DCFC
Heavy Truck – Truck Tractor	247	20	Tesla/Semi/BEV	$541,930	3,542	0	20
Heavy Truck – Straight Truck	2	0	N/A	N/A	N/A	N/A	N/A
TOTAL	**249**	**20**		**$541,930**	**3,542**	**0**	**20**

Chart G: Recommended EV Replacement Timeline: Vehicle Types[3]



[3] All vehicles projected for retirement prior to 2027 have daily mileage requirements that exceed current EV model ranges, therefore recommended EV replacements don't begin until 2027.

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 75-70 miles of range for every 14 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 14 minutes charging and the Nissan LEAF PLUS can add about 70 miles per 14 minutes charging. A transit bus will be able to add 60-125 miles for every 14 minutes spent charging, depending on the capacity of the DC Fast charger.

Site Assessment

CUSTOMER will need a maximum of 20 DCFC chargers to support the recommended 20 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 250 kW total power demand and 527,448 annual kWh across the 3 CUSTOMER sites, summarized in Table C on the next page. Depending on the scheduled duty cycles of the vehicles, it may be possible to reduce the number of chargers.

Table C: Site Load Impact Study

Charging Site	L2 (QTY)	DCFC (QTY)	Estimated Total Power Demand (kW)
SITE 1	0	20	250
SITE 2	0	0	0
SITE 3	0	0	0
TOTAL	**0**	**20**	**250**

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 20 EVs at CUSTOMER's sites. The rate analysis also compared this rate against Consumers' General Service Secondary rate. Chart H below summarizes the fleet annual fuel costs across each rate, and Chart I summarizes the cumulative fuel costs across each scenario over time.

Chart H: Rate Analysis Fleet Annual Fuel Cost Comparison

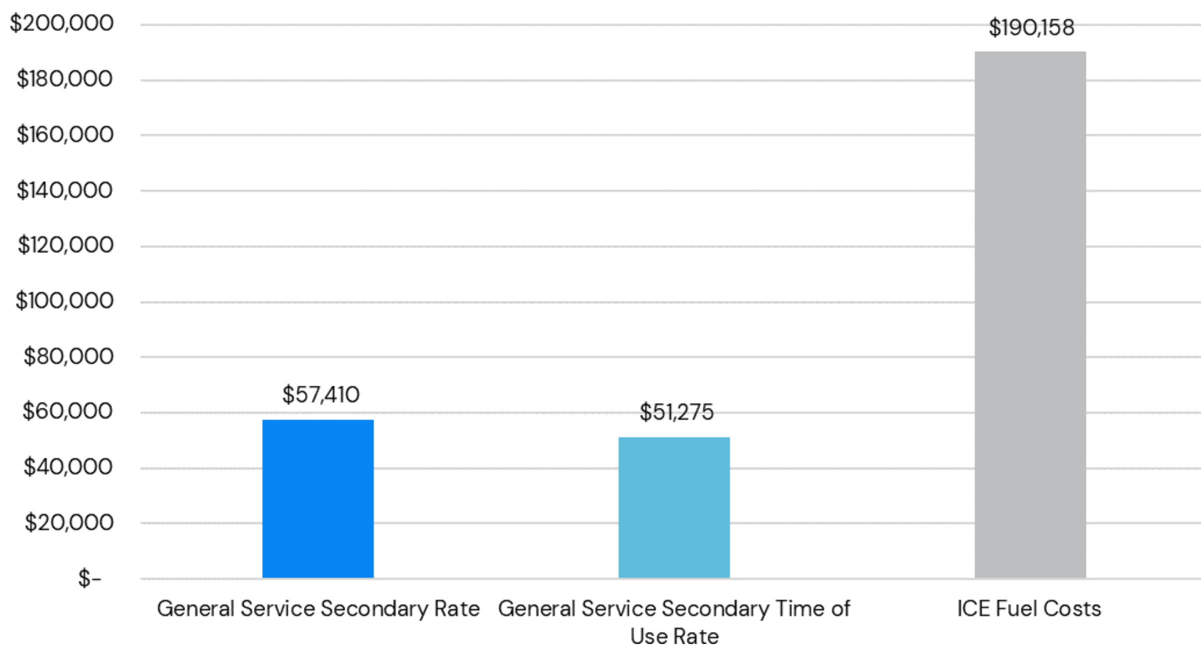
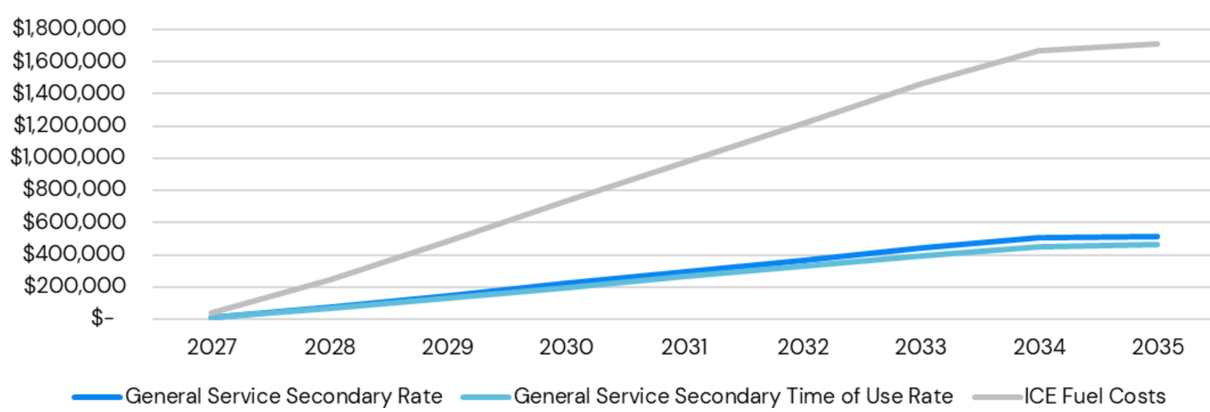


Chart I: Rate Analysis Fleet Cumulative Fuel Cost Comparison



Incentives and Funding Source Assumptions Applied

Incentives are available for the purchase of EVs and EVSE. Table D 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 D: Incentive and Funding Sources[4]

Program	Light Duty	Medium Duty	Heavy Duty	Administrator	Vehicle Costs	EVSE	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	50% capital costs with 3000+ annual miles and model pre-2009.
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[5]	45% of capital costs with 7,000+ annual miles

EV Model Comparison

There are over 400 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 J through Chart K highlight the lowest TCOs for each vehicle type within your fleet.

[4] All vehicles projected for retirement prior to 2027 have daily mileage requirements that exceed current EV model ranges, therefore recommended EV replacements don't begin until 2027. As the current incentive and grant programs only apply to vehicles purchased prior to 2025, none of the vehicles recommended for conversion have incentives applied.
[5] 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.

This analysis is for 1 vehicle for each vehicle type, uses your fleet's average annual mileage, miles driven per day, and vehicle life 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 J: Heavy Truck – Truck Tractor EV Model TCO Comparison

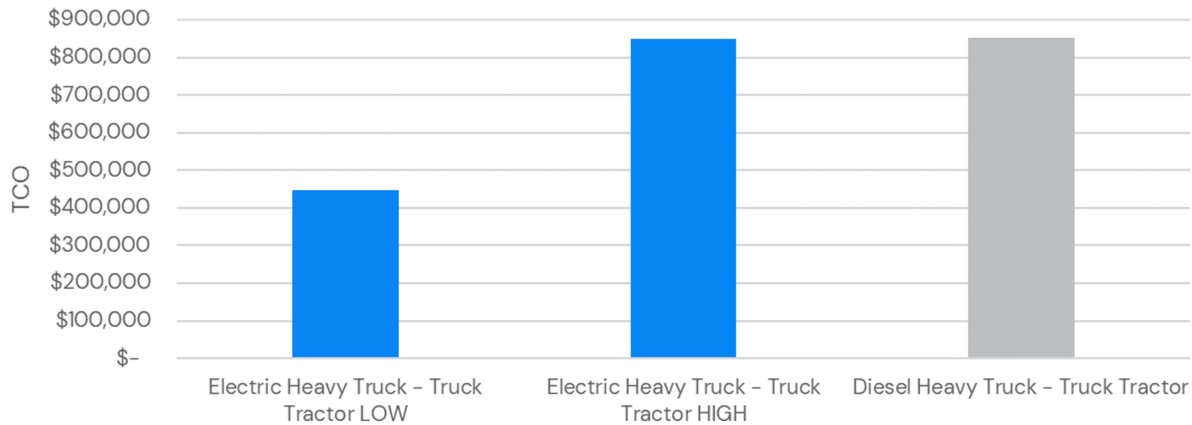
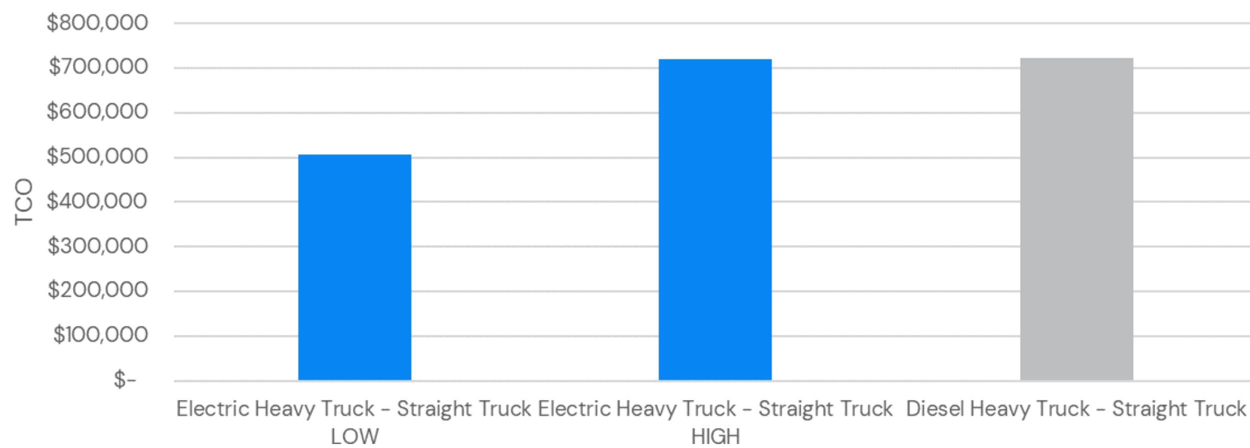


Chart K: Heavy Truck – Straight Tractor EV Model TCO Comparison



There is limited MSRP pricing available for EV heavy truck models, however, based on your fleet's average annual mileage, miles driven per day, and vehicle lifespan the TCO for a diesel heavy truck – truck tractor would be $852,097, while an EV heavy truck TCO could range between $448,514 to $848,514 depending on the make and model (not including incentives or charging infrastructure costs). The TCO for a diesel heavy truck – straight truck would be $723,695, while an EV heavy truck TCO could range between $507,800 to 720,800 depending on the make and model (not including incentives or charging infrastructure costs). Available EV heavy truck manufacturers include:

- BYD
- Freightliner
- Kenworth
- Lion Electric
- Mercedes-Benz
- Peterbilt
- SEA Electric
- Tesla
- US Hybrid
- Volvo

There are 198 vehicles in CUSTOMER’s fleet that were not recommended for conversion as the current EV model ranges are insufficient. Charts L and M illustrate current EV heavy truck model mileage ranges per full charge.

Chart L: Heavy Truck – Truck Tractor EV Mileage Range Comparison

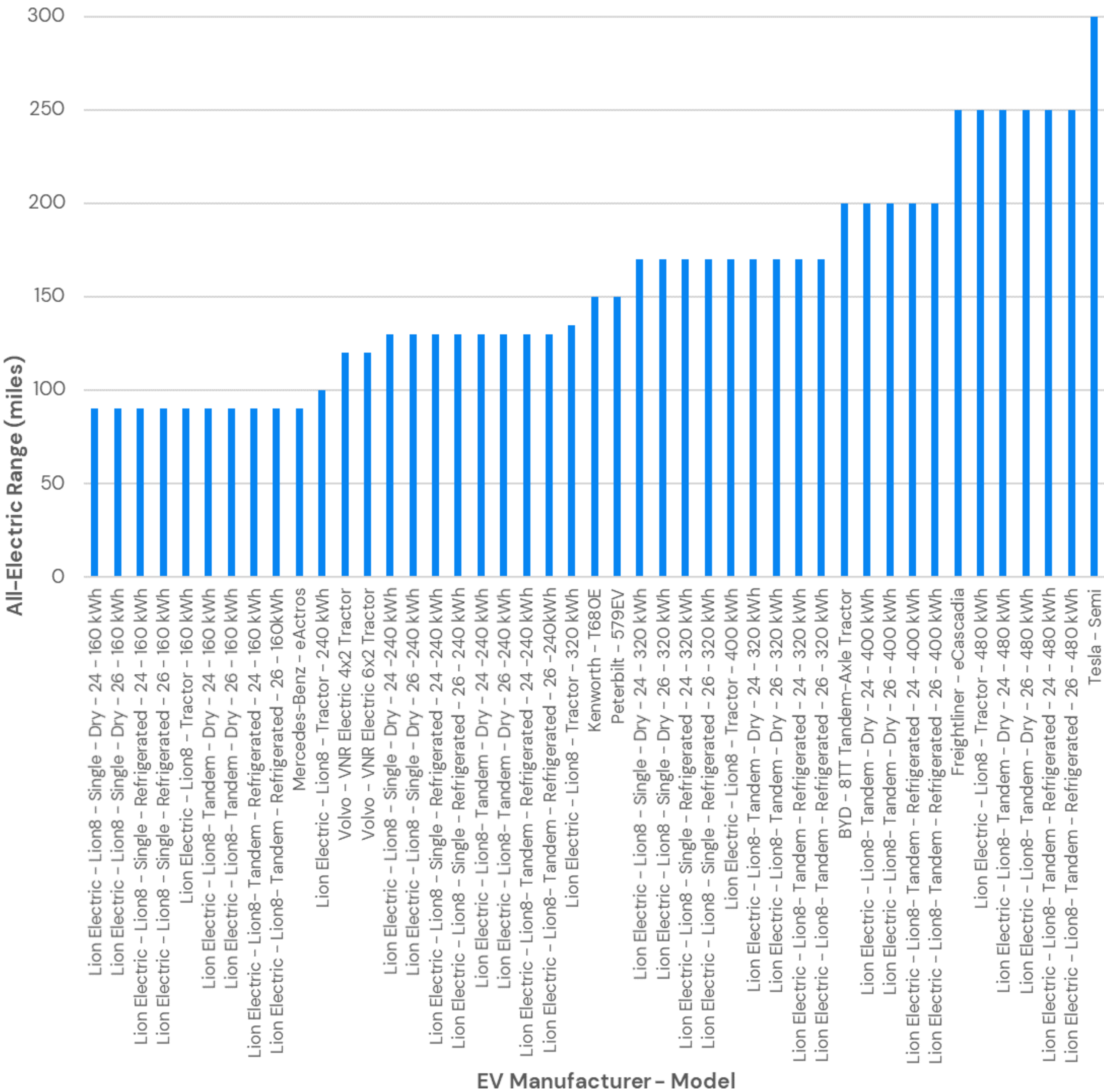
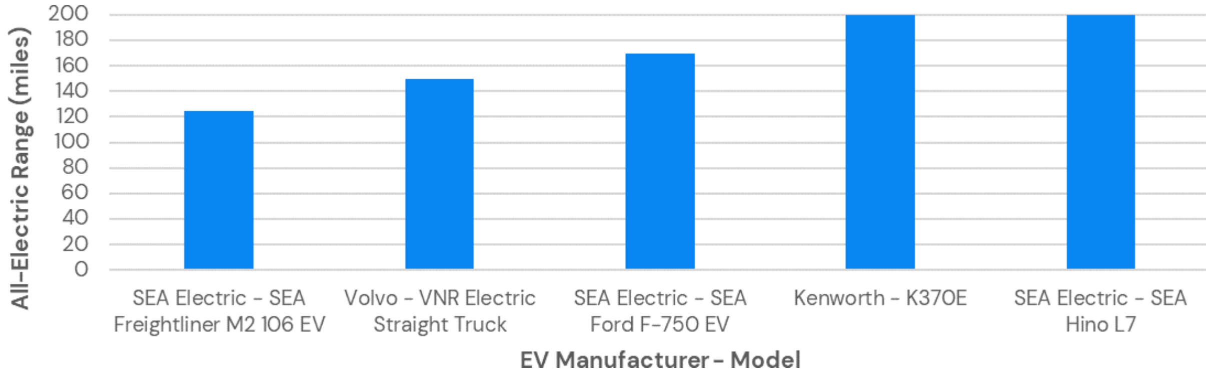


Chart M: Heavy Truck – Straight Tractor EV Mileage Range Comparison



Sample Heavy Truck Financial Analysis

Table F provides a sample TCO comparison for a single, purchased Heavy Truck – Truck Tractor. This analysis uses a 7-year vehicle life and 140,028 annual miles driven based on CUSTOMER's average vehicle annual mileage data.

Table F: Heavy Truck – Truck Tractor TCO Comparison

	Diesel	BEV (Tesla - Semi)
Capital Cost	$130,000	$150,000
Charging Infrastructure Hardware (DCFC)	N/A	$29,000
Charging Infrastructure Installation	N/A	$37,500
Incentives[6]	N/A	$(35,000)
Annual Fuel/Energy Costs	$78,092	$21,445
Annual Maintenance Costs	$25,065	$21,199
7-Year Total Costs[7]	$720,713	$419,616

Charts N and O provide a visual representation of the annual and cumulative cost comparisons across a diesel and BEV Heavy Truck. Incentives and lower operational costs result in lower annual and overall TCO costs for the BEV option.

[6] Assumes Consumers Energy PowerMIFleet EVSE and Make-Ready Program incentives. EV capital and infrastructure costs shown in table does not have incentives applied.
[7] NPV assumes a 5% discount rate.

Chart N: Heavy Truck 7-Year Annual Cost Comparison

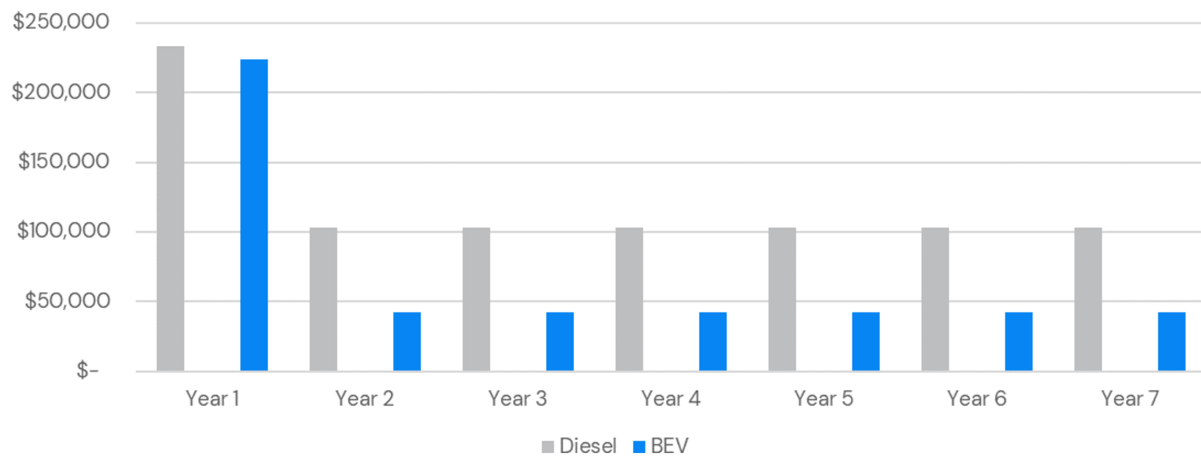
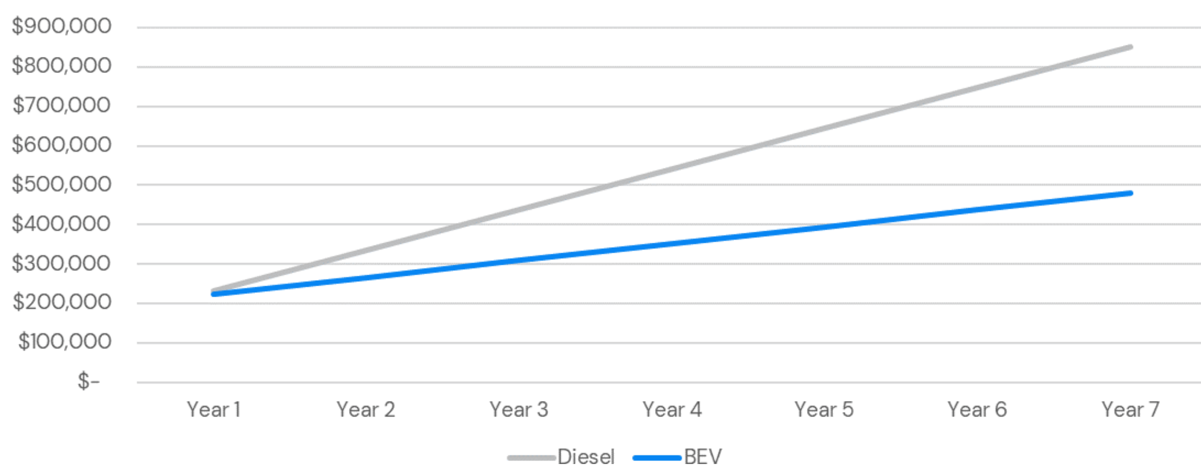


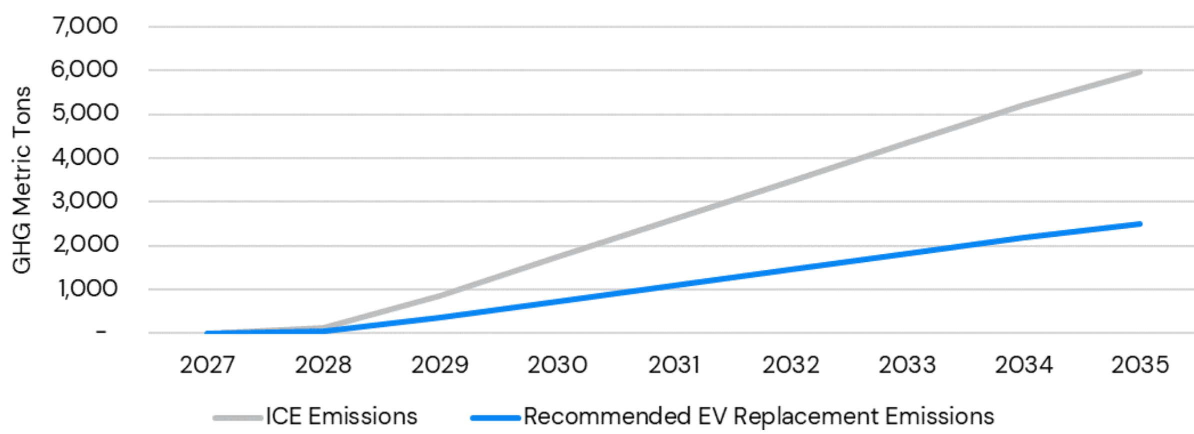
Chart O: Heavy Truck 7-Year Cumulative Cost Comparison



Fleet Environmental Impact Analysis

By converting the 20 recommended vehicles to EVs, you could reduce GHG emissions by 3,542 MT and NOx emissions by 17,689 pounds (lbs) over 9 years. Chart P 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 R: Cumulative Fleet Green House Gas Emissions[8]



3,542 GHG Emission Reductions (MT over 9 years)

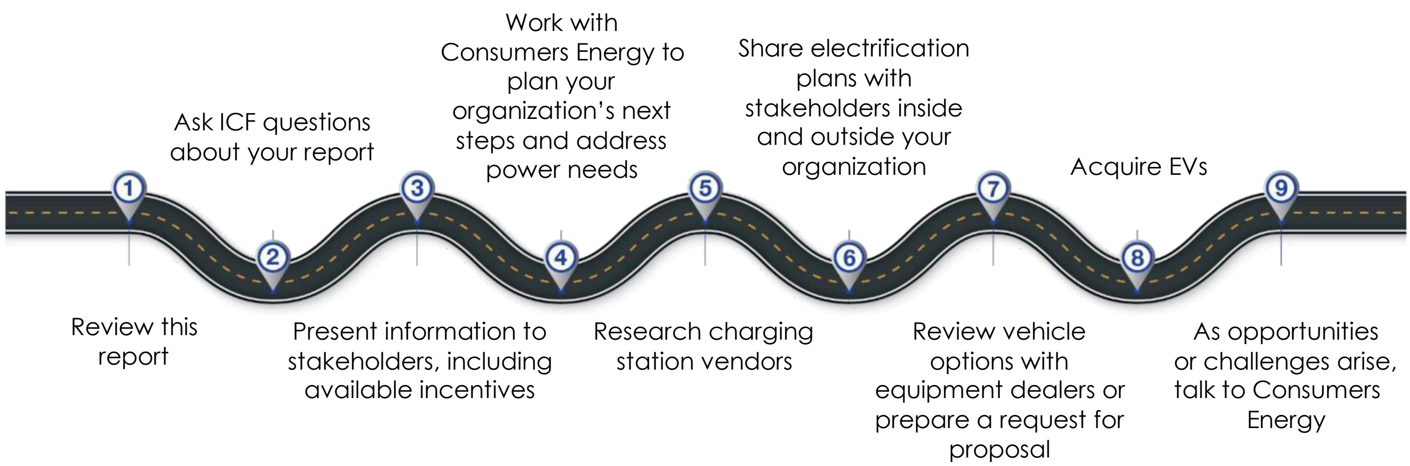
765 Equivalent to removing passenger vehicles from the road for one year

17,689 NOx Emission Reductions (Lbs. over 9 years)

58,447 Equivalent to tree seedlings grown for 10 years

[8] All vehicles projected for retirement prior to 2027 have daily mileage requirements that exceed current EV model ranges, therefore recommended EV replacements and emission reductions don't begin until 2027.

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 14-50% 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 7-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.