Fleet Organization Long Name
Fleet Electrification Assessment

February 3, 2022

ICF on behalf of SRP Fleet Electrification Program

Table of Contents

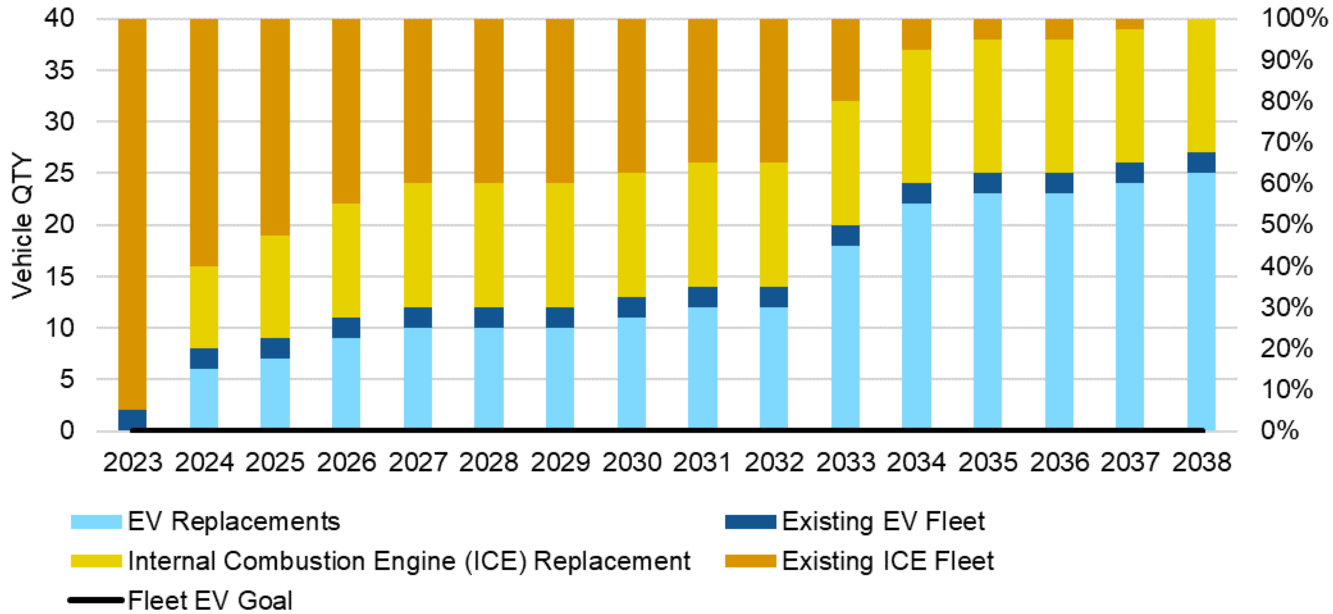
Executive Summary

The SRP Fleet Electrification Program provides fleet electrification recommendations and objective guidance from our team of electric vehicle (EV) experts. We are here to help you, Example Fleet Name Long (Example Fleet Name), understand the impacts of shifting your fleet to EVs and support you every step of the way. 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 2024 to 2038, which accounts for a maximum vehicle life of 15 years based on assumptions used in the model. However, the fleet total cost of ownership (TCO) analysis extends to 2052 to account for the ongoing fuel and maintenance costs from the vehicles acquired in 2038. We assessed the economic feasibility of 47 vehicles in the Example Fleet Name's fleet including 40 on-road vehicles and 7 non-road vehicles.[1] We identified 39 on-road vehicles that have EV options available and 25 of those that would be beneficial to convert over the next 15 years. Chart A illustrates the phasing in of these electric vehicles as you replace your existing fleet vehicles. These 25 vehicles would result in a net present value (NPV) TCO savings of $498,980 over the next 29 years, which accounts for the savings across the vehicles' full lifespans.

[1] [1] There are 7 non-road vehicles included in the total vehicle counts that 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 A. Recommended EV Replacement Timeline: Fuel Types



The report also details the analysis assumptions, specific vehicle recommendations, financial and environmental impacts, and next steps. Your Fleet Electrification Program Account Manager (Zach Heninger) will continue to check in with you and provide one-on-one support for the length of the program as you navigate fleet electrification. Please review this report and reach out to your Account Manager at srpetechrebates@icf.com with any questions or to discuss next steps.

Based on our analysis, converting 26 on-road vehicles to EVs is estimated to produce the following impacts:

$2,125,146
TCO savings over 29 years*

$1,094,231
fuel cost savings over 29 years*

$42,975
maintenance savings over 29 years*

5,514
metric tons (MT) of CO_2 eliminated over 29 years

Over 29 years, those estimated CO_2 reductions equate to:

eliminating **634** homes' energy use for one year, or:

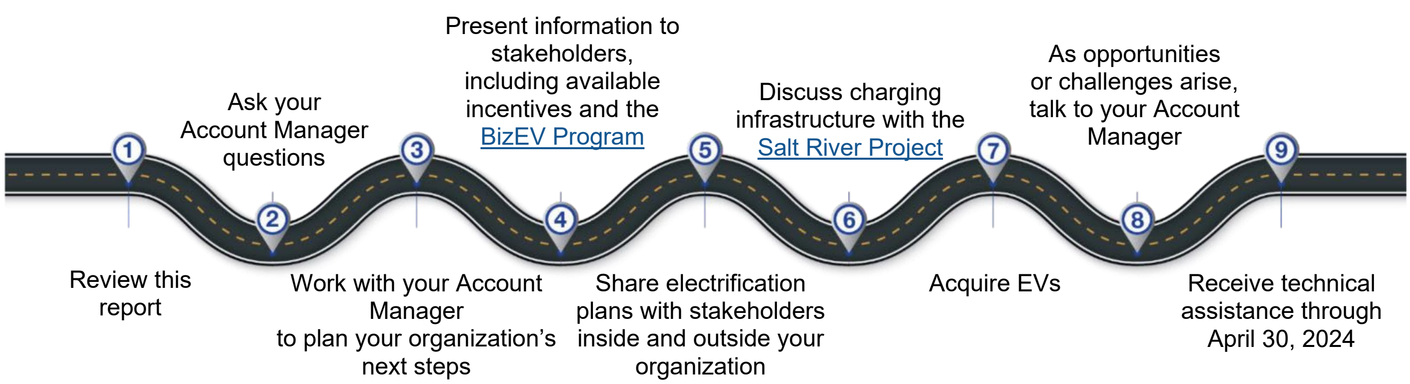
switching **209,541** incandescent lamps to LEDs, or:

recycling **1,875** tons of waste instead of landfilling it, or:

planting **90,985** trees.

* NPV assumes a 5.00% discount rate

Your Roadmap to Fleet Electrification



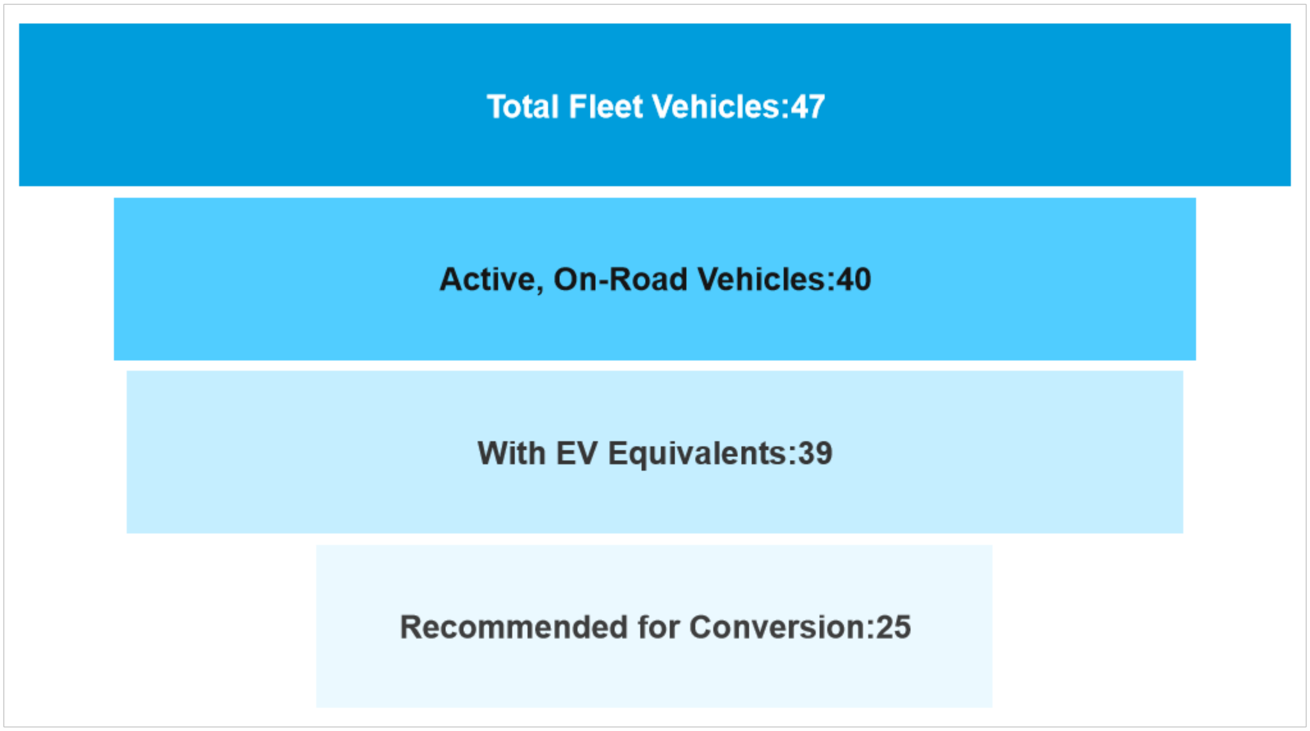
Project Information

On August 01, 2023, representatives from Example Fleet Name, including John, Fleet Manager, Sally, Finance Manager, and Jane, Sustainability Director, met with the Account Manager, Zach Heninger, and other program staff for an initial intake call. The discussion covered topics including an overview of the Fleet Assessment Program, fleet data availability, fleet usage characteristics, and the fleet's motivation for exploring EV options. A key takeaway of the intake call was the use of state purchasing contracts for all vehicle purchases..

Example Fleet Name provided an initial fleet dataset on September 01, 2023. The Account Manager provided follow up questions on October 01, 2023, and the fleet responded on November 01, 2023. Example Fleet Name's fleet dataset was used to establish a fleet baseline in the model.

There are 47 vehicles in the Example Fleet Name's current fleet, 40 on-road vehicles and 7 pieces of non-road equipment. Of the 40 on-road vehicles, 39 have EV equivalents commercially available, and 25 would be cost beneficial to convert to EVs at this time. This breakdown is illustrated in Chart B. 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 40 on-road vehicles in Example Fleet Name's current fleet, all of which are gasoline- and diesel-powered as shown in Table A. About half of the fleet is made up of medium- and heavy-duty vehicles which is illustrated in Chart C below. Almost a quarter of the sedans and SUVs are police vehicles. Police vehicles are assessed separately due to their significantly different duty cycles and applications. The estimated retirement schedule for the existing fleet is represented in Chart D. This schedule informs the recommended EV replacement schedule, which is shown later in Chart G.

TABLE A. Existing Fleet Fuel Type Distribution

Vehicle Type	Gasoline	Diesel	PHEV	BEV
Sedan	4	3	1	0
SUV	1	5	0	1
Minivan	2	0	0	0
Light-Duty Pickup	1	0	0	0
Medium-Duty Pickup	0	1	0	0
Van	0	2	0	0
Step Van	0	1	0	0
Medium-Duty Vocational Truck	0	1	0	0
Box Truck	0	2	0	0
Street Sweeper	0	1	0	0
Refuse Truck	0	1	0	0
Shuttle Bus	0	1	0	0
Transit Bus	0	2	0	0
School Bus	0	3	0	0
Bucket Truck	0	1	0	0
Heavy Truck	0	3	0	0
Motorcycle	2	0	0	0
Other	0	1	0	0
TOTAL	10	28	1	1

CHART C. Existing Fleet - Vehicle Types

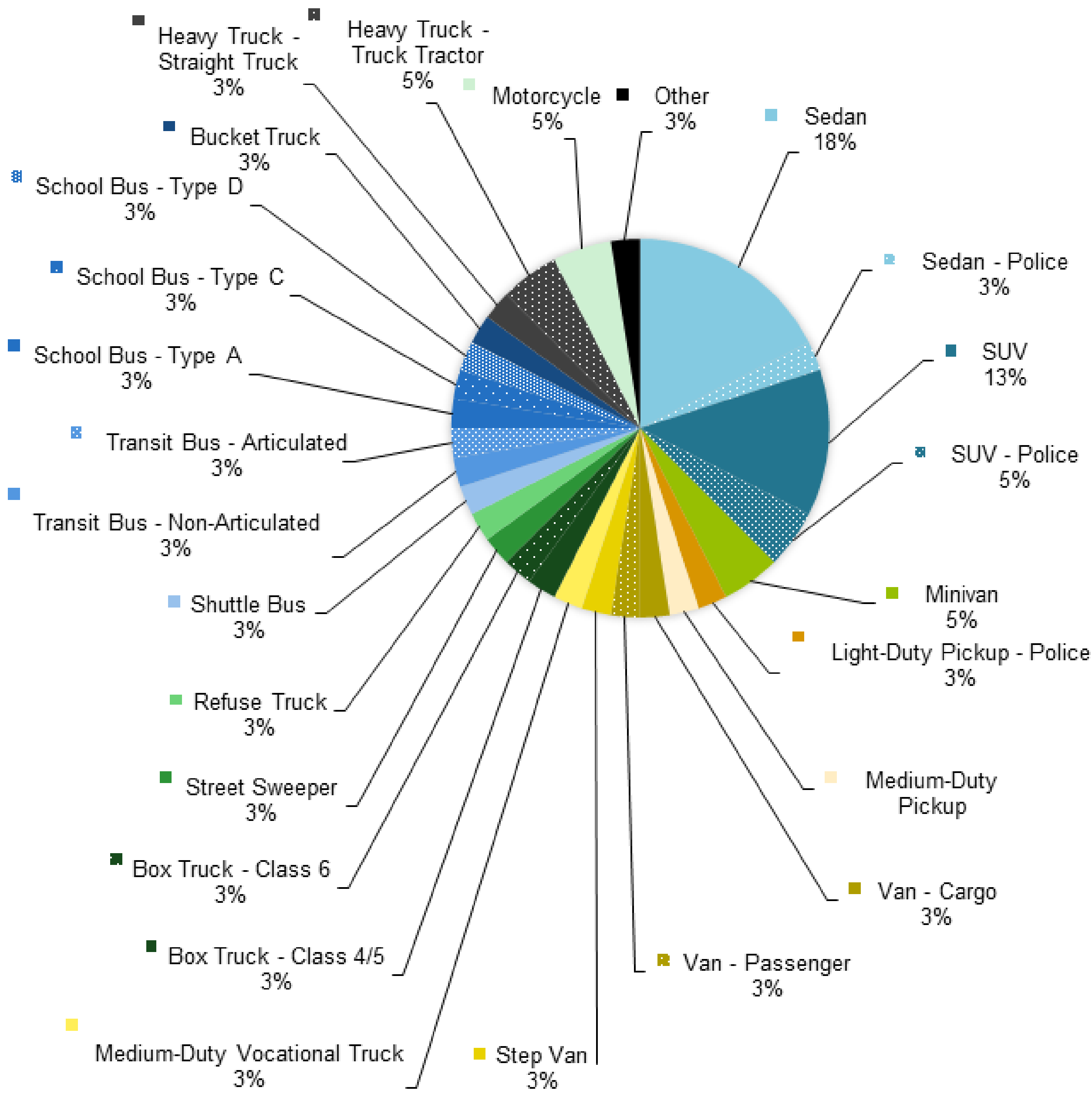
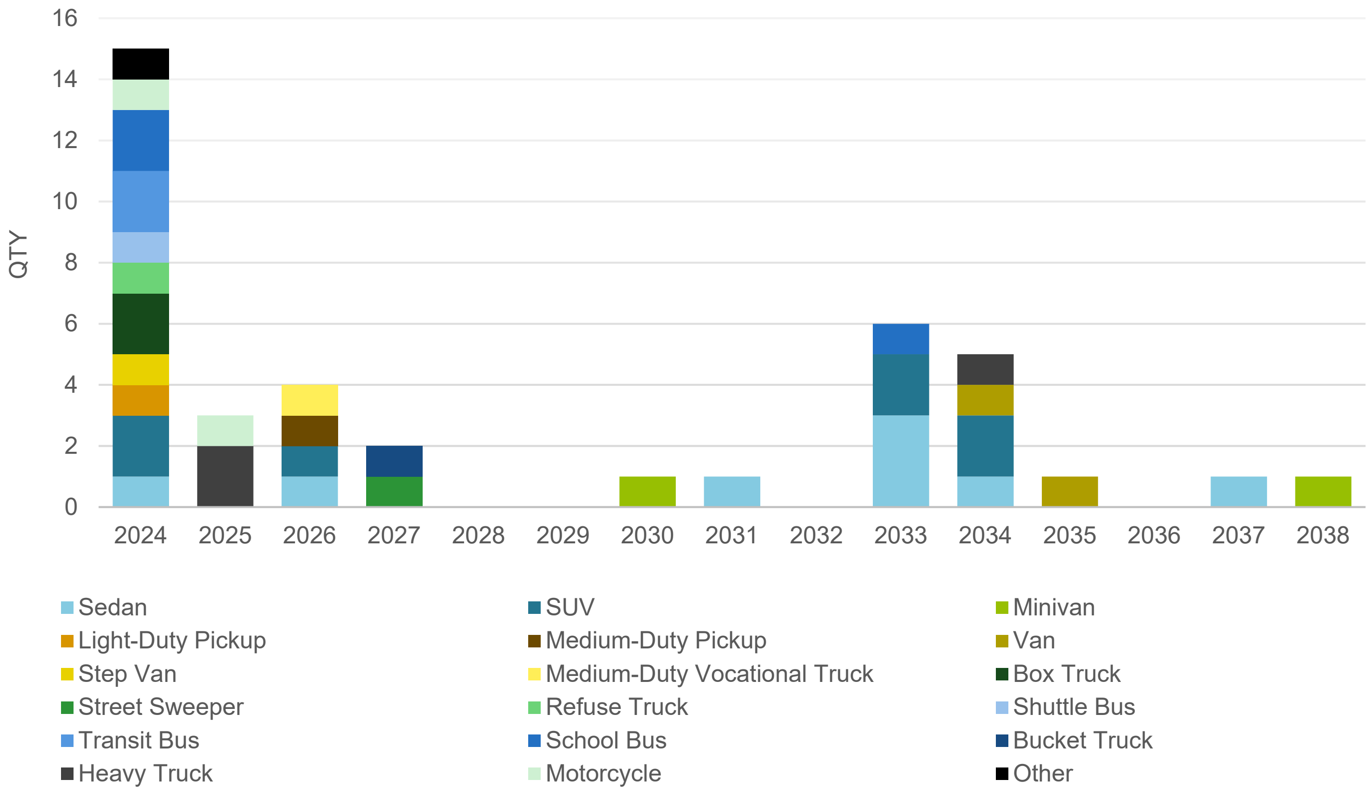


CHART D. Existing Fleet - Retirement Schedule



The 1 vehicle identified as "Other" and 7 pieces of non-road equipment are summarized in Table B below and were exluded from this analysis and the Electric Vehicle Acquisition Recommendations section of this report, for one of two reasons (see the Non-Road Equipment Section for more information). Additionally, 2 vehicles were identified as having already been electrified and were thus excluded from the anlysis. Follow-up report refreshes will be available as additional EV models become available.

TABLE B. Vehicle Types Excluded from Analysis

Vehicle Type	Quantity	Reason for Exclusion
Non-Road Equipment	7	Non-road equipment (See Non-Road Equipment Section)
Fire Trucks	1	Vehicle outside bounds of this initial study
Sedans	1	PHEV (already converted)
SUVs	1	BEV (already converted)
TOTAL	10	

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. See Appendix A for an alternate analysis with a higher EV TCO threshold.
- **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* report for the California Electric Transportation Coalition (CalETC report). Vehicle pricing was escalated annually using the U.S. Energy Information Administration's (EIA) 2022 Annual Energy Outlook (AEO) and ICF's CaleETC report for the California Electric Transportation Coalition. The model assumed all vehicles are owned and not leased.
- **Fuel and Maintenance**: The model uses the U.S. EIA's average gasoline and diesel prices in Arizona for the past five years, which is $3.81 per gallon of diesel and $3.56 per gallon of gasoline. 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 the AFLEET Tool and ICF's CalETC report. The model also uses these sources to estimate average per mile maintenance costs based on vehicle and fuel type. Maintenance costs were escalated 2.20% annually.
- **Electricity Pricing**: The model uses $0.10/kWh base rate, escalated annually using projections from the U.S. EIA's 2022 AEO Reference Case for Transportation: Electricity.
- **Vehicle Replacements**: The Example Fleet Name's capital improvement plan identified the vehicles for replacement in 2021 and 2022. For all other years, the model uses the vehicle lifespan assumptions by vehicle type in AFLEET to estimate the vehicle retirement schedule. The vehicle lifespan was added to the model year to determine the replacement year, with the minimum being 2023.
- **Timeframe**: This analysis focuses on vehicle replacements for 2024 through 2038, with TCO calculations extending out across the vehicle lifespans to 2052.
- **Discount Rate**: 5.00% 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 37.44 to 91.66°F to assess the potential impact temperatures can have on EV ranges; this reduced EV model ranges to 88% of their maximum mileage range. For Example Fleet Name's current vehicles, the model uses AFLEET assumptions by vehicle type to estimate the range required each day; this varies from 50 to 150 miles per day depending on the vehicle type.

- **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 40 Example Fleet Name on-road vehicles scheduled for retirement between 2024 and 2038, and 25 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 TCO for the 25 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. Based on these estimates, you may see financial payback as early as 2031. 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

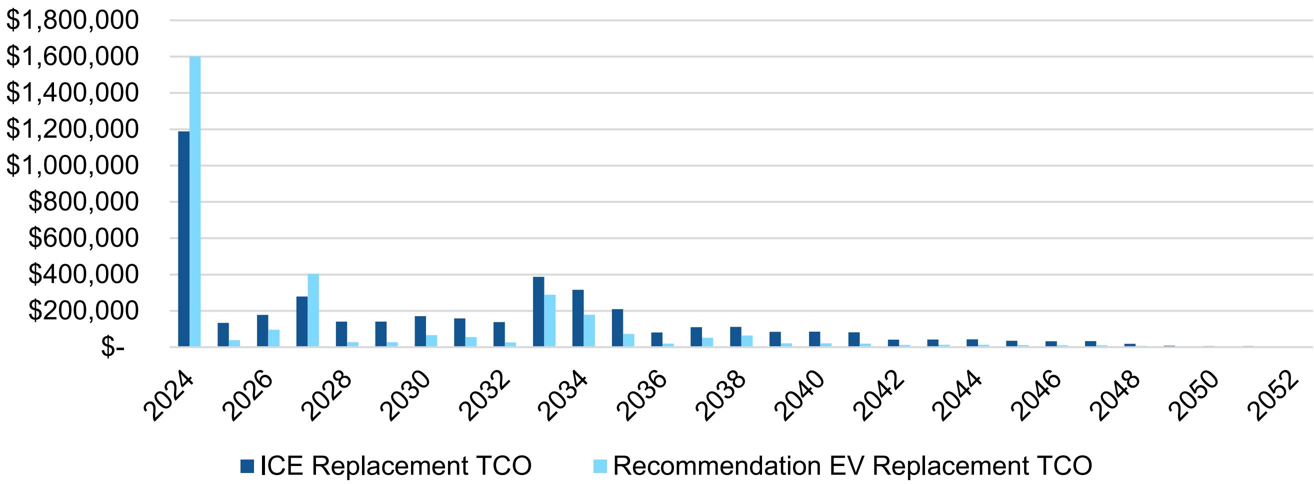


CHART F. Fleet Recommended Replacements TCO Comparison - Cumulative

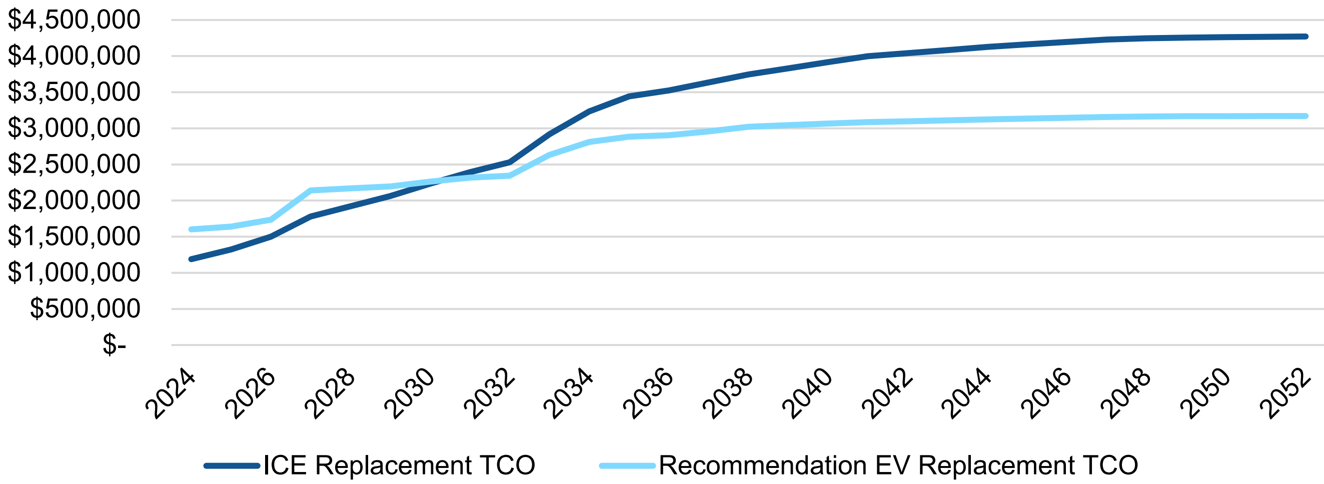


Table C on the next page identifies the vehicles that will be cost effective to convert to electric within the next 15 years. Chart G illustrates the recommended replacement timeline for these vehicles. Each vehicle within your fleet has been assessed to identify the lowest cost option, while also accounting 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 14 vehicles with EV equivalents that are not recommended for conversion, either due to already being an EV (exisiting 1 PHEV and 1 BEV), the currently available EV model mileage ranges being too low, or the TCO for the ICE vehicle being lower than any of the EV options' TCO. Future EV model options or incentive program availability may open opportunities for these to be converted; this will also be considered in future report updates.

Currently, only five EV models are being used as police patrol vehicles in a handful of police fleets in the United States, three of which are sedans and two that are SUVs. These models have been considered in Example Fleet Name's fleet analysis. Additionally, the Hyundai Kona Electric SUV is being piloted by some police fleets in Europe, and will be included in future analyses if deemed suitable for Example Fleet Name's police fleet.

Additionally, electric emergency vehicles, such as fire trucks and ambulances, are currently in the development and testing phases. Pierce Manufacturing delivered its first plug-in hybrid electric fire truck to the Madison Fire Department in Madison, WI, for testing in June 2021, and Rosenbauer is developing an extended range plug-in hybrid electric fire truck, which the Los Angeles Fire Department (LAFD) will receive later this year. Lightning eMotors and REV Group Inc. expect to deliver their first electric ambulance by the end of this year. These models will be included in future analyses if deemed suitable for Example Fleet Name's fleet.

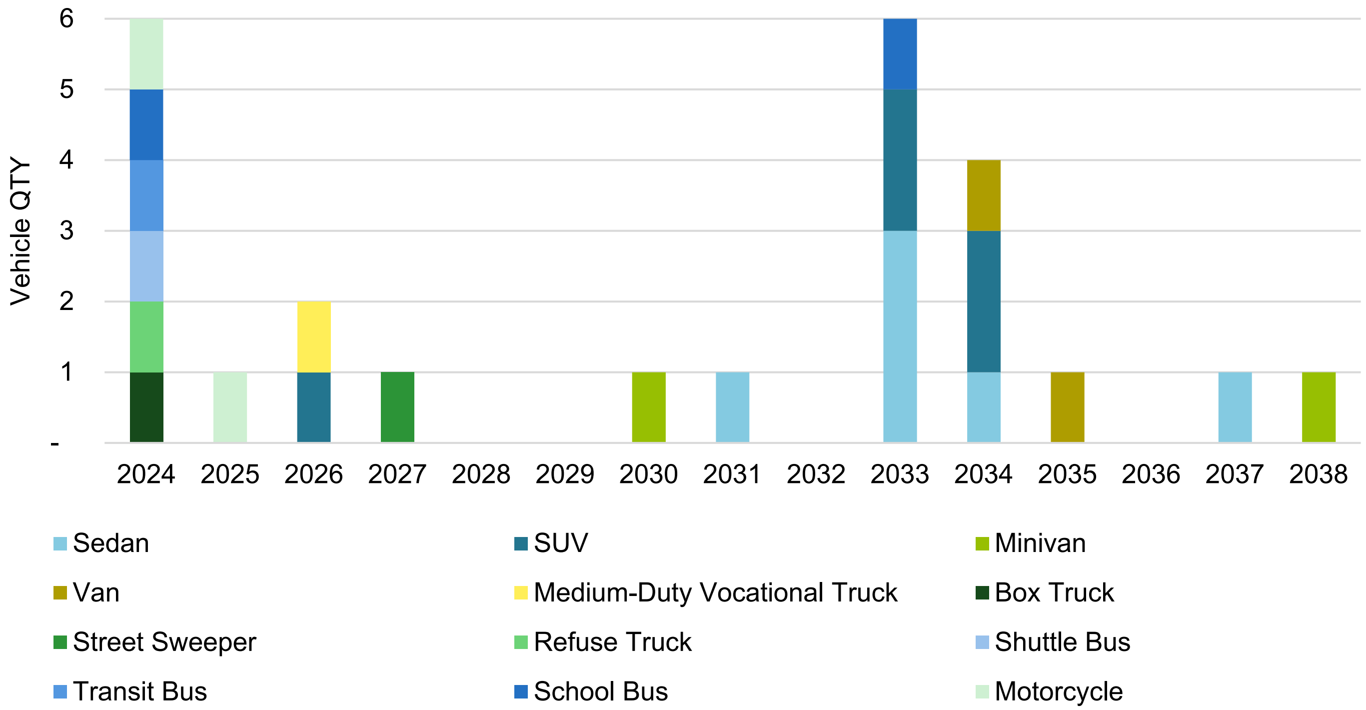
TABLE C. 15-Year Electrification Recommendations

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
Sedan	8	6	Nissan/ Leaf S/ BEV	$57,600	210	6	0
SUV	7	5	Chevrolet/ Equinox EV 1LT/ BEV	$63,927	264	5	0
Minivan	2	2	Canoo/ Lifestyle Delivery Vehicle/ BEV	$14,908	136	2	0
Light-Duty Pickup	1	0	N/A	N/A	N/A	N/A	N/A

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
Medium-Duty Pickup	1	0	N/A	N/A	N/A	N/A	N/A
Van	2	1	Maxwell Vehicles/ ePro LR Passenger Van/ BEV	$6,409	186	1	0
		1	Maxwell Vehicles/ ePro SR Cargo Van/ BEV	$1,919	243	1	0
Step Van	1	0	N/A	N/A	N/A	N/A	N/A
Medium-Duty Vocational Truck	1	1	ZEVx/ Ford F-450 (Chassis Cab)/ BEV	$7,948	166	1	0
Box Truck	2	1	SEA Electric/ SEA Hino M5 Box/ BEV	$16,380	180	1	0
Street Sweeper	1	1	Dulevo/ D.zero2 Plus/ BEV	$95,513	1,665	0	1
Refuse Truck	1	1	Lion Electric/ Lion 6 – SR – Refuse/ BEV	$48,100	1,649	0	1
Shuttle Bus	1	1	GreenPower Motor Company/ EV Star All-Electric Min-eBus/ BEV	$17,123	330	1	0
Transit Bus	2	1	GreenPower Motor Company/ EV250 All-Electric Transit Bus/ BEV	$77,526	797	0	1
School Bus	3	1	ZEVx/ Chevrolet Express 3500 (School Bus)/ BEV	$14,380	123	1	0
		1	Starcraft/ E-Quest XL (Paratransit)/ BEV	$23,516	139	1	0
Bucket Truck	1	0	N/A	N/A	N/A	N/A	N/A
Heavy Trucks	3	0	N/A	N/A	N/A	N/A	N/A
Motorcycle	2	2	Zero Motorcycles/ Zero FX ZF7.2/ BEV	$53,731	101	2	0
Other	1	0	N/A	N/A	N/A	N/A	N/A
TOTAL	**40**	**25**		**$498,980**	**6,189**	**22**	**3**

Of the three school buses in Example Fleet Name’s fleet, one was excluded from the electrification recommendations because the analysis determined it was not cost effective to purchase at this time. However, other acquisition models, such as leases or subscription services, offer cost-effective alternatives to traditional school bus ownership. For example, Highland Electric Fleets offers a mileage-based electric school bus subscription service that includes the necessary buses, charging infrastructure, and training for technicians and operators. Highland also plans to leverage their electric buses to support the grid through vehicle-to-grid (V2G) charging, earn supplemental income, and lower the price of their service. Example Fleet Name may want to consider leases and subscription services that could enable the town to avoid the high upfront costs of electric school buses while capturing significant emissions benefits.

CHART G. Recommended EV Replacement Timeline: Vehicle Types



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 Nissan LEAF PLUS can add about 150 miles per 30 minutes charging. A transit bus or heavy truck will be able to add 60-125 miles for every 30 minutes spent charging, depending on the capacity of the DC Fast charger.

Some EVs may have limited battery acceptance rates due to the capacity of their onboard chargers. If the EVSE is capable of delivering more power than the maximum acceptance rate of a vehicle's onboard charger, the car's charge rate will be limited to the maximum acceptance rate of the onboard charger. Charging an EV with a charger that has a higher kW rating than the onboard charger capacity will not damage the EV or the EVSE. In fact, purchasing a high-output charger helps future-proof EVSE investments so they are useful for years to come.

EV Charging Infrastructure Assumptions in Your Analysis

During Example Fleet Name's intake call, it was indicated that there are private (fleet) chargers located at the Example Fleet Name headquarters. It was also indicated that there are 2 public EV chargers at the Example Fleet Name's Parking Garage. The following EVSE recommendations do not account for the fleet's existing chargers.

Example Fleet Name will need a maximum of 3 DCFC and 22 Level 2 chargers to support the recommended 25 EVs. This conservatively assumes a one-to-one charger-to-vehicle ratio and does not account for any existing chargers at Example Fleet Name's fleet facilities. The determination of charger type (Level 2 versus DC Fast) and charger kW range is made based on battery size, range, mileage, number of shifts per day, and time charge between shifts and at night. Your Account Manager can also provide helpful resources on charging best practices.

Depending on the scheduled duty cycles of the vehicles, it may be possible to reduce the number of chargers by:

- Manipulating the duty cycles of the vehicles to allow for successive (non-overlapping) charging schedules;
- Identifying managed charging solutions to optimize charger use; and
- Garaging EVs together to allow for shared chargers.
- Leveraging publicly available EVSE, where appropriate
- Make use of opportunity charging when vehicles are stationary, but still in-use

While some fleets may require 1 or fewer chargers-per-vehicle, Example Fleet Name may want to consider purchasing additional vehicle chargers to maximize service reliability. The installation of additional EVSE at vehicle depots allows for greater room for error by engineering redundancy into fleet operations. Depending on the length of typical service routes, Example Fleet Name may also want to consider opportunity charging using on-route chargers. On-route chargers improve range, uptime, and service reliability by eliminating the need to return to a charging depot during the day and reducing total overnight charge time. The Utah Transit Authority (UTA) recently contracted with GILLIG to deploy 4 high-power on-route chargers that will service 44 electric transit buses.

The charger equipment and installation cost assumptions used for your analysis are highlighted in Table D:

TABLE D. Charger Equipment Cost Assumptions

Charging Level	Nameplate Demand (kW) Range	Hardware Cost	Installation Cost	Total
L2	3-6 kW	$2,500	$3,500	$6,000
L2	6-8 kW	$3,000	$3,500	$6,500
L2	8-11 kW	$3,500	$3,500	$7,000
L2	12-15 kW	$4,000	$3,500	$7,500
L2	15-19 kW	$4,500	$3,500	$8,000
DCFC	50 kW	$35,800	$28,100	$63,900
DCFC	150 kW	$100,000	$42,200	$142,200
DCFC	350 kW	$150,000	$61,600	$211,600

Note that these are estimates and do not consider any incentives (see below for more information). The model assumes that EVSE is networked but does not consider networking and data fees or other long-term expenses.

It may be possible to reduce the cost of EVSE hardware and installation, by:

- Mounting EVSE on the wall, rather than on a pedestal, to simplify the installation process;
- Purchasing multiple EVSE at once to capture volume discounts;

- Installing multiple EVSE at the same location to spread fixed electricity upgrade, EVSE installation, and maintenance costs across more chargers;
- Installing infrastructure with excess capacity to future-proof charging sites;
- Installing chargers during new construction to reduce design and installation costs; and
- Taking advantage of Salt River Project's Business EV Charger Rebate Program, which offers incentives for L2 and DCFC EVSE. Refer to Table F for more information about EVSE incentives and grant funding.

We strongly encourage Example Fleet Name to reach out to Salt River Project before installing any new charging infrastructure. Your Account Manager can also answer questions on charging best practices.

Site Assessment

Example Fleet Name will need a maximum of 3 DCFC and 22 Level 2 chargers to support the recommended 25 EVs. This will result in an estimated incremental 280 kW total power demand and 422,038 annual kWh across the 3 Example Fleet Name 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)	Estimated Total Nameplate Demand (kW)
Main Office	5	0	56	76
Office B	14	0	49	86
Park 1	3	3	175	383
TOTAL	**22**	**3**	**280**	**545**

We strongly encourage Example Fleet Name to reach out to Salt River Project before installing any new charging infrastructure. Your Account Manager can also answer questions on charging best practices.

Charging Options for Take Home Vehicles

There are # vehicles in Example Fleet Name's fleet that have been identified as take-home vehicles. Enabling take-home EVs to charge at home reduces the need for additional trips, decreases reliance on public chargers, improves uptime, and lessens the need for infrastructure investment at fleet facilities. The easiest way to charge an EV at a residence is by plugging the vehicle into a 120V wall outlet using the Level 1 charger that was purchased with the vehicle. Level 2 chargers are also popular for home charging but rely on a 240V outlet and require the purchase and installation of Level 2 charging hardware.

If Example Fleet Name plans to reimburse employees for home charging, the cost of electricity used to charge the vehicle is easy to calculate. Vehicle telematic data that quantifies total energy usage is available through the vehicle manufacturer's smartphone application or the vehicle's dashboard. To calculate the cost of home charging, multiply the amount of energy used to charge the EV by the price of electricity.

Alternative Charger Procurement Options

During the CALL NAME call, Example Fleet Name expressed TAKEAWAY ABOUT BUDGET BARRIER. Example Fleet Name may want to consider alternative charger procurement options, such as Charging-as-a-Service (CaaS). CaaS programs reduce the up-front cost of EV adoption through turnkey EVSE solutions that can include EVSE hardware, software, maintenance, and support. CaaS shifts the capital risk away from the fleet by bundling up-front, operational, and energy costs into a fixed rate, resulting in predictable costs. CaaS also addresses operational concerns by providing ongoing support for EVSE maintenance and upgrades, resulting in reliable chargers that are ready to support current and future EVs. Commercially available CaaS programs are offered by Electrada, bp pulse, and ChargePoint.

During the CALL NAME call, Example Fleet Name expressed TAKEAWAY ABOUT IMMEDIATE/SHORT-TERM NEED FOR CHARGERS. Example Fleet Name may want to consider alternative short-term charging infrastructure solutions, such as containerized or mobile chargers. Containerized chargers are semi-portable charging solutions that can be rapidly deployed to meet short-term charging needs, such as during temporary building leases or while EVSE is under construction. For example, bp pulse's INRUSH charging system upcycles shipping containers to provide up to 10 charging stations in a portable capsule. Assembly occurs offsite and electrical components are stored inside the container making containerized charging solutions relatively affordable and easy to relocate.

Mobile charging is a portable charging solution that delivers high-speed charging to EVs, independent of the grid, when they are unable to charge at a base site or charging depot. Mobile chargers improve resiliency by adding a layer of protection against blackouts, brownouts, natural disasters. Portable chargers can potentially save money, time, and space because they do not require permanent hardware installation. Mobile chargers are ideal for on-demand off-site charging needs, such as construction and emergency response vehicles, or for temporary charging needs, such as short-term building leases. SparkCharge's Roadie is an example of a commercially available portable charger that provides flexible DC fast charging at any location using a compact modular battery stack.

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 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 and reach out to your Account Manager to discuss opportunities for your fleet.

Wireless Charging

Magnetic resonance chargers, also known as wireless chargers, are bi-directional EV chargers capable of transmitting electricity over wide air gaps and through solid barriers with the same level of energy efficiency as plug-in chargers, but without the plug. Wireless charging can improve uptime, service reliability, and accessibility by beginning an EV charging session as soon a vehicle is parked on top of the charging pad. Opportunity charging is an example of a wireless charging application. Opportunity charging occurs when vehicles are charged while they are stationary, but still in-use. For example, taxis and buses could take advantage of wireless opportunity charging while waiting in a queue to pick up passengers. Since 2018, the

Antelope Valley Transit Authority (AVTA) has deployed 12 wireless chargers to service 47 wireless-equipped 40-foot and 60-foot BYD transit buses. The AVTA plans to add an additional 28 BYD wireless-equipped transit buses to their fleet by the end of 2023.

Wireless chargers are still in the development and testing phases. Various vendors have products currently in real world validation, but experts estimate that they will not be widely available until the end of the decade. A barrier to wireless charging adoption is that most EVs are not currently manufactured with wireless charger compatibility. However, a handful of vehicle manufacturers have piloted wireless charging for their EVs, including Nissan, BMW, BYD, Hyundai, Genesis, and Volvo. While aftermarket wireless charging solutions exist, future vehicles will likely be equipped with wireless charging receivers from the factory to enable the most efficient wireless transmission of energy. For more information about wireless charging, refer to the National Renewable Energy Laboratory's wireless EV charging resource.

Electric Rate Analysis

The ICE and EV TCO comparison used Salt River Project's General Service 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 25 EVs at Example Fleet Name's sites. The rate analysis also compared this rate against Salt River Project's General Service 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

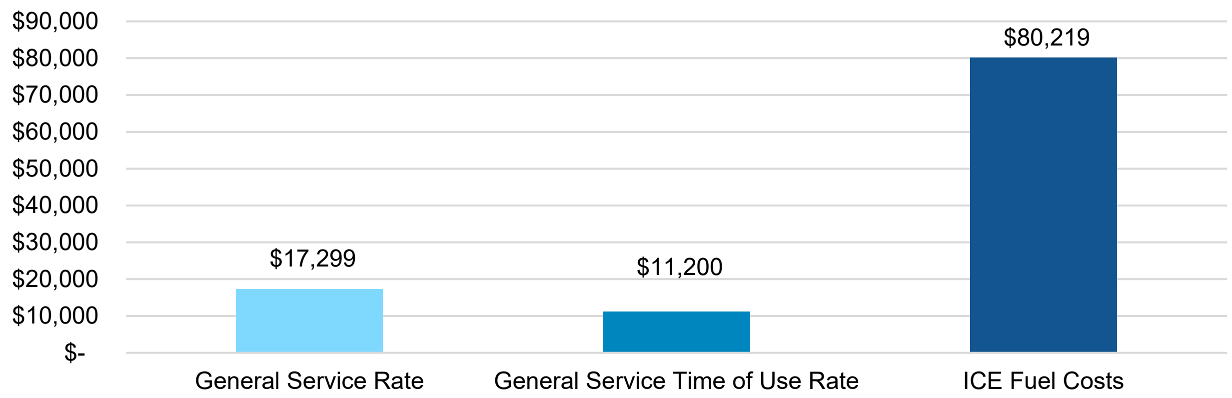
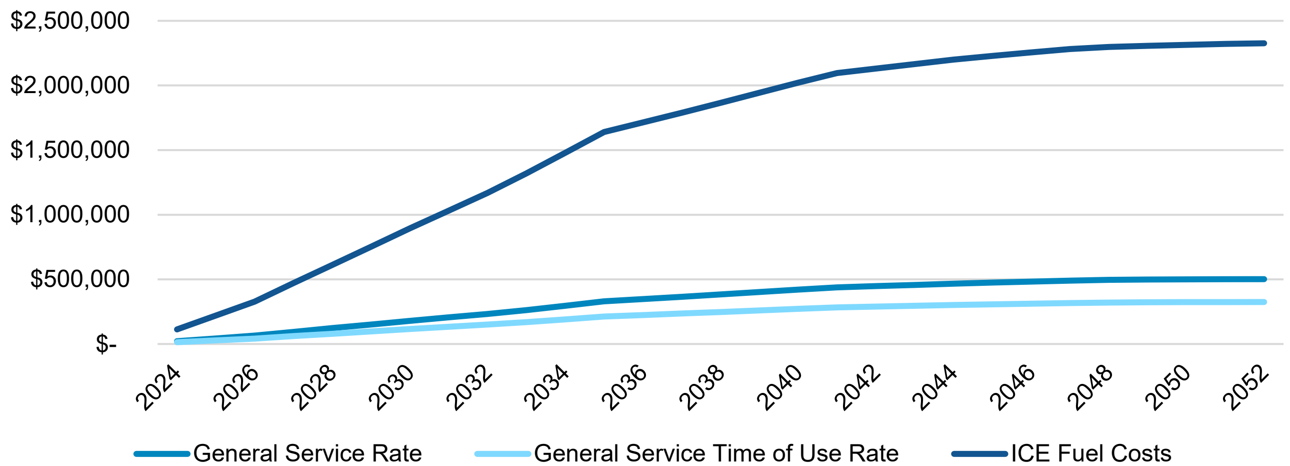


CHART I. Rate Analysis Fleet Cumulative Fuel Cost Comparison



Incentives and Funding Source Assumptions Applied

Incentives are available for the purchase of EVs and EVSE. Table 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.

Example Fleet Name may also want to reach out to their local planning agency to discuss Congestion Mitigation and Air Quality Improvement (CMAQ) and other funding opportunities. The local transportation planning agencies may be able to assist cities and transit agencies with grants that reduce emissions.

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
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[2]	45% of capital costs with 7,000+ annual miles
Clean School Bus Rebate Program[3]			✓	EPA	✓	✓	✓	Up to $190,000 (prioritized: $285,000) vehicle funding per replaced school bus used to transport preprimary, primary, and secondary school students. Up to $13,000 (prioritized: $20,000) infrastructure funding per replaced bus.	Funding projected to open annually through 2026.	Up to $285,000 vehicle funding and $20,000 infrastructure funding per replaced school bus
Clean School Bus Grant Program[4]			✓	EPA	✓	✓	✓	Up to $195,000 (prioritized: $315,000) vehicle and infrastructure funding per replaced school bus. School District Sub-Program: Minimum of 15, Maximum of 50 vehicles	Application open until 8/22/2023	Up to $315,000 vehicle and infrastructure funding per replaced school bus
Commercial Electric Vehicle (EV) and Fuel	✓[5]	✓	✓	IRS	✓			Tax credit amount is equal to the lesser of the following amounts:	2032	Tax credit between 15%-30% dependent upon PHEV, BEV, or

[2] While the initial program was open until 3/16/2021, the Consolidated Appropriations Act passed on 12/22/2020 included reauthorization of the DERA Program through 2024.
[3] Hopkins's vehicles were assessed for the Clean School Bus Rebate, as a future Notice of Funding Opportunity (NOFO) iteration will arise later in 2023.
[4] The 2023 Clean School Bus Grant NOFO was recently announced. Watch the Webinar from May 10th to learn more.
[5] Vehicles with a gross vehicle weight rating (GVWR) below 14,000 pounds (lbs.) must have a battery capacity of at least seven kilowatt-hours (kWh) and vehicles with a GVWR above 14,000 lbs. must have a battery capacity of at least 15 kWh.

Program	Light Duty	Medium Duty	Heavy Duty	Administrator	Vehicle Costs	EVSE Installation	EVSE Hardware	Program Offerings	Upcoming Deadlines	TCO Funding Assumptions
Cell Electric Vehicle (FCEV) Tax Credit								15% (PHEV) or 30% (BEV/FCEV) of the vehicle purchase price; Incremental vehicle cost compared to equivalent internal combustion engine vehicle		FCEV or incremental cost
Low or No Emission Vehicle Program			✓	FTA	✓	✓	✓	85% funding for purchase or lease of zero-emission and low-emission transit buses & acquisition of required supporting facilities.[6]	FY2023: TBA Funded until: 9/30/25	85% of capital costs and installation costs
SRP Business EV Charger Rebate				SRP		✓	✓	$1,500 per networked L2 EV charging port. $4,000 per port for government, non-profit, and school customers. Limit 75 ports per customer per year.	Applications for FY23 due 7/31/2023; funding extends through 2025.	$4,000 per L2 charger through 2025, capped at 75 ports per year.

Tax Credits for Electric Vehicles and Charging Equipment

In addition to the incentives listed in Table E, there may be tax credits available to Example Fleet Name not included in the model. The Clean Vehicle Credit, formerly known as the Qualified Plug-In Electric Vehicle (PEV) Tax Credit, offers a tax credit for the purchase of a new qualified EVs, including passenger vehicles and light-duty trucks. After December 31, 2022, newly purchased EVs and FCEVs are eligible for a tax credit ranging from $3,750 to $7,500 dependent on meeting requirements for critical mineral extraction, processing, and recycling and battery component manufacturing and assembly. The credit begins to phase out after a manufacturer reaches 200,000 qualified PEVs sold.

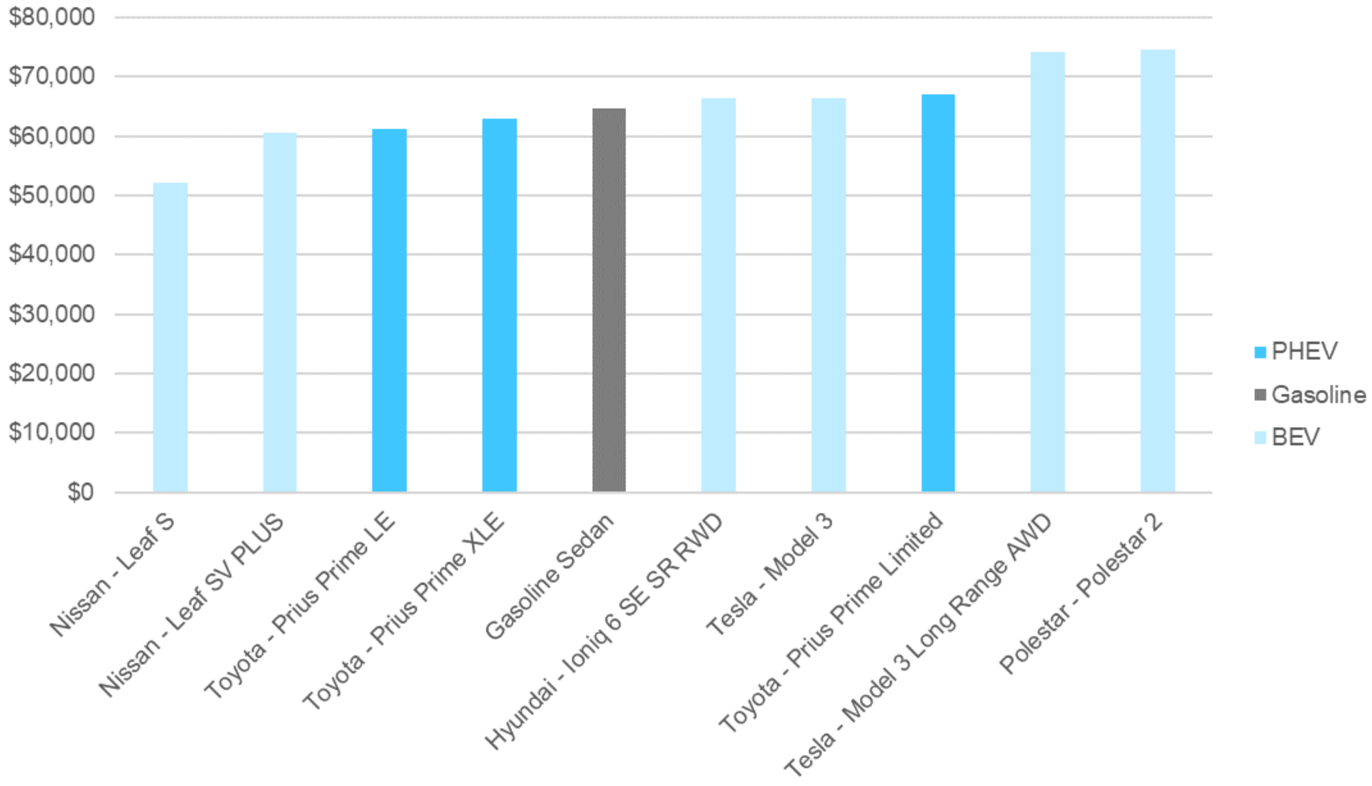
Another tax credit that may be relevant for Example Fleet Name's fleet is the Alternative Fuel Infrastructure Tax Credit. Fueling equipment for natural gas, propane, liquefied hydrogen, electricity, E85, or diesel fuel blends containing a minimum of 20% biodiesel is eligible for a tax credit of 30% of the cost, not to exceed $100,000. The credit attributable to depreciable property (refueling property used for business purposes) is treated as a general business credit. This tax credit will be available in January 2023 and continues until 2032. Eligible equipment must also be installed in locations that meet specific census requirements. Contact Salt River Project for additional information and assistance with tax credit resources and materials.

[6] Applicants may be eligible for grants up to 90% of project costs for fleet and charging facilities. Due to the competitive nature of the funding, this assessment applies a conservative 85% funding match. Applications require the submission of a Zero-Emission Transition plan. For projects focused on improving the age and condition of a fixed-route fleet, consider the Grants for Buses and Bus Facilities program.

EV Model Comparison

There are over 600 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 AH highlight the lowest TCOs for each vehicle type within your fleet. This analysis is for 1 vehicle for each vehicle type, uses the Example Fleet Name's average annual mileage and miles driven per day by vehicle type, and assumes a XX year vehicle life. 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. Sedan EV Model TCO Comparison



Fleet advisory services provided by ICF

CHART K. Police Sedan EV Model TCO Comparison

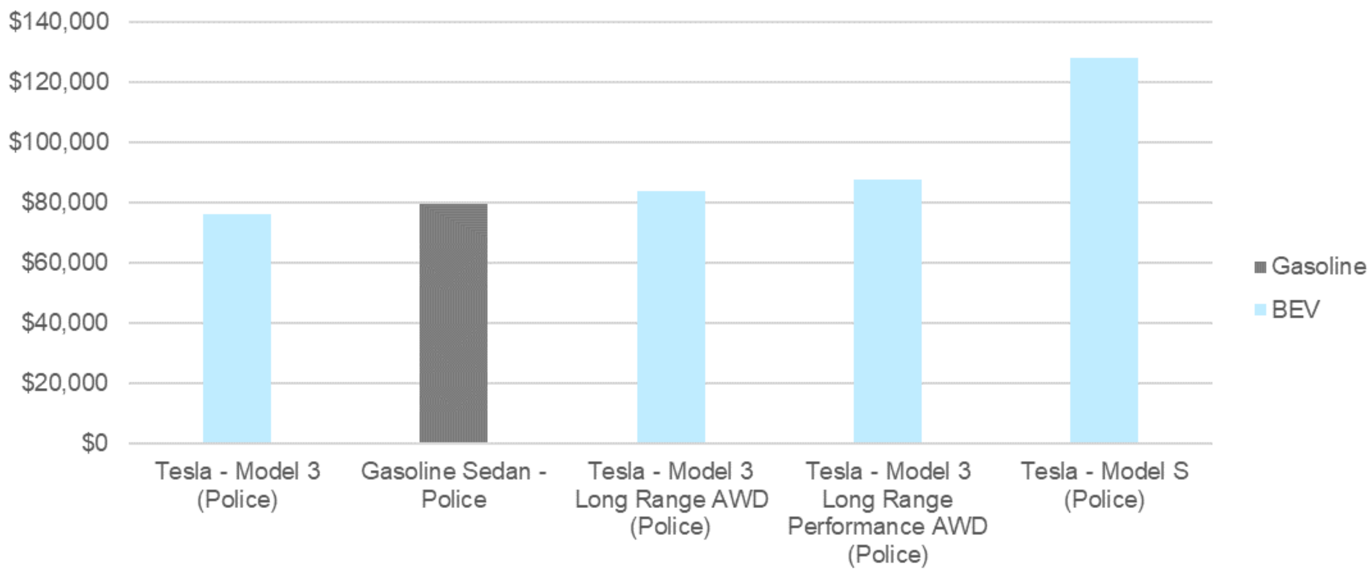
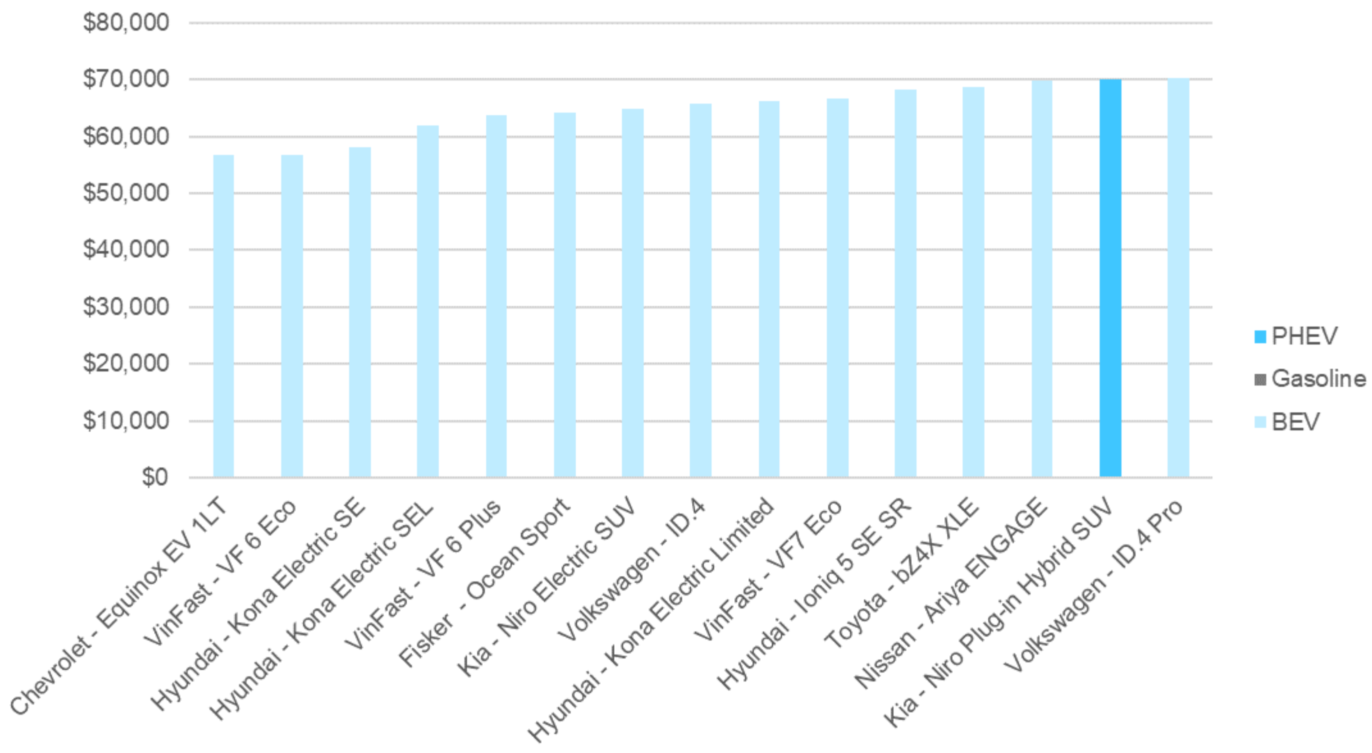


CHART L. SUV EV Model TCO Comparison[7]



[7] The TCO of a Gasoline SUV is $89,885.

CHART M. Police SUV EV Model TCO Comparison

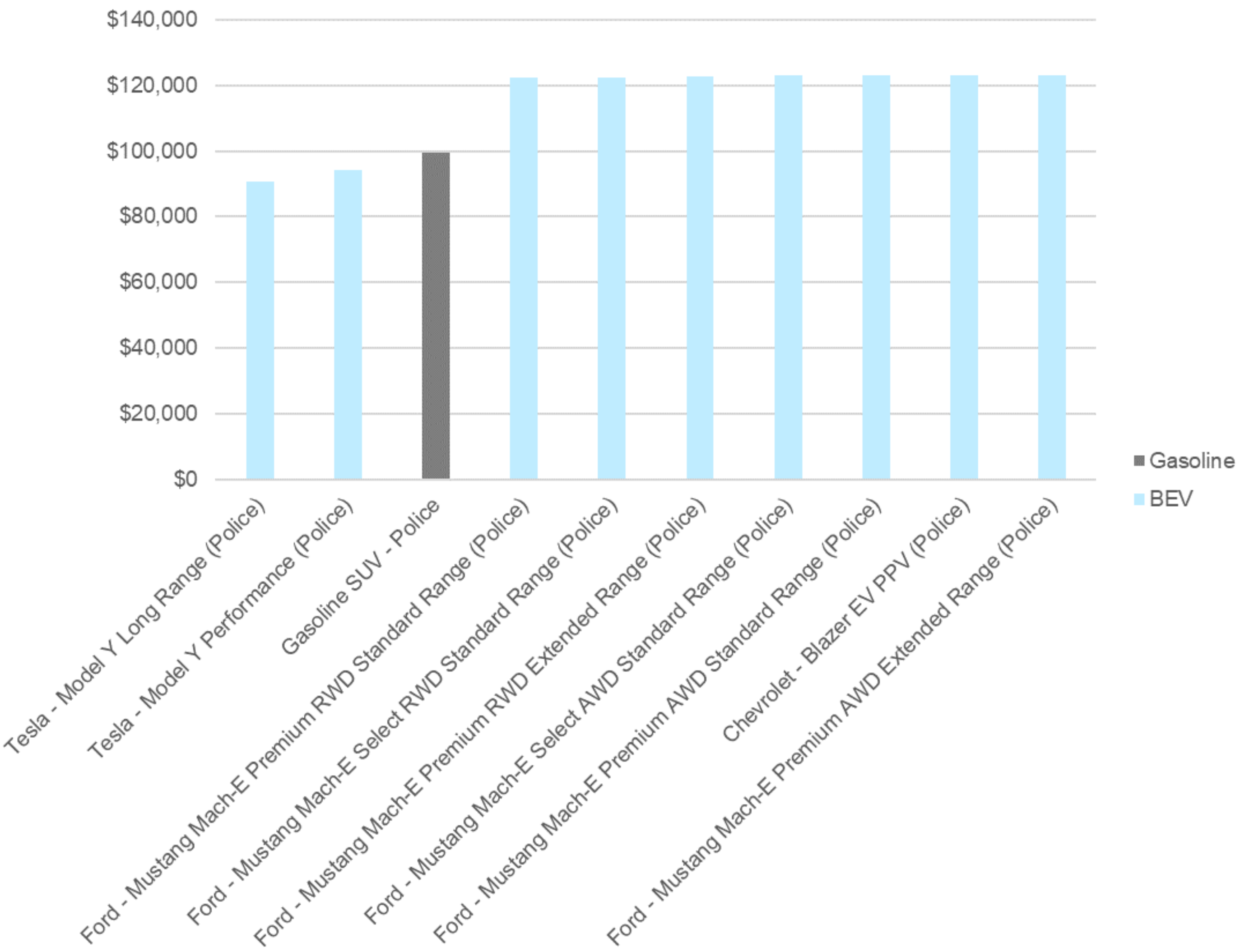


CHART N. Minivan EV Model TCO Comparison

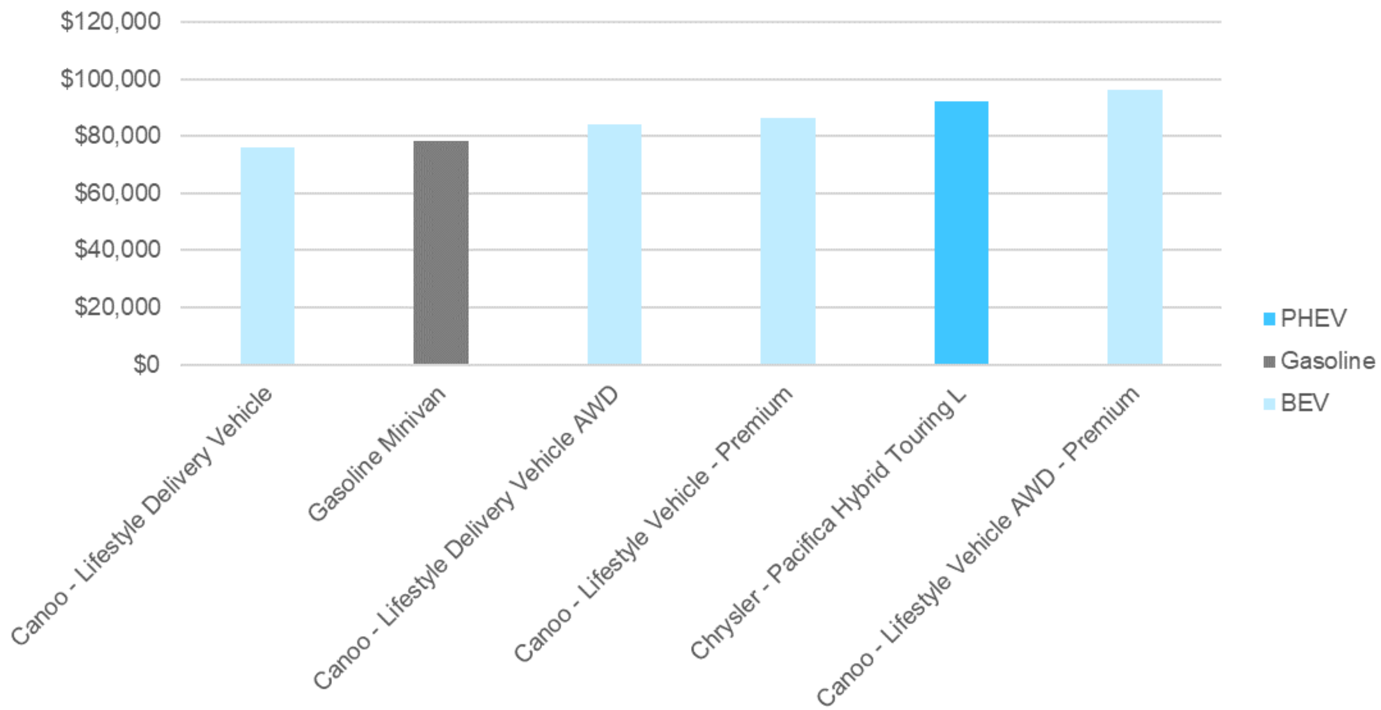


CHART O. Police Light-Duty Pickup EV Model TCO Comparison

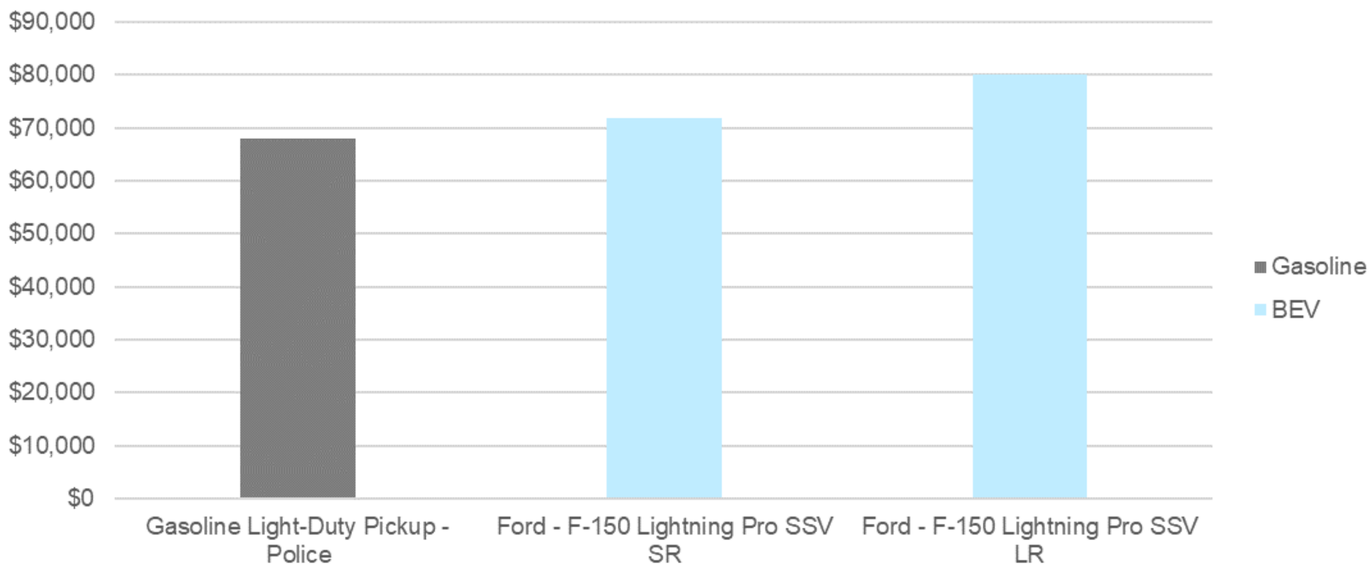


CHART P. Medium-Duty Pickup EV Model TCO Comparison

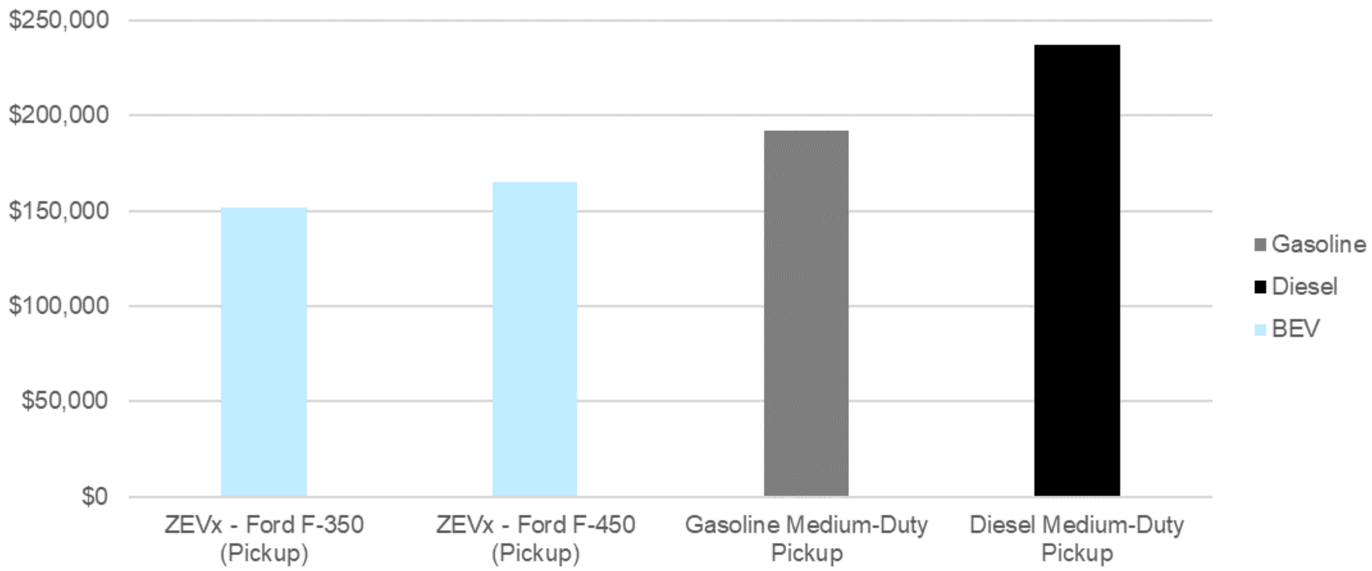


CHART Q. Passenger Van EV Model TCO Comparison

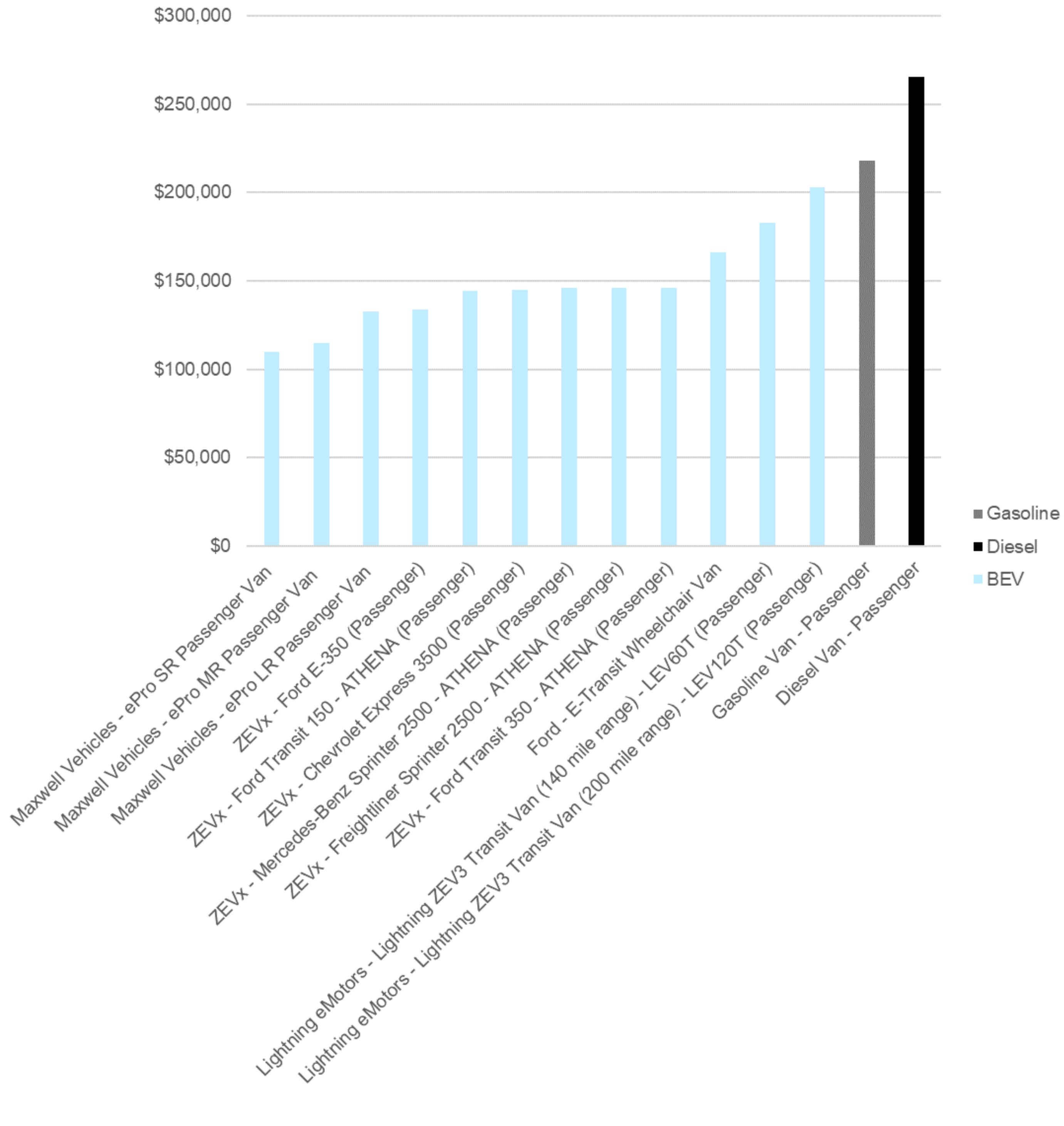
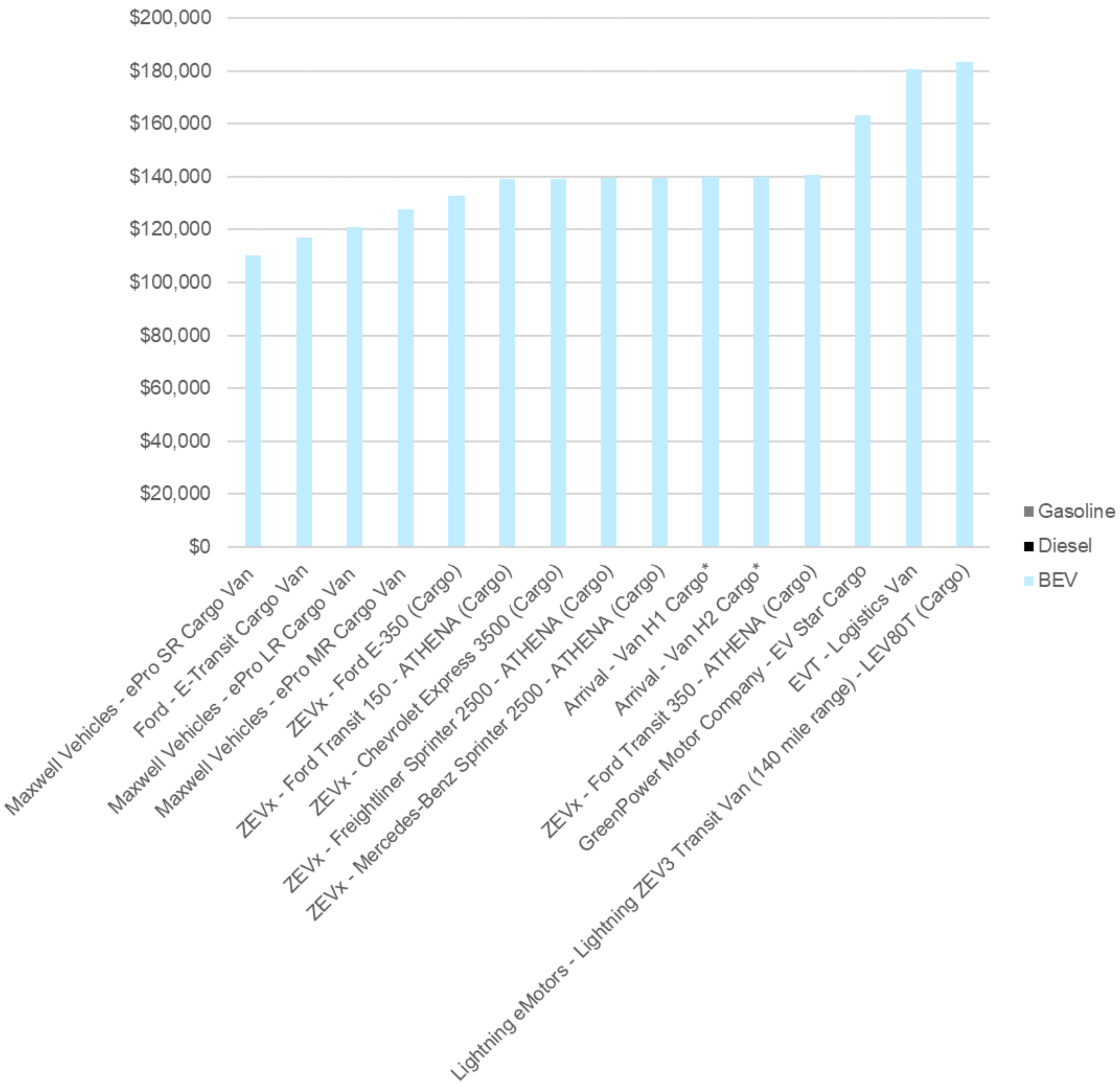


CHART R. Cargo Van EV Model TCO Comparison[8]



[8] The TCO of a Gasoline Cargo Van is $272,800 and the TCO of a Diesel Cargo Van is $310,351.

CHART S. Step Van EV Model TCO Comparison

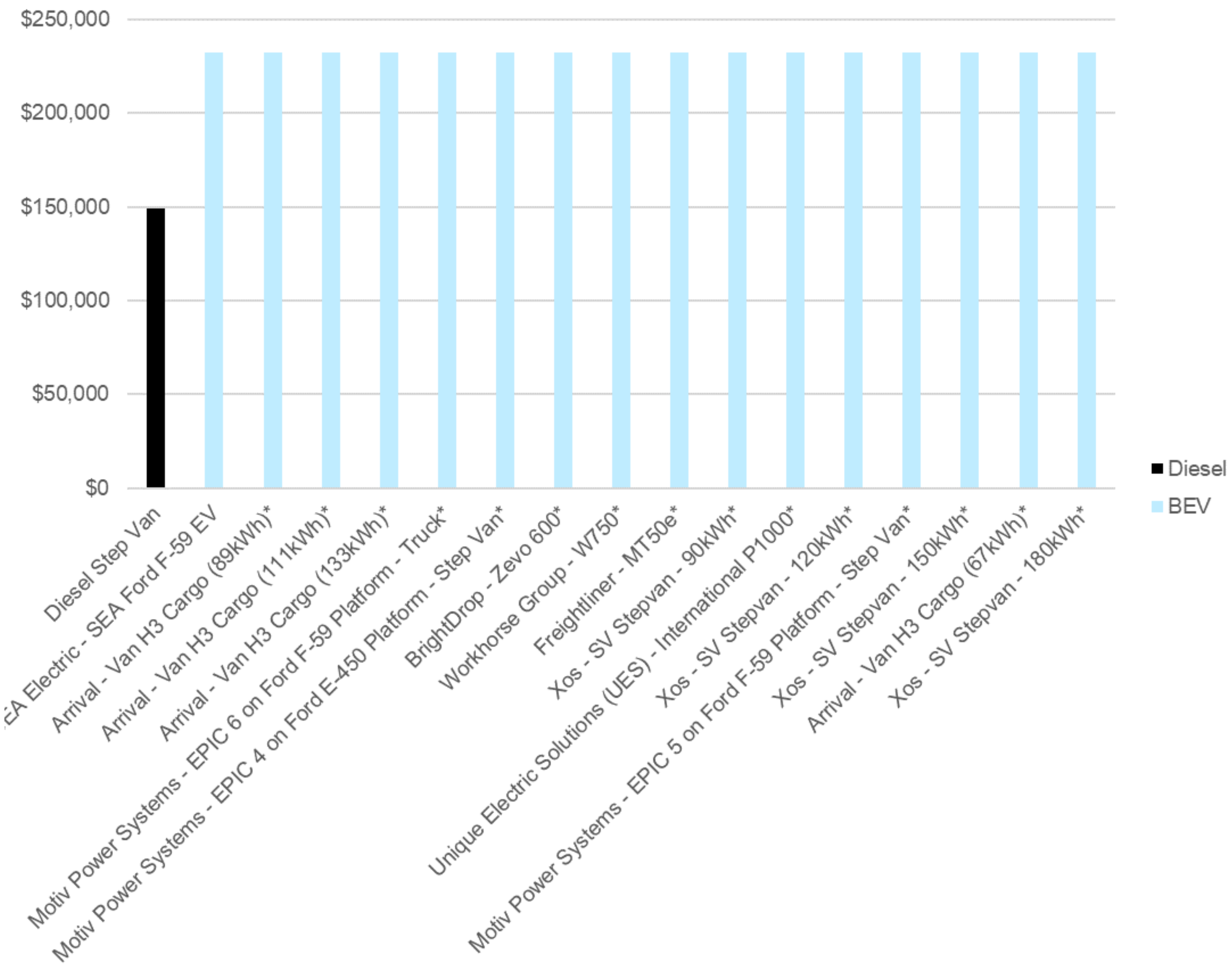
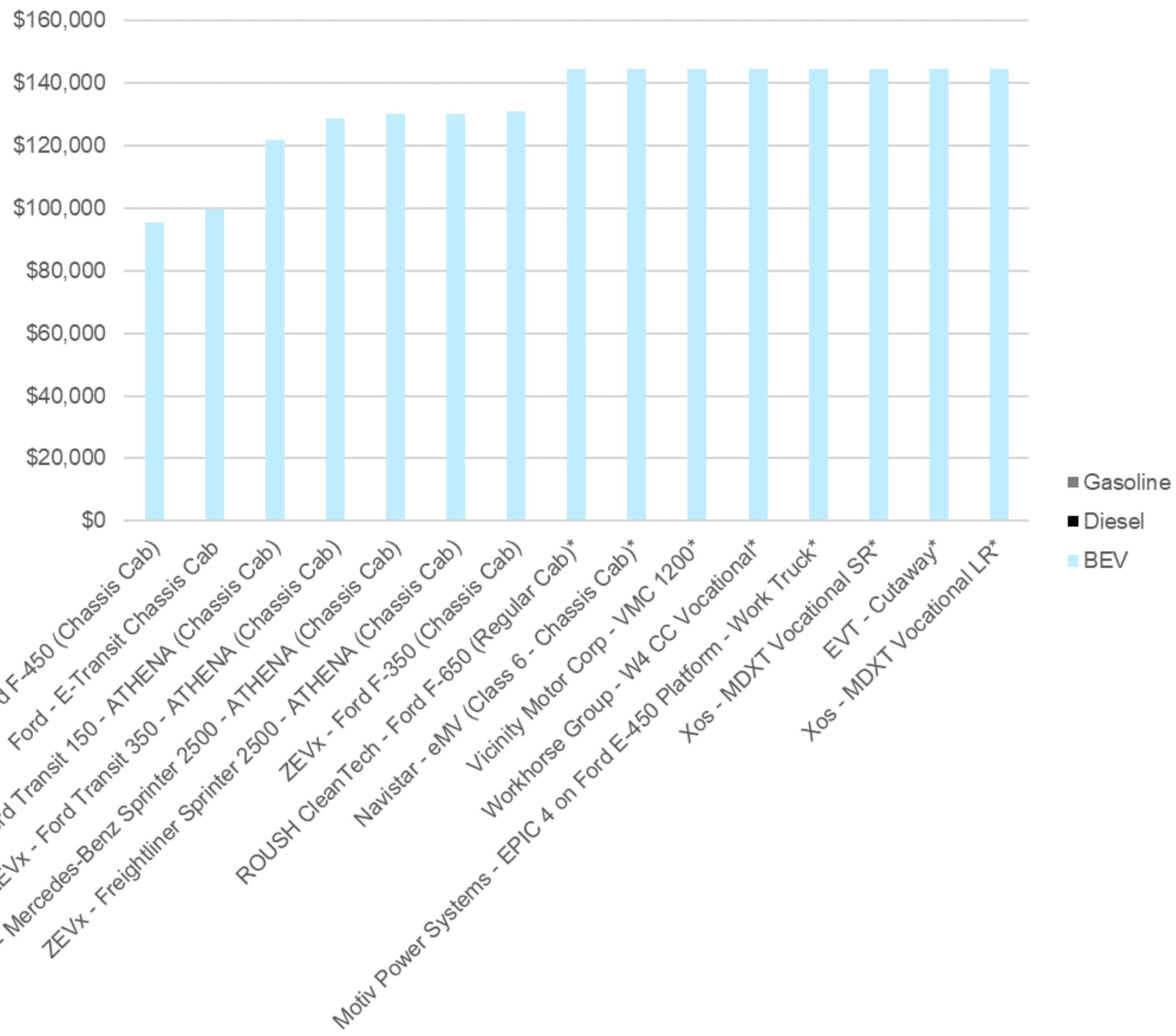


CHART T. Medium-Duty Vocational Truck EV Model TCO Comparison[9]



[9] The TCO of a Gasoline Medium-Duty Vocational Truck is $216,817 and the TCO of a Diesel Medium-Duty Vocational Truck is $254,834.

CHART U. Class 4/5 Box Truck EV Model TCO Comparison

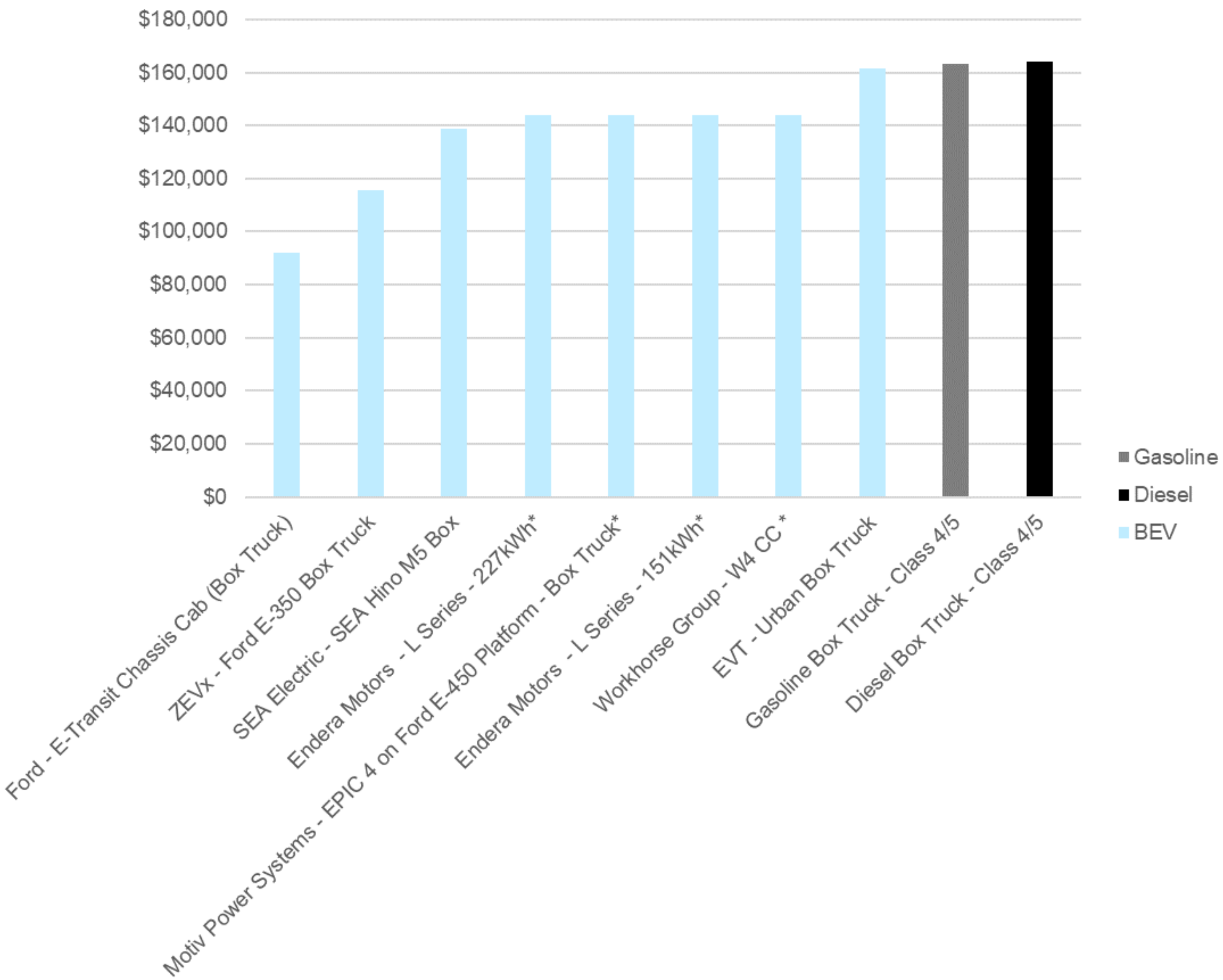


CHART V. Class 6 Box Truck EV Model TCO Comparison

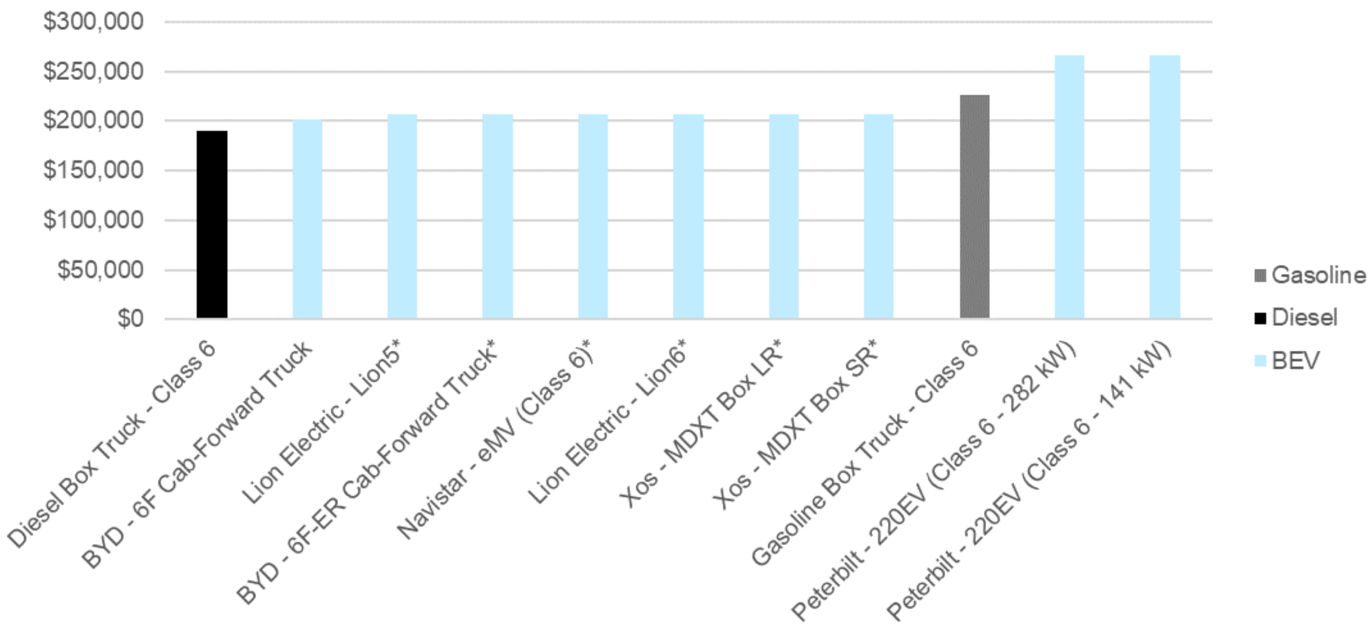


CHART W. Street Sweeper EV Model TCO Comparison

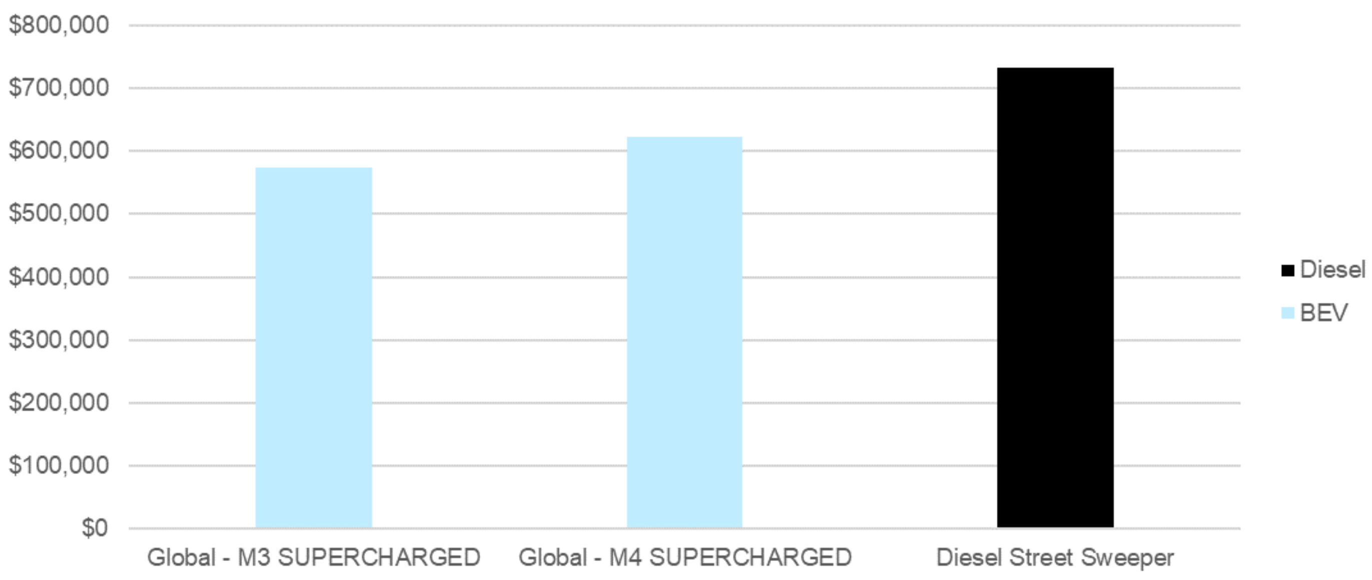


CHART X. Refuse Truck EV Model TCO Comparison

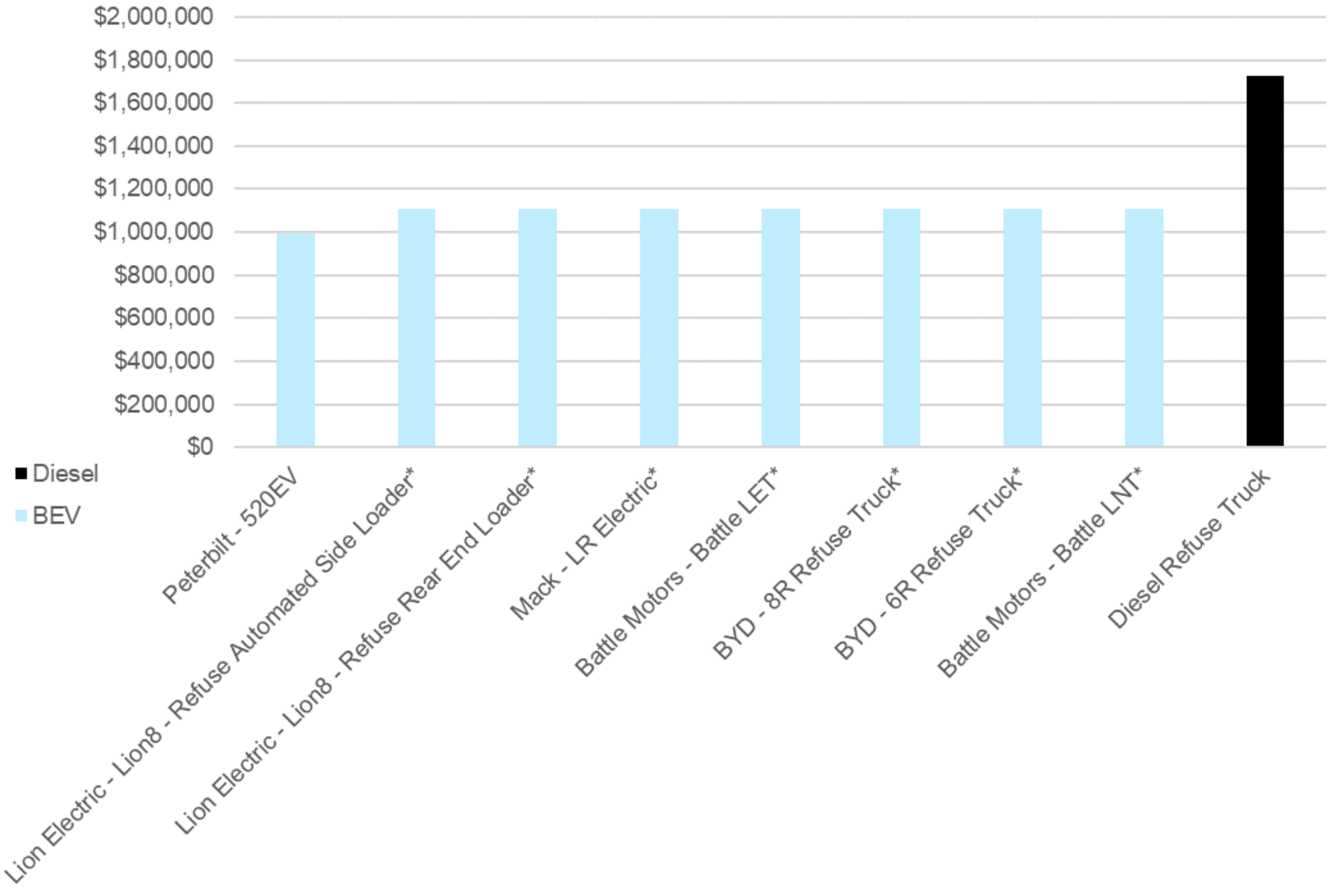
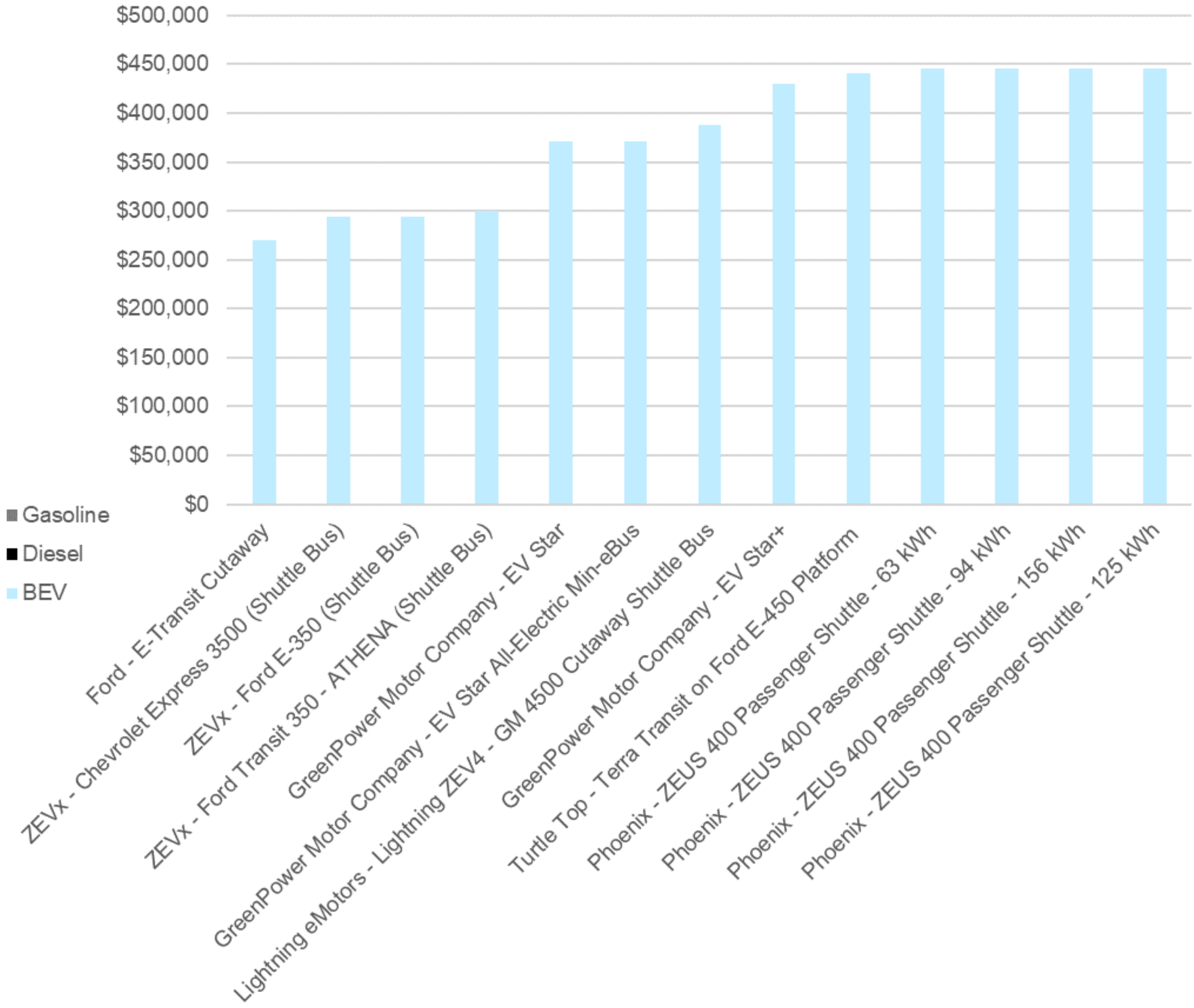
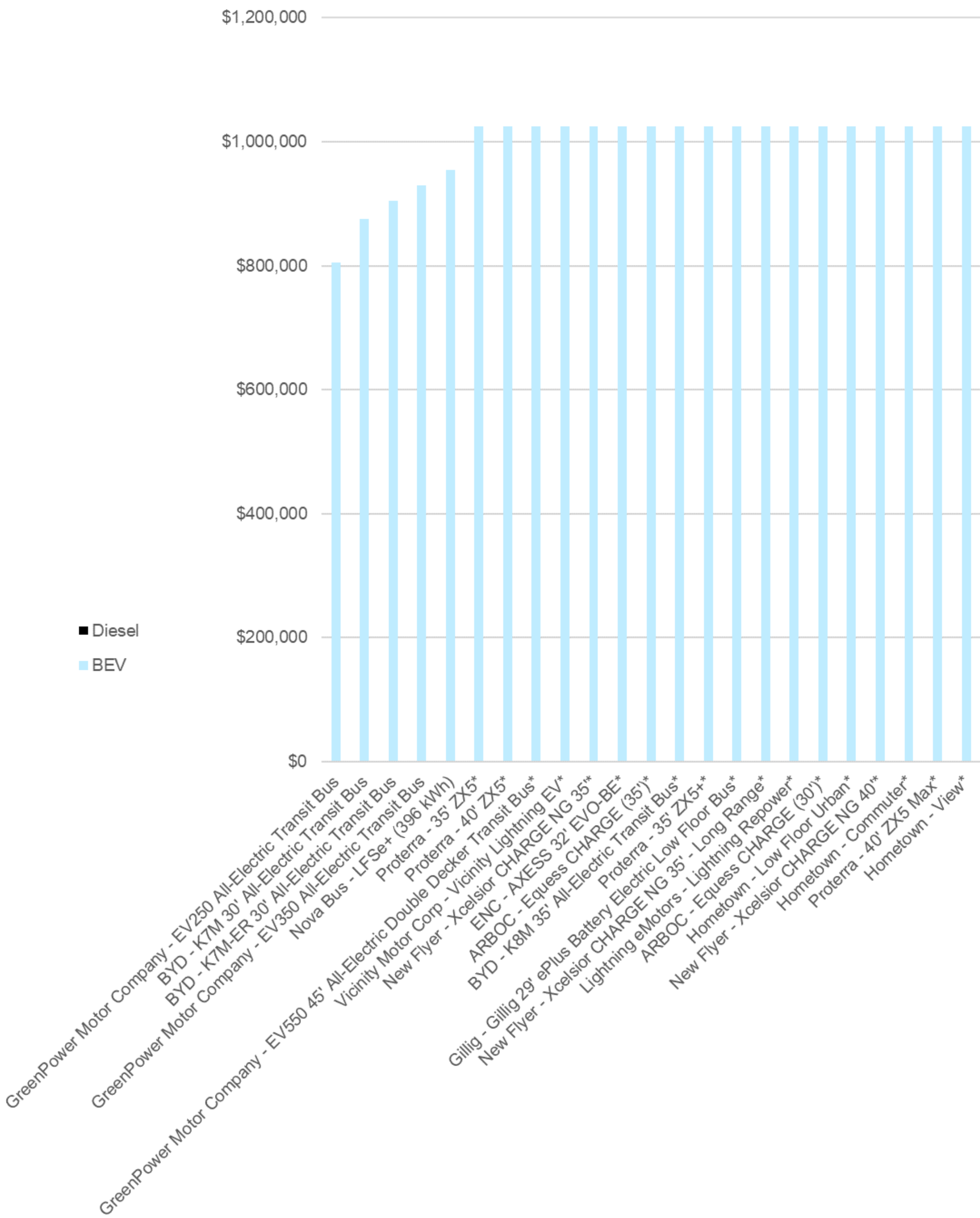


CHART Y. Shuttle Bus EV Model TCO Comparison[10]



[10] The TCO of a Gasoline Shuttle Bus is $495,827 and the TCO of a Diesel Shuttle Bus is $580,491.

CHART Z. Non-Articulated Transit Bus EV Model TCO Comparison[11]



[11] The TCO of a Diesel Non-Articulated Transit Bus is $1,263,903.

CHART AA. Articulated Transit Bus EV Model TCO Comparison

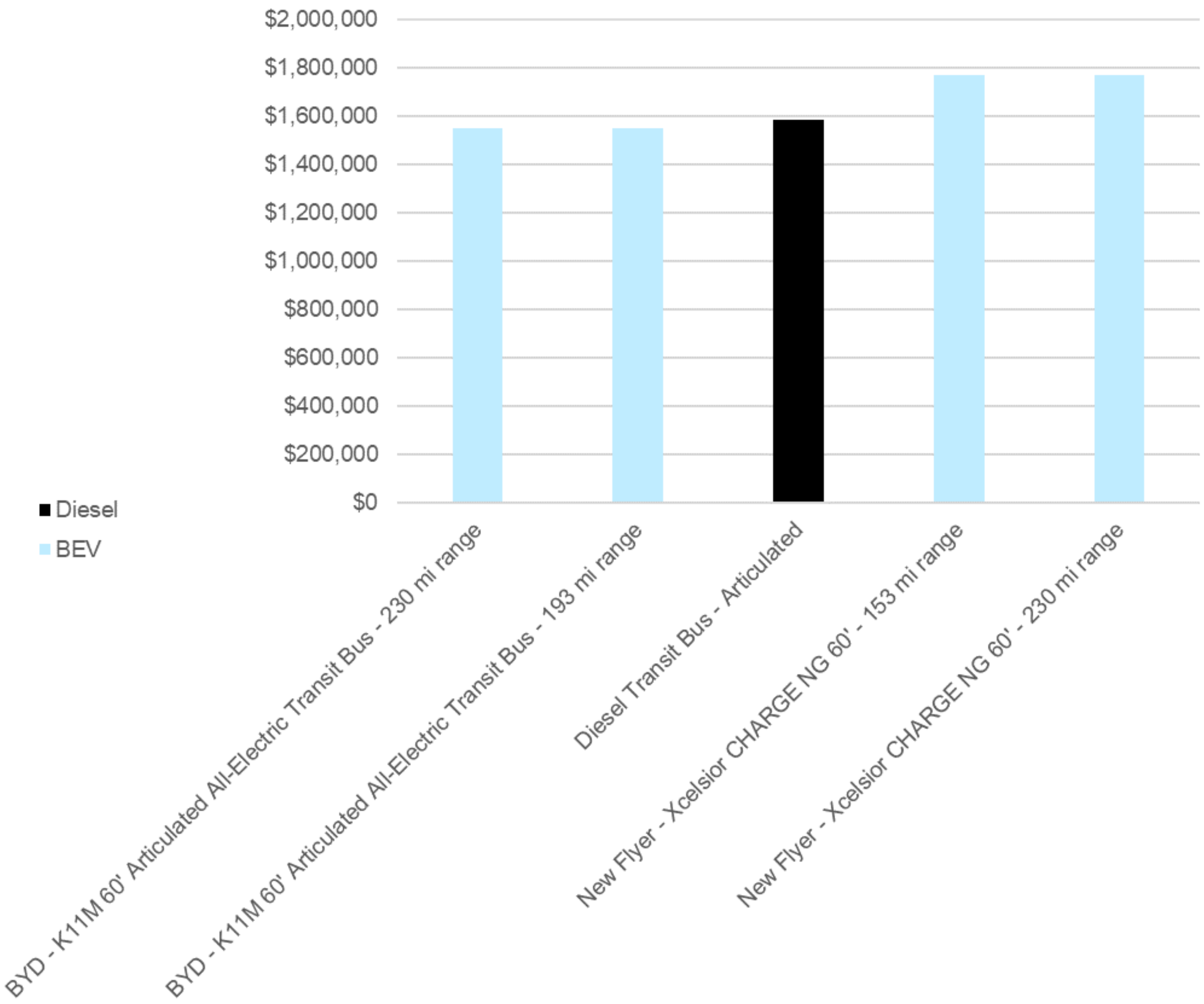


CHART AB. Type-A School Bus EV Model TCO Comparison

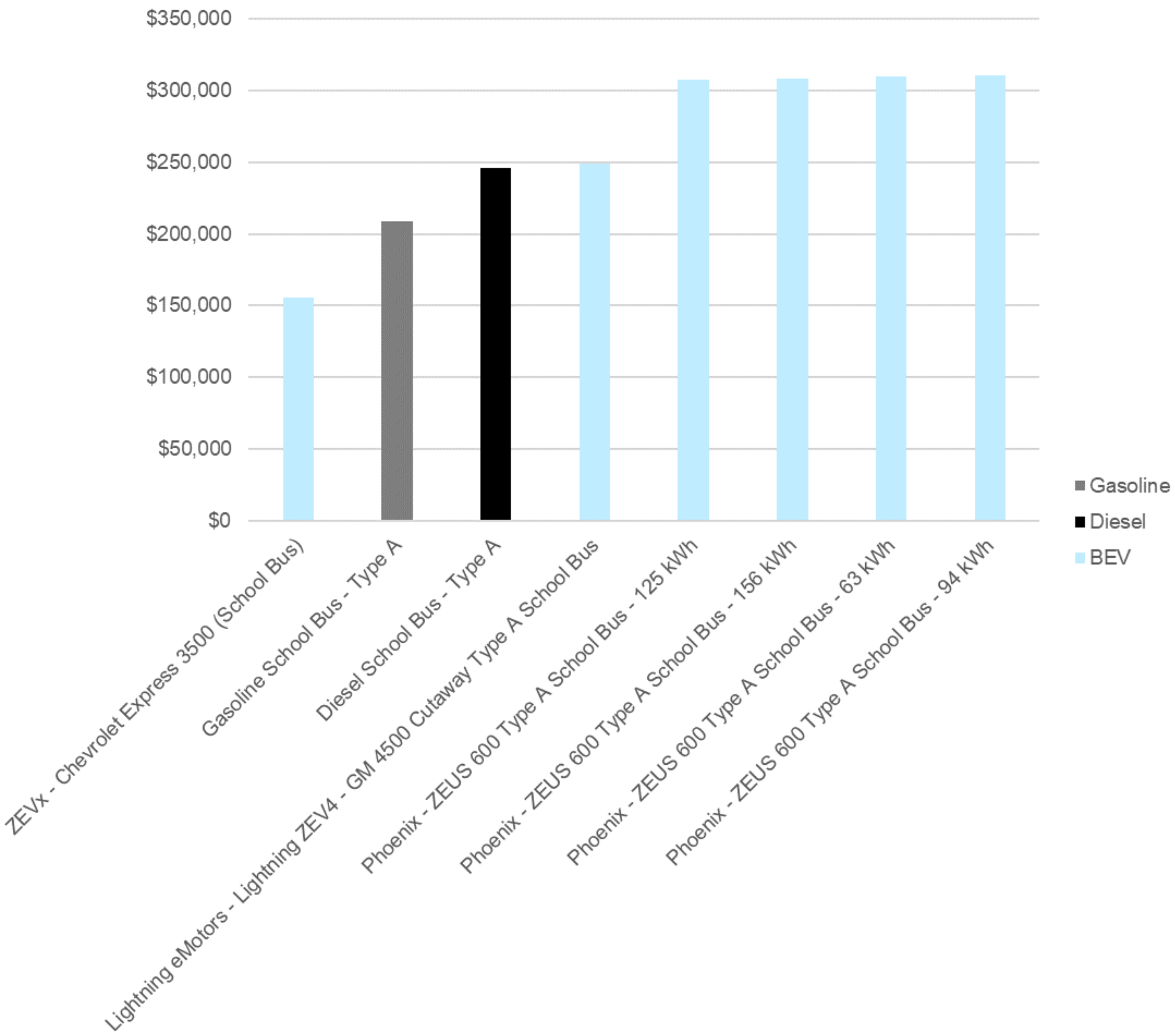


CHART AC. Type-C School Bus EV Model TCO Comparison

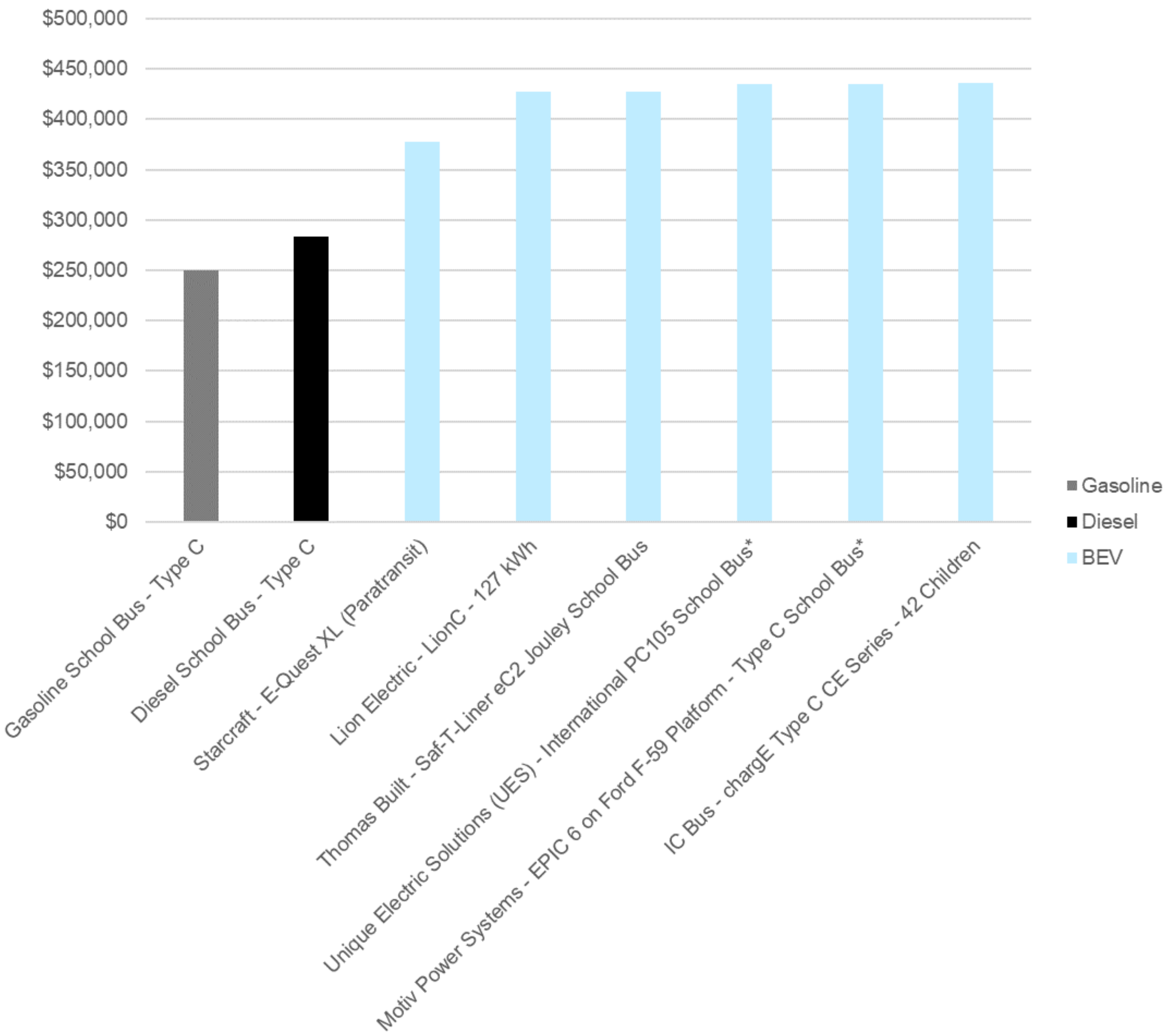


CHART AD. Type-D School Bus EV Model TCO Comparison

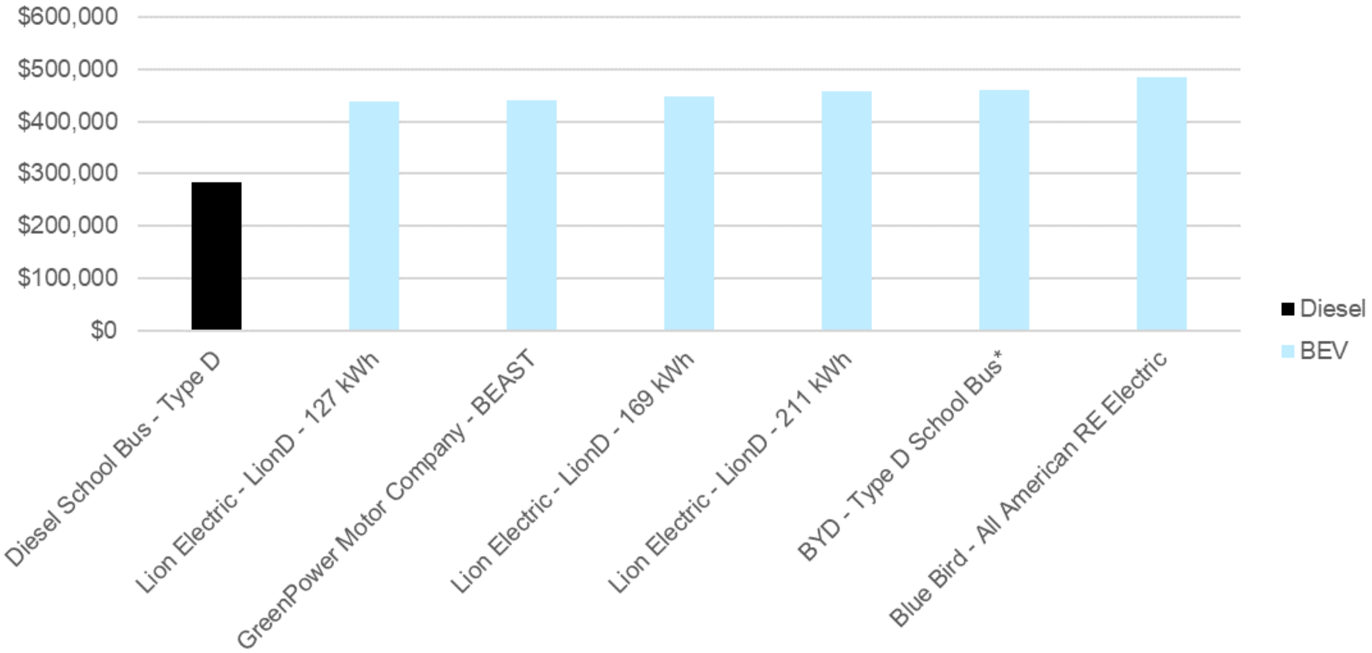


CHART AE. Bucket Truck EV Model TCO Comparison

CHART AF. Straight Truck - Heavy Truck EV Model TCO Comparison

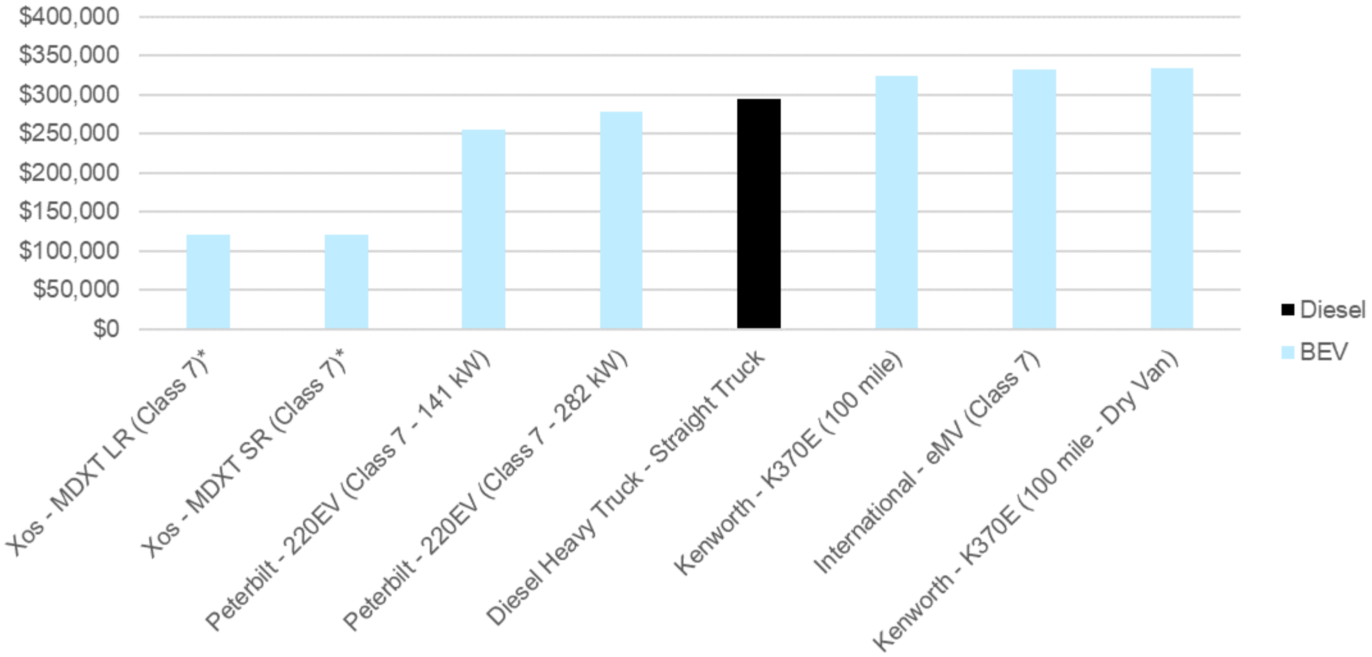


CHART AG. Truck Tractor - Heavy Truck EV Model TCO Comparison

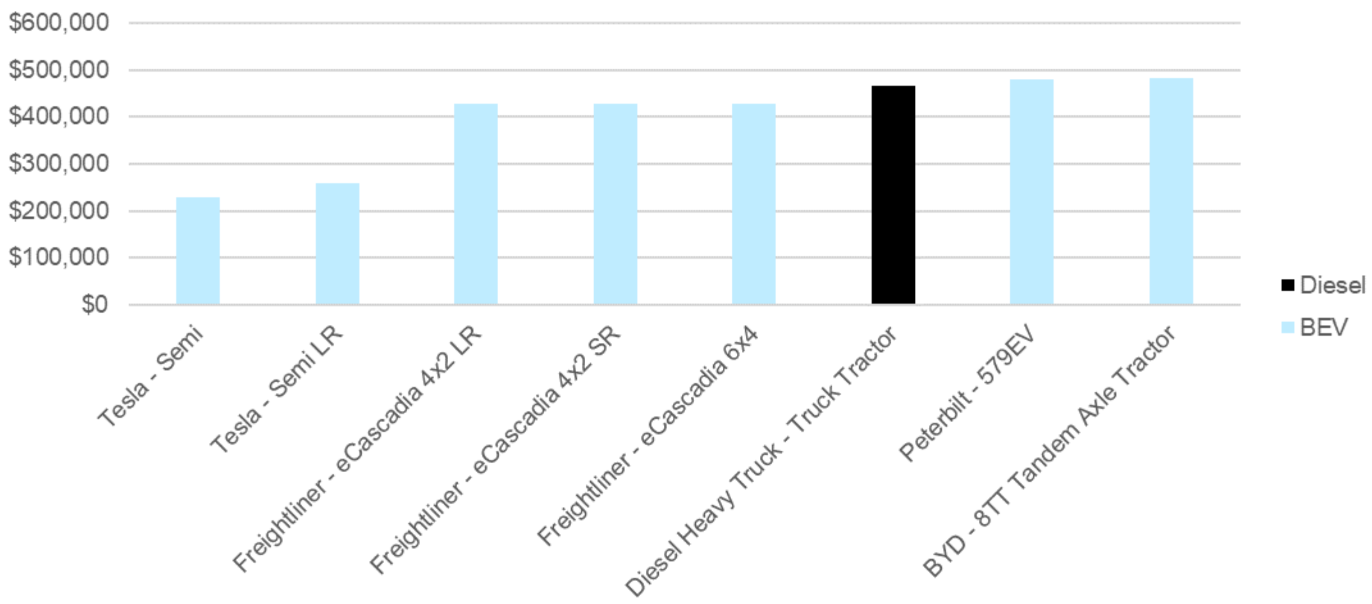
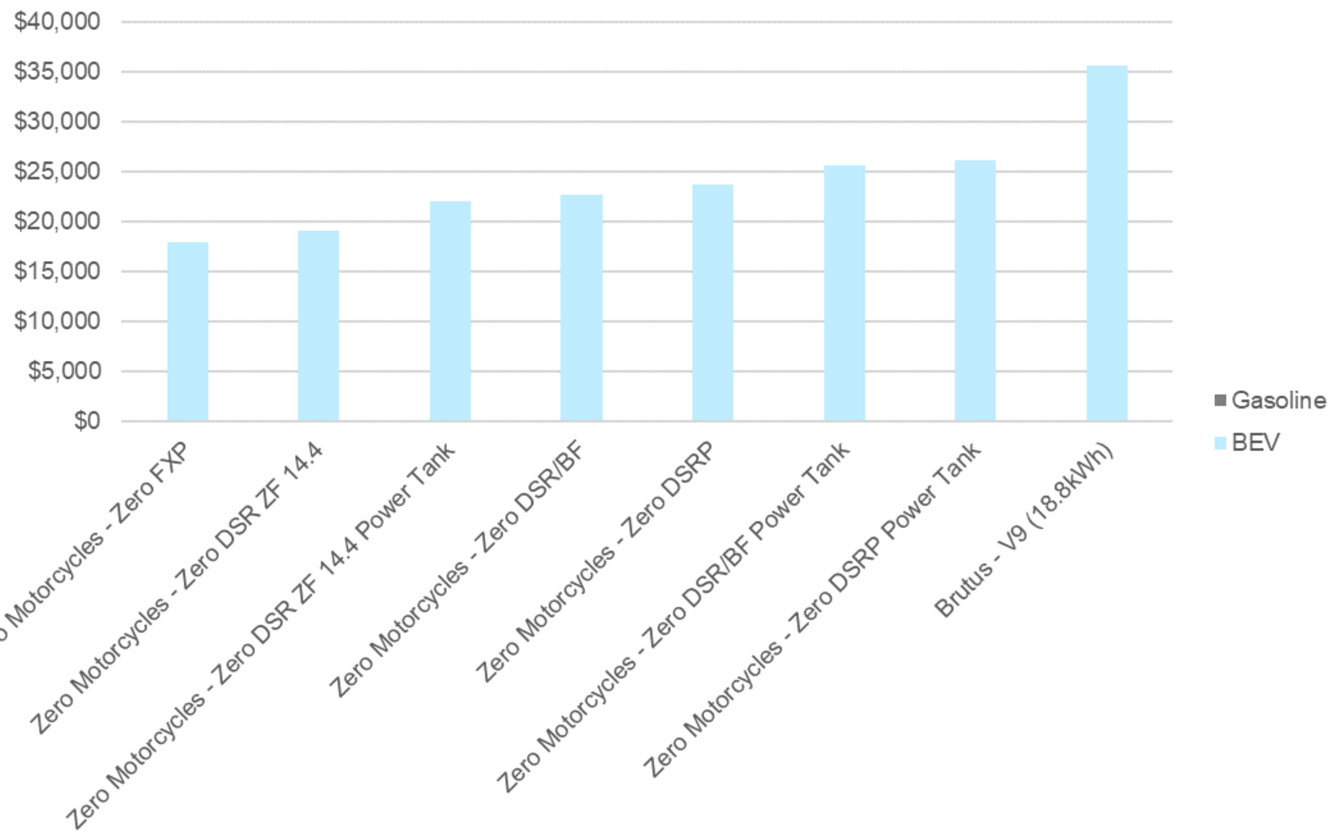


CHART AH. Motorcycle EV Model TCO Comparison[12]



Electric Police Patrol Vehicles

Currently, only five EV models, including one pickup truck, two sedans and two SUVs, are being used as police patrol vehicles in a handful of police fleets in the United States. The Chevrolet Blazer EV PVV is expected to be available in 2024. These models have been considered in Example Fleet Name's fleet analysis, and additional models will be added as more EVs are piloted for police use. Additionally, the Hyundai Kona Electric SUV is being piloted by some police fleets in Europe, and will be included in future analyses if deemed suitable for Example Fleet Name's police fleet. The Ford Mustang Mach-E SUV models have passed police pursuit testing. While the Chevrolet Blazer is anticipated to meet pursuit qualifications, official testing results have not yet been released. Police pursuit vehicles (PPVs) are equipped for high-speed response calls, while police patrol vehicles serve administrative or general patrol purposes. The police models that are available now, or will be available in the near future, are listed below.

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

[12] The TCO of a Gasoline Motorcycle is $57,710.

- Tesla Model Y (SUV)
- Chevrolet Blazer EV PPV (SUV)
- Ford F-150 Lightning Pro SSV (Light-Duty Pickup)

Used Vehicles

Sales of EVs increased rapidly toward the end of the last decade, and as such, used EVs are becoming available for fleet purchase. Used vehicles have not been included in this analysis, but may be a cost-effective option for purchase. Considerations of battery life and quality, range, and maintenance that accompanied the first generation of new EVs are pertinent. However, due to regenerative braking, EVs typically have less wear and tear on the drivetrain and therefore are a good fit to extend the vehicle lifespan. Batteries are generally expected to last upwards of 10 years, with newer models capable of longer lifetimes. On average, EV battery degradation is about 2% per year.

According to the World Resources Institute, 80% of all new EVs that are leased enter the used vehicle market just a few years later at a much lower price, under 40,000 miles, and only halfway through their warranties (EV manufacturers' warranties typically cover 8 years, or 100,000 miles). Additionally, with fewer moving parts, EVs require little maintenance in comparison to ICE vehicles, further factoring into a positive investment. For further information on used EV availability and pricing, see the Recurrent Used Electric Car Prices & Market Report.

Carrying and Towing Heavy Loads

Electric trucks usually have more power and torque than ICE vehicles, making them capable of towing similar loads as ICE equivalents. The Ford F-150 Lightning and the Chevrolet Silverado EV have tow ratings of 10,000 lbs. and the Rivian R1T has a tow rating of 11,000 lbs. Both ICE vehicles and EVs experience significant fuel efficiency reductions when carrying or towing heavy loads. Towing with an EV is estimated to reduce range by between 30%-70% depending on the weight and aerodynamics of the trailer. EVs have lower payload ratings than their ICE equivalents, usually in the 1,500 lbs. range for light-duty vehicles, because the heavy weight of electric batteries reduces the remaining weight capacity of the chassis. A heavy payload won't impact EV range as much as towing, but it may reduce EV range by 5% or more.

EV towing capacity may improve over time as battery weights are reduced and vehicle chassis design is improved.

Sample Sedan Financial Analysis

Table G provides a sample TCO comparison for a single, purchased Sedan. This analysis uses a 15-year vehicle life and 12,400 annual miles assumption, based on the average annual mileage for Sedans within your fleet.

TABLE G. Sedan TCO Comparison

	Gasoline	PHEV (Toyota – Prius Prime SE)	BEV (Nissan – Leaf S)
Capital Cost	$20,600	$34,970	$30,311
Charging Infrastructure Hardware (L2)	N/A	$2,500	$2,500
Charging Infrastructure Installation	N/A	$3,500	$3,500
Incentives [13]	N/A	($6,746)	($9,000)
Annual Fuel/Energy Costs	$1,427	$799	$372
Annual Maintenance Costs	$1,860	$1,700	$1,173
15-Year Total Costs [14]	$53,735	$58,540	$42,044

Charts AI and AJ provide a visual representation of the annual and cumulative cost comparisons across a gasoline, PHEV, and BEV SUV. Incentives and lower operational costs result in lower annual and overall TCO costs for the PHEV and BEV options.

[13] Assumes Commercial Electric Vehicle (EV) and Fuel Cell Electric Vehicle (FCEV) Tax Credit vehicle incentive (30% of BEV and 15% of PHEV capital cost) and SRP Business EV Charger Rebate ($1,500 per L2 charging port) EVSE incentives. EV capital and infrastructure costs shown in table does not have incentives applied.
[14] NPV assumes a 5% discount rate.

CHART AI. Sedan 15 Year Annual Cost Comparison

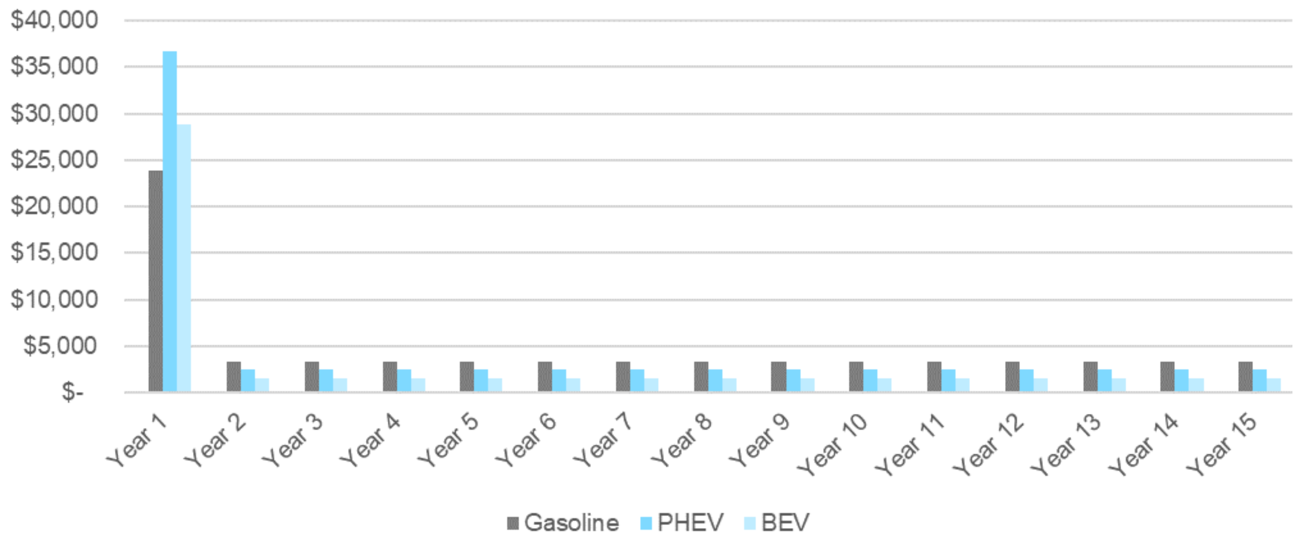
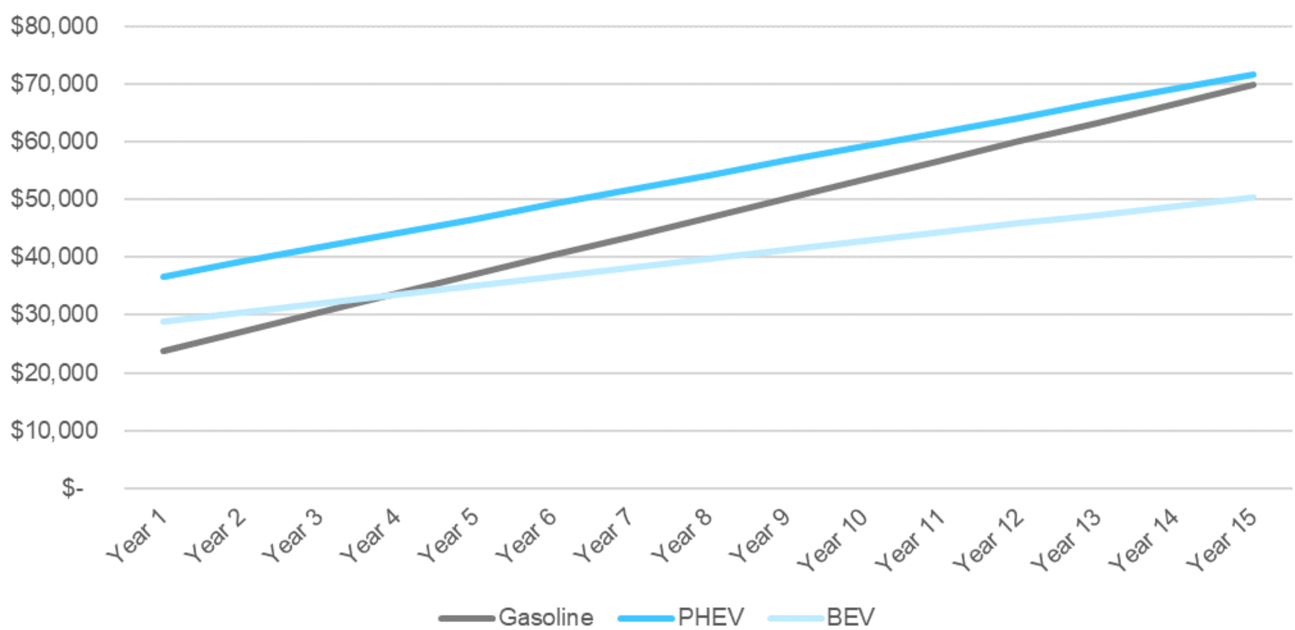


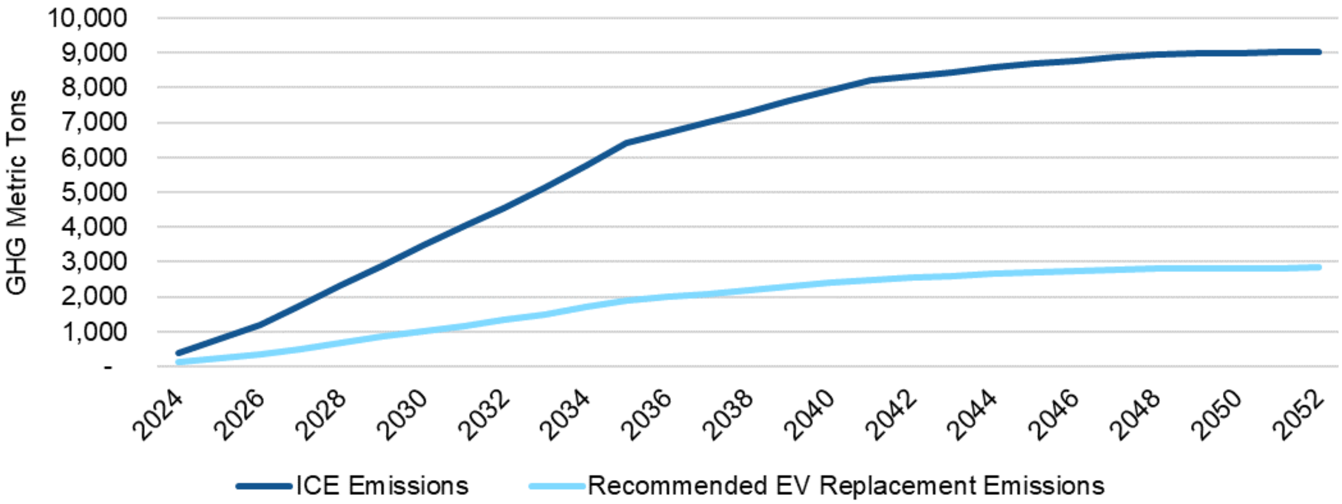
CHART AJ. Sedan 15 Year Cumulative Cost Comparison



Fleet Environmental Impact Analysis

By converting the 25 recommended vehicles to EVs, you could reduce GHG emissions by 6,188 MT and NOx emissions by 16,184 pounds (lbs) over 29 years. Chart AK 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 AK. Cumulative Fleet Green House Gas Emissions



6,188	GHG Emission Reductions (MT over 29 years)	**1,337**	Equivalent to removing passenger vehicles from the road for one year
16,184	NOx Emission Reductions (Lbs. over 29 years)	**102,094**	Equivalent to tree seedlings grown for 10 years

Non-Road Equipment

There are 7 vehicles in Example Fleet Name's fleet identified as non-road equipment, summarized in Table H below. Of these vehicle types, 3 types were identified as having electric equivalents options: golf carts, backhoes, and forklifts. Electric non-road equipment could help Example Fleet Name further reduce fuel costs, maintenance costs, and site emissions.

TABLE H. Non-Road Equipment

Equipment Type	Quantity	Quantity Recommended to Convert to Electric	Financial Savings (across vehicle lifespan)	GHG Emission Reductions (across vehicle lifespan)
Golf Cart	5	5	$16,155	41
Backhoe	1	0	N/A	N/A
Forklift	1	1	$14,551	50
Total	**18**	**5**	**$95,326**	**255**

Golf Carts

Example Fleet Name currently owns five golf carts that are gasoline powered. Electric golf carts are quiet, require little maintenance, and produce no site emissions. Transitioning to an electric golf cart from your gasoline unit could produce estimated lifetime savings of about $16,155. Electric golf cart manufacturers include: Yamaha, Club Car, and EZ-GO.

Forklifts

Example Fleet Name's currently owns one diesel forklift. We recommend Example Fleet Name 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 $14,551. Electric forklift manufacturers include: Toyota, BYD, Hyster, Crown, Jungheinrich, Caterpillar, Kalmar, Mitsubishi, Unicarrier, Yale, Clark, Doosan, Linde, Drexel, Carer and Bendi.

Backhoes

Example Fleet Name currently owns one backhoe. While a relatively new technology, there are a few electric backhoe models available through CASE, Volvo, John Deere, and MultiOne. While capital costs are much higher than diesel backhoes (2-3 times the cost) electric backhoes can help reduce operational costs, noise, and emissions.

Next Steps

Get Support.

Have questions about this report? Contact your Account Manager to discuss challenges and answer questions.

Explore Resources for Electrifying.

Visit the Salt River Project webpage to find resources about available incentives, trainings, news and updates, and more.

Move Forward with Electrifying Your Fleet.

Circulate the findings of this report with key stakeholders in your organization. Contact your Account Manager for additional support in preparing to present these findings.

Navigate SRP's Construction Services.

Start a new project or access an existing project through the SRP Plan Portal. Call 602-236-0777 and provide basic details. An SRP Project Leader will contact you within 5 business days to discuss your project. Check here for project status updates.

Salt River Project website has the tools you need to succeed.

Visit the webpage and you can:

- Explore funding opportunities
- Find RFP language to help your fleet acquire EVs
- Find partners that can support your transition to EVs
- Find information about EV and EVSE operation and maintenance
- Identify trainings
- Stay up to date on the latest industry news

We're here to help.

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

Web: https://www.srpnet.com/energy-savings-rebates/business/rebates/ev-charger

Email: srpetechrebates@icf.com

Phone: 602-236-3065

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 Arizona, this can equate to small range reductions in the winter, and up to 20% in the summer. The higher end of that spectrum would be during extreme cold (i.e., temperatures not often seen in Arizona).

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, your Account Manager can connect you with vetted charging station installers, as well as the SRP Fleet Electrification Team 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.

Who do I contact with additional questions?
Your Account Manager at srpetechrebates@icf.com or 602-236-3065.

Appendix A: TCO Threshold Comparison

The comparison below highlights the potential impacts of looking at a 25% TCO threshold scenario, where EVs are recommended when their TCO's are no more than 25% higher than the TCO of the equivalent ICE vehicle. Both scenarios are outlined in more detail in the excel recommendations file. Your Account Manager is here to help you navigate these two scenarios and connect you to helpful resources to explore your options.

Recommendation impacts using a cost-effective 0% TCO threshold, where EVs are recommended when their TCO is lower than the TCO of the equivalent ICE vehicle:

25
vehicles recommended

$498,980
TCO savings over 25 years*

$1,161,989
fuel cost savings over 25 years*

6,188
Metric tons (MT) of CO2 eliminated over 25 years

$42,533
maintenance costs savings over 25 years*

Recommendation Impacts using a 25% TCO threshold, where EVs are recommended when their TCO is no more than 25% greater than the TCO of the equivalent ICE vehicle:

29
vehicles recommended

$434,858
TCO savings over 29 years

$1,217,944
fuel cost savings over 29 years

7,030
Metric tons (MT) of CO2 eliminated over 29 years

$45,550
maintenance costs savings over 29 years

* NPV assumes a 5% discount rate