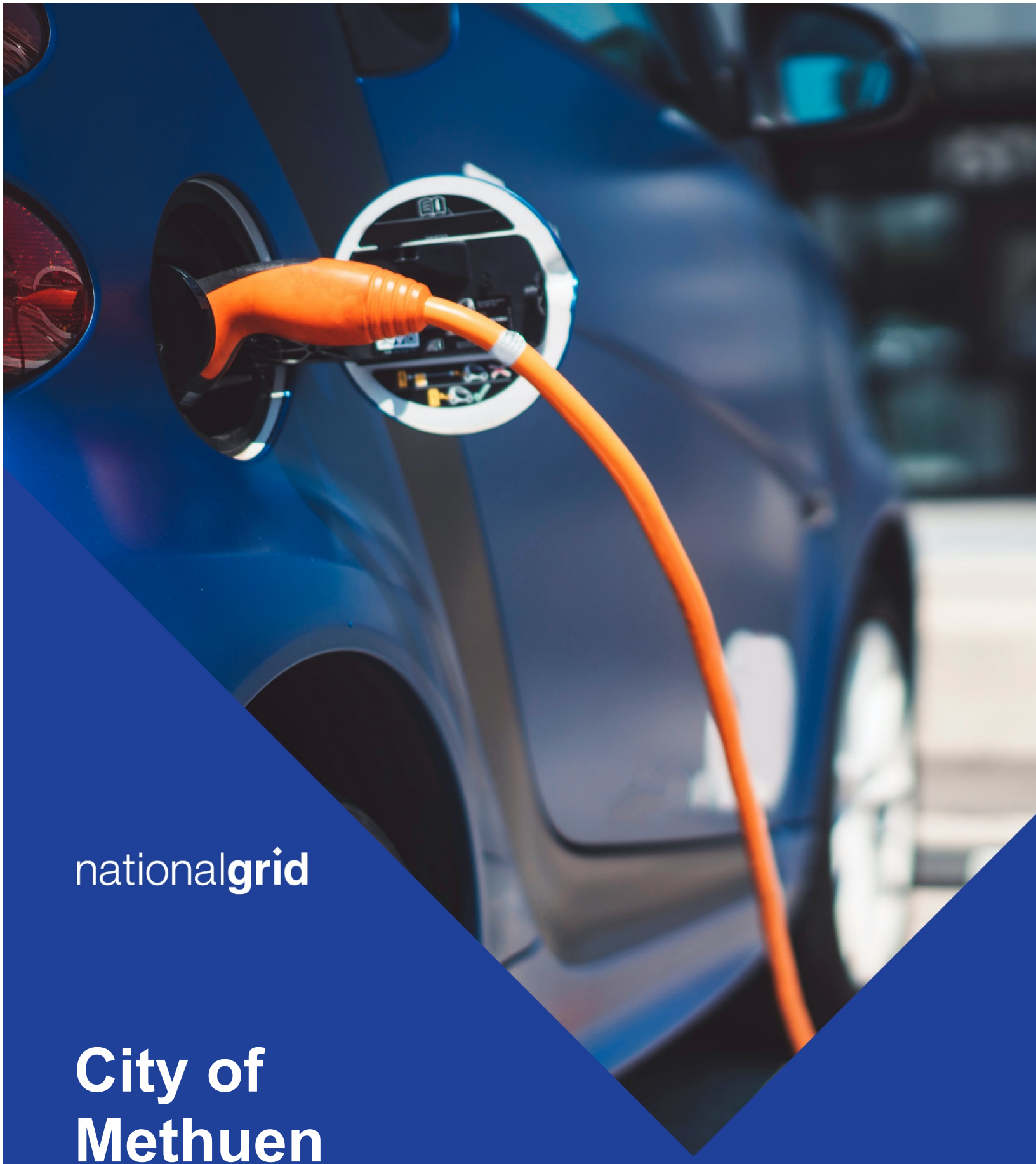


nationalgrid

City of Methuen

Fleet Electrification Assessment
March 18, 2021

Fleet advisory services provided by ICF

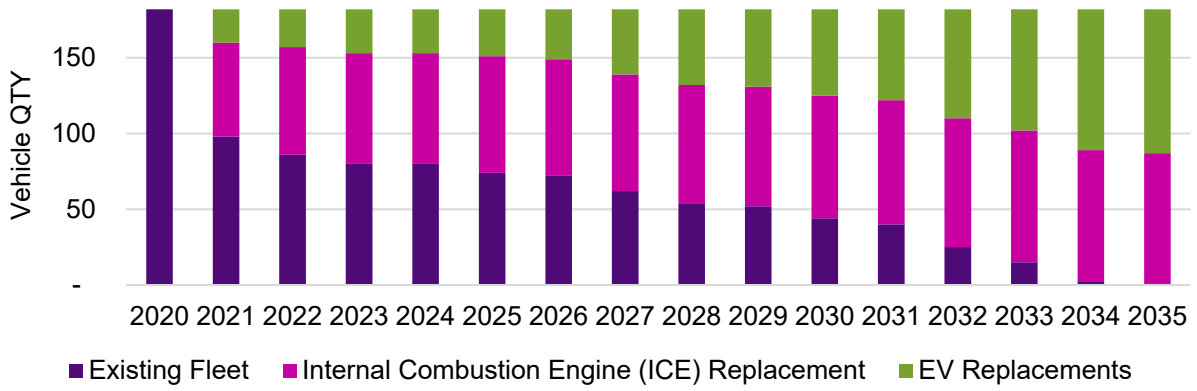
Table of Contents

Executive Summary

National Grid's Massachusetts (MA) Fleet Advisory Services Program provides fleet electrification recommendations and objective guidance from our team of electric vehicle (EV) experts. We are here to help you, the City of Methuen (Methuen), 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.

This analysis takes into account Methuen's preference to conduct vehicle procurement through the Massachusetts Operational Services Division's statewide contracts for the purchase of vehicles, including VEH98 and VEH102, and thus only reflects EVs currently offered through the state contracts.[1] The timeframe identified for the vehicle replacements is 2021 to 2035, which accounts for a maximum vehicle life of the existing fleet. 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 2035. We assessed the economic feasibility of 282 vehicles in Methuen's fleet and identified 182 that have EV options commercially available and 165 that have EV options available through state contracts. There are 83 of those that would be beneficial to convert over the next 15 years which would result in a net present value (NPV) TCO savings of $1,462,656 over the next 30 years (this accounts for the savings across the vehicles' full lifespans). Chart A below illustrates the phasing in of the recommended EVs as you displace your existing fleet.[2]

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 MA Fleet Advisory Services Program Account Manager (Account Manager) 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 FleetAdvisoryMA@icf.com or 617-218-2100 with any questions or to discuss next steps.

[1] The state contract dedicated to heavy-duty vehicle acquisitions, VEH93, does not currently include any EV options.
[2] This chart excludes the 100 pieces of non-road equipment, vehicles outside the scope of this analysis (motorcycles), and vehicles without EV models commercially available (fire trucks).

Based on our analysis, converting 83 vehicles to EVs is estimated to produce the following impacts:

$1,462,656
TCO savings over **30** years*

$2,006,109
fuel cost savings over **30** years*

$2,473,503
maintenance savings over **30** years

13,117
metric tons (MT) of CO_2 eliminated over **30** years

Over 30 years, those estimated CO_2 reductions equate to:

eliminating **1,508** homes' energy use for one year, or:

switching **498,431** incandescent lamps to LEDs, or:

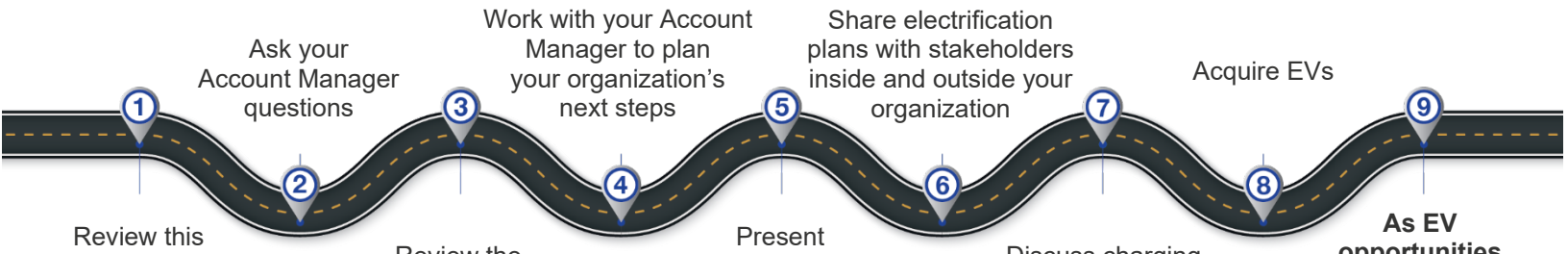
recycling **4,460** tons of waste instead of landfilling it, or:

planting **216,424** trees.

* NPV assumes a 5% discount rate.

If Methuen has flexibility to explore purchasing options outside of the state contracts, we have calculated that you could convert **95** vehicles with a total TCO savings of **$2,887,662** over 30 years (see Appendix A for more details). Your Account Manager is here to help you navigate independent purchasing and connect you to helpful resources such as sample RFP text, which is available on the Program portal.

Your Roadmap to Fleet Electrification



1. Review this report
2. Ask your Account Manager questions
3. Review the MA Fleet Advisory Services Program portal at www.FleetAdvisoryMA.NationalGrid.com for resources on incentives, grants, training, news, updates, and more
4. Work with your Account Manager to plan your organization's next steps
5. Present information to stakeholders, including available incentives and the National Grid Infrastructure Program
6. Share electrification plans with stakeholders inside and outside your organization
7. Discuss charging infrastructure with National Grid
8. Acquire EVs
9. **As EV opportunities or challenges arise, talk to your Account Manager**

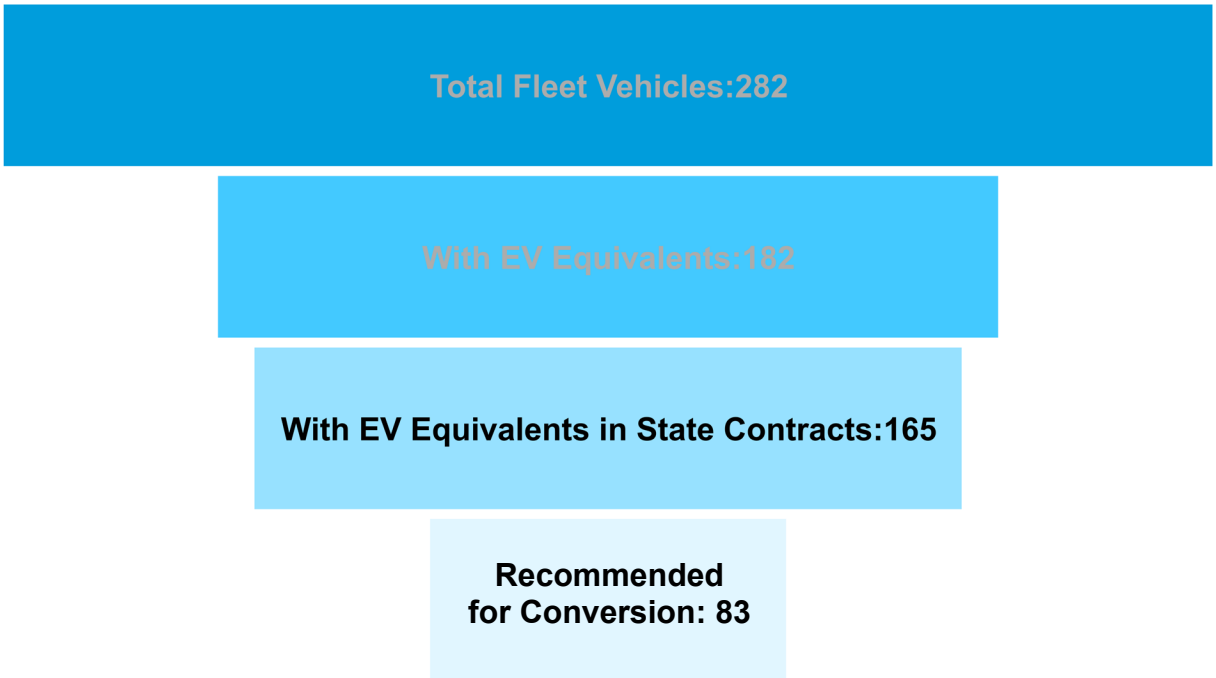
Project Information

On October 29, 2020, Joseph Cosgrove, Environmental Planner/Energy Manager, and Rick Guilmette, Fleet Manager, of Methuen met with the Account Manager, Justin Eichenberger, and other program staff for an initial intake call. The discussion covered topics including an overview of the MA Fleet Advisory Services Program, fleet data availability, fleet usage characteristics, and the fleet's motivation for exploring EV options. A key takeaway of the intake call was Methuen's use of state contracts to purchase vehicles, which limits EV options and pricing. VEH98 and VEH102, are administered through COMMBUYS, and currently include only 61 EV model options.VEH98 includes 28 EVs (2 minivans, 3 school buses, 9 SUVs, and 14 sedans). VEH102 includes 33 EVs (4 box trucks, 4 medium-duty vocational trucks, 5 shuttle buses, 9 step vans, 2 vans, 6 light-duty pickups, and 3 medium-duty pickups).

Methuen provided an initial fleet dataset on December 31, 2020. The Account Manager provided follow up questions on January 14, 2021, and the City responded on January 25, 2021 with some additional data and to approve the proposed assumptions. Methuen's fleet dataset was used to establish a fleet baseline in the model.

There are 282 vehicles in Methuen's current fleet, 182 of which have EV equivalents commercially available. However, only 165 of these vehicles have EV equivalents available through the state contracts, 83 of which would be cost beneficial to convert to EVs at this time. This vehicle breakdown is illustrated in Chart B below.

CHART B. Fleet Assessment Vehicle Breakdown



Existing Fleet Makeup

There are 282 vehicles in Methuen's current fleet, 182 that have EV equivalents. About half of the existing fleet vehicles that have EV equivalents are gasoline powered and half are diesel powered, as shown in Table A. About half of the fleet is made up of light-duty vehicles, which is illustrated in Chart C below; 37% are police vehicles and 8% are non-police sedans and SUVs (15 vehicles). Police vehicles are assessed separately due to their significantly different duty cycles and applications. Based on the Argonne National Laboratory's Alternative Fuel Life Cycle Environmental and Economic Transportation (AFLEET) Tool's vehicle lifespans, the estimated retirement schedule for the existing fleet is represented in Chart D. The large number of sedans and SUVs estimated for 2021 retirement are police patrol vehicles, which we estimate to have a 4-year lifespan based on high annual vehicle mileages.

TABLE A. Existing Fleet Fuel Type Distribution

Vehicle Type	Gas	Diesel
Sedan	2	0
Sedan - Police	28	0
SUV	13	0
SUV - Police	39	0
Light-Duty Pickup	2	1
Medium-Duty Pickup	0	64
Van	13	0
Box Truck	0	2
Medium-Duty Vocational Truck	0	1
Other (No State Contract EVs)	0	17
TOTAL	97	85

CHART C. Existing Fleet - Vehicle Types

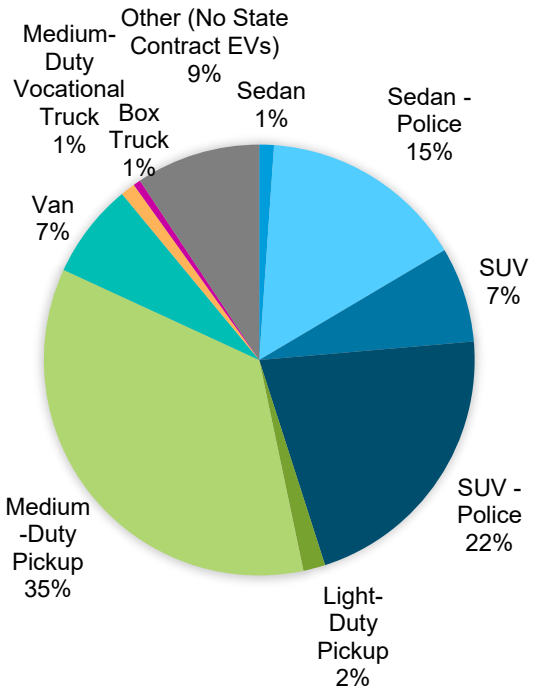
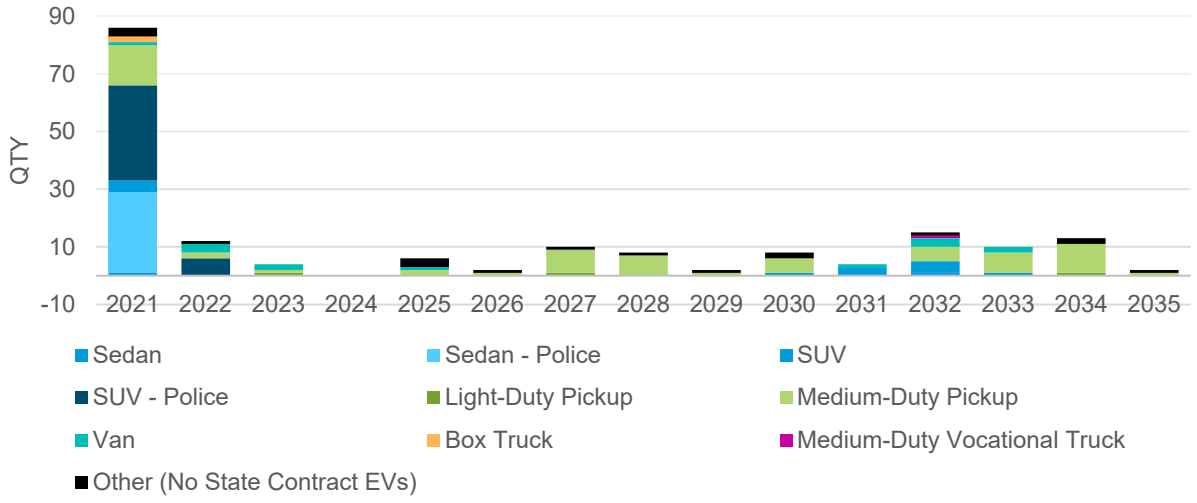


CHART D. Existing Fleet - Retirement Schedule



The 117 vehicles excluded from the vehicle replacement recommendations are summarized in Table B below and were excluded from this analysis for one of two reasons:

- 17 have EV equivalents on the market, but they do not currently have a plug-in hybrid electric vehicle (PHEV) or battery electric vehicle (BEV) option available through state contracts.
- 100 are non-road equipment (see the Non-Road Equipment Section for more information), vehicles outside the bounds of this initial study, or vehicles without commercially available EV models.

Follow-up report refreshes will be available as additional EV models become available, or Methuen elects to conduct their own procurement for EVs to the general market.

TABLE B. Vehicle Types Excluded from Analysis

Vehicle Type	Quantity	Reason for Exclusion
Street Sweeper	6	No EV models currently available through state contracts
Dump Truck	11	
Fire Truck	8	No EV models commercially available
Miscellaneous Non-Road	25	Non-road equipment or vehicles outside the bounds of this initial study
Tractors	14	

TABLE B. Vehicle Types Excluded from Analysis		
Vehicle Type	**Quantity**	**Reason for Exclusion**
Make/Model Not Listed	11	Non-road equipment or vehicles outside the bounds of this initial study
Trailers	11	
Generators	9	
Loaders	9	
Air Compressors	7	
Police Motorcycles[3]	6	

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 vehicle.
- **Vehicle Pricing:** The model uses February 2021 VEH98 and VEH102 purchase rates for the available EV sedan and SUV models. Vehicle pricing was escalated annually using the U.S. Energy Information Administration's (EIA) 2020 Annual Energy Outlook (AEO) and ICF's *Comparison of Medium- and Heavy-Duty Technologies in California* report for the California Electric Transportation Coalition. The model assumed all vehicles are owned and active.
- **Annual Mileage:** The model estimated annual vehicle mileage by vehicle type using ALFEET assumptions.
- **Fuel and Maintenance:** Fuel costs were estimated using AFLEET miles per gallon and annual mileage assumptions by vehicle and fuel type. Maintenance costs were estimated using ALFEET dollar per mile and annual mileage assumptions by vehicle and fuel type. Maintenance costs were escalated 2% annually.
- **Gasoline Pricing:** The model uses a $2.46/gallon gasoline base rate based on the United States Energy Information Administration (EIA)'s New England average gasoline pricing for the past 5 years. Gasoline pricing is escalated annually using projections from the U.S. EIA's 2020 AEO Reference Case for Transportation: Motor Gasoline.

[3] Some information about electric motorcycle options is highlighted in the EV model comparison section, however these options are not included in the state contracts.

- **Electricity Pricing:** The model uses $0.17/kWh base rate, escalated annually using projections from the U.S. EIA's 2020 AEO Reference Case for Transportation: Electricity.
- **Vehicle Replacements:** The estimated retirement schedule is based on the manufacturing year and vehicle lifetime assumptions by fuel and vehicle type from AFLEET, as Methuen indicated vehicles are driven until the end of their useful life.
- **Timeframe:** This analysis focuses on vehicle replacements for 2021 through 2035, with TCO calculations extending out across the vehicle lifespans to 2050.
- **Discount Rate:** 5% was used for NPV calculations.
- **Vehicle Ranges:** Existing vehicles were assumed to travel a maximum of 50 miles a day. EV mileage ranges per charge were accounted for when recommending vehicle replacements. The analysis used an average temperature range of 22 to 88°F to assess the potential impact temperatures can have on EV ranges; this reduced EV model ranges to 80% of their maximum mileage range.
- **Vehicle Fuel Types:** Existing sedans and SUVs were assumed to be gasoline powered. Medium- and heavy-duty vehicles were assumed to be diesel-powered.
- **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 282 Methuen vehicles scheduled for retirement between 2021 and 2035, and 83 of them will be cost effective to convert to electric. Chart E below shows the TCO for the 83 recommended vehicles each year if they were replaced with conventional, internal combustion (ICE) vehicles versus with the recommended EVs. This timeline is based on the existing fleet retirement schedule outline in Chart D above. When looking at the annual costs in Chart E, there are higher EV costs during some years with vehicle replacements which is due to the higher EV capital and infrastructure costs. However, Chart F shows how the overall TCO for EVs is lower due to the incentives, fuel, and maintenance savings. Based on these estimates, you may see a financial payback as early as 2023.

CHART E. Fleet Recommended Replacements TCO Comparison - Annual

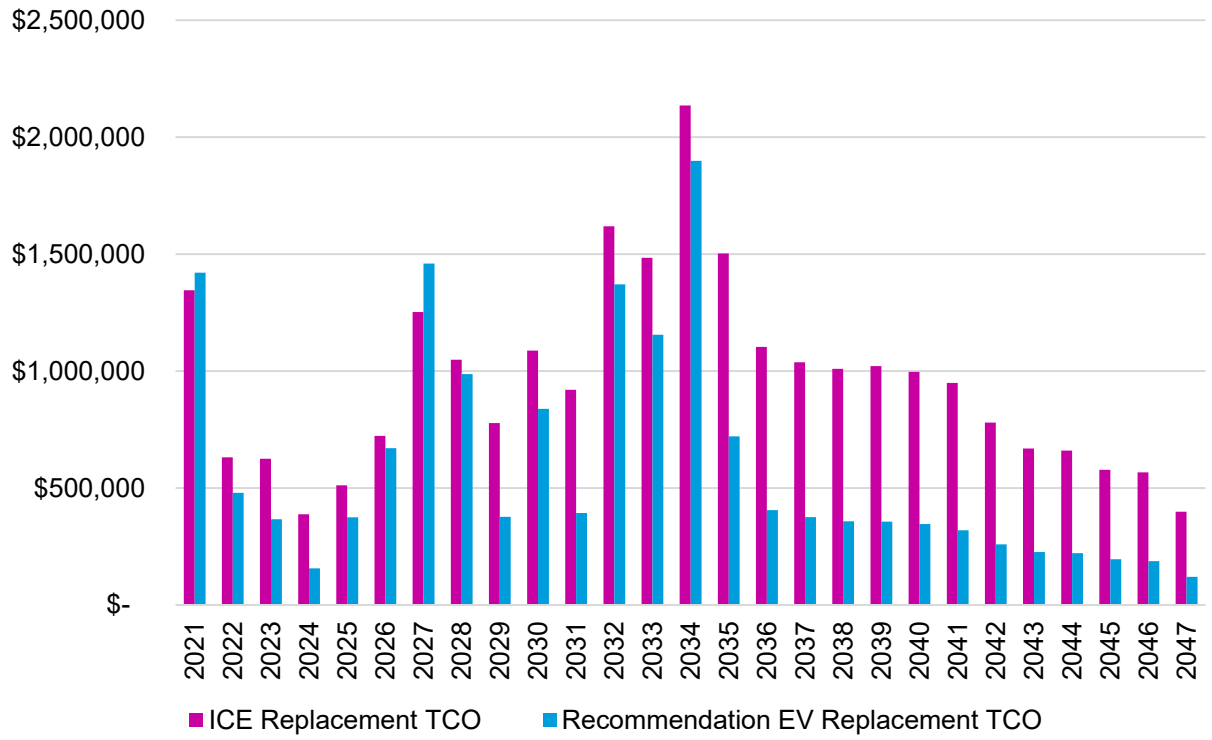


CHART F. Fleet Recommended Replacements TCO Comparison - Cumulative

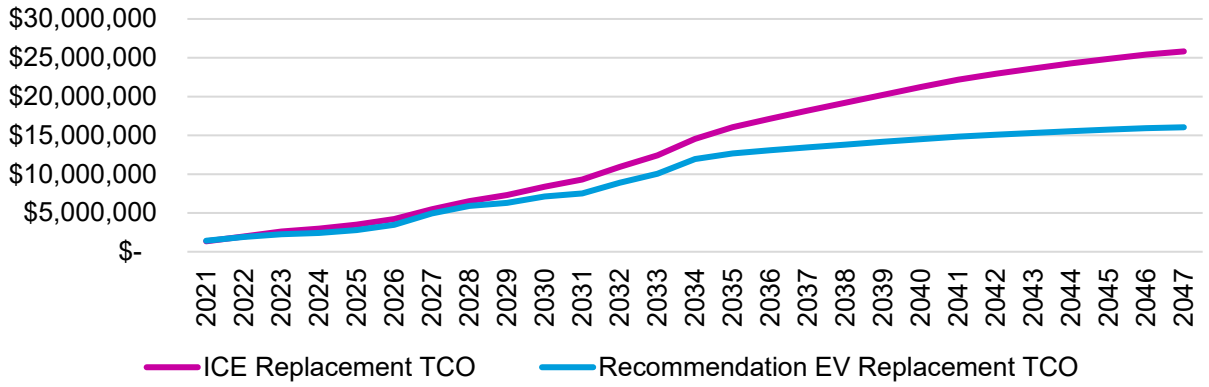


Table C and Chart G identify the 83 vehicles that will be cost effective to convert to electric within the next 15 years. Each vehicle within your fleet has been assessed to identify the lowest cost option, while also accounting for potential mileage and charging time restrictions.

The financial savings and greenhouse gas (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

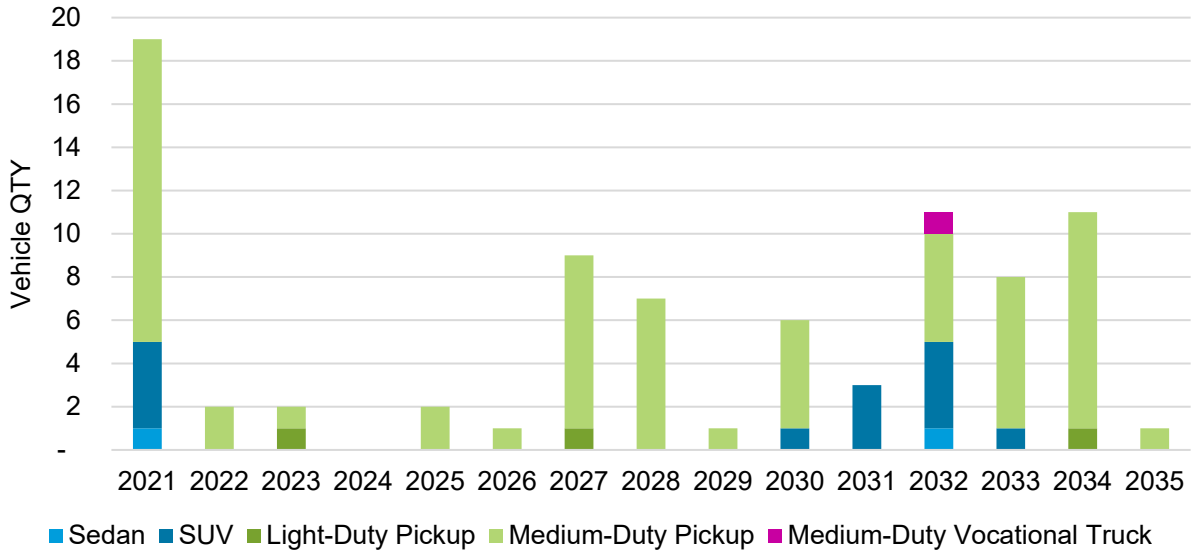
There are 82 vehicles with state contract EV equivalents that are not recommended for conversion, either due the TCO for the ICE vehicle being lower than any of the state contract EV option's TCO (41 vehicles), the state contract EV option being too large (2 box trucks that are Class 4/5 are smaller than the state contract Class 6 box trucks), or it being a police patrol SUV (39 vehicles). Currently, only three EV models are being used as police patrol vehicles in a handful of police fleets in the United States, and all models are sedans. These models have been considered in Methuen'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 Methuen's police fleet. In general, future EV model options or incentive program availability may open opportunities for additional vehicles to be converted; this will also be considered in future report updates.

TABLE C. 13-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 30 years)	GHG Emission Reductions (across 30 years, MT)	Incentive / Grant Funding Available
Sedans	2	1	Nissan/ Leaf S/ BEV	$6,628	61	✓
		1	Toyota/ Prius Prime/ PHEV	$1,247	49	✓
Sedans - Police	28	0	N/A	N/A	N/A	✓
SUVs	13	13	Hyundai/ Kona Electric Limited/ BEV	$80,352	1,173	✓
SUVs - Police	39	0	N/A	N/A	N/A	✓
Light-Duty Pickup	3	3	XL Fleet/ Ford F-150/ PHEV[4]	$5,771	179	
Medium-Duty Pickup	64	64	XL Fleet/ Chevrolet Silverado 3500 HD/ PHEV[3]	$1,359,644	11,440	
Van	13	0	N/A	N/A	N/A	✓
Box Truck	2	0	N/A	N/A	N/A	✓
Medium-Duty Vocational Truck	1	1	Lightning eMotors/ Ford E-450 LEV80E/ BEV	$9,014	214	
Other (No State Contract EVs)	17	0	N/A	N/A	N/A	✓
TOTAL	**182**	**83**		**$1,462,656**	**13,117**	

[4] There are no BEV light-duty pickup or medium duty pickup options available through state contracts.

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 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 as 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.

EV Charging Infrastructure Assumptions in Your Analysis

Methuen will need a maximum of 65 DCFC and 18 Level 2 chargers to support the recommended 83 EVs. This conservatively assumes a one-to-one charger-to-vehicle ratio. Depending on the scheduled duty cycles of the vehicles, it may be possible to reduce the number of chargers. The MA Fleet Advisory Services Program portal (*www.FleetAdvisoryMA.NationalGrid.com*) provides information for chargers available to fuel vehicles off-site or when traveling long distances. Your Account Manager and the program portal can also provide helpful resources on charging best practices.

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.

Methuen 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 D. Incentive and Funding Sources

Program	Sedans	SUVs	LD Pickup	MD/HD Trucks	Administrator	Vehicle Costs	EVSE Installation	EVSE Hardware	Program Offerings	Upcoming Deadlines	TCO Funding Assumptions
EV Charging Station Program	✓	✓	✓	✓	National Grid		✓	✓	Up to 50% of EVSE hardware and 100% of installation costs for BEV fleets[5]	12/21/21 (Have until 2023 to install)	100% of installation costs for BEV vehicle EVSE installed before 2024
MassEVIP Fleet Incentives	✓	✓	✓		Massachusetts Department of Environmental Protection (MassDEP)	✓			Light-duty vehicles only. BEVs: $7500/purchase, $5000/lease; PHEVs: $5000/purchase $3000/lease[6]	First-come, first-serve	BEVs: $7500/ purchase; PHEVs: $5000/ purchase

[5] Up to 75% of hardware costs covered for publicly accessible ports and 100% for environmental justice (EJ) community sites. Prescriptive incentives are available for less than five charging stations. Equipment must be installed by 12/21/2023.
[6] MassEVIP application caps were considered in this analysis. MassEVIP Fleet incentives for vehicles have a limit of 25 vehicles per applicant, so incentives were only applied to the first 25 eligible vehicles to retire.

Program	Sedans	SUVs	LD Pickup	MD/HD Trucks	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[7]	45% of medium- and heavy-duty EV capital costs with 7,000+ annual miles
MassEVIP EVSE	✓	✓	✓	✓	MassDEP		✓	✓	Up to 60% of EVSE hardware and installation costs[8]	First-come, first-serve	60% of EVSE installation costs for vehicle EVSE
MOR-EV Trucks				✓	MA DOER	✓			$7,500 - $90,000 per BEV vehicle over 8,501 GVWR (lbs.)[9]	First-come, first-serve	$7,600 for vans, $15,000 for medium-duty vocational trucks,
Green Communities Grant Program	✓	✓	✓	✓	MA DOER	✓			BEVs: $7500/purchase or $5000/lease; PHEVs: $5000/purchase or $3000/lease[10]	Block 1: 4/9/21 Block 2: 10/8/21	$7,500 for BEVs and $5,000 for PHEVs purchased in 2021

[7] Current program is open until 3/16/2021, but the Consolidated Appropriations Act passed on 12/22/2020 included reauthorization of the DERA Program through 2024.
[8] MassEVIP EVSE incentives have a limit of $50,000 per site. Since vehicle dwell sites were not provided in Methuen's fleet data, the 20 departments were used instead. This incentive was evenly distributed across applicable vehicles for the 20 sites.
[9] Purchases of BEVs with a sales price of more than $50,000 and having a gross vehicle weight rating (GVWR) of more than 8,500 pounds made on or after 2/16/2021 are eligible for a rebate in the MOR-EV Trucks Program. Rebates vary depending on vehicle GVWR and block schedule.
[10] Additional funds available for charging stations (up to $7,500) but they must be publicly accessible and were excluded from this analysis. Green Communities Grant Program funding may be available in future years, but amounts by year vary.

EV Model Comparison

There are 61 EV models currently offered by state contracts 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 H through Chart L highlight the lowest TCOs for each vehicle type recommended for conversion within your fleet. This analysis is for 1 vehicle for each vehicle type, uses AFLEET assumptions for annual miles and lifespans for each vehicle type, and 50 miles driven per day. 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 H. Sedan EV Model TCO Comparison

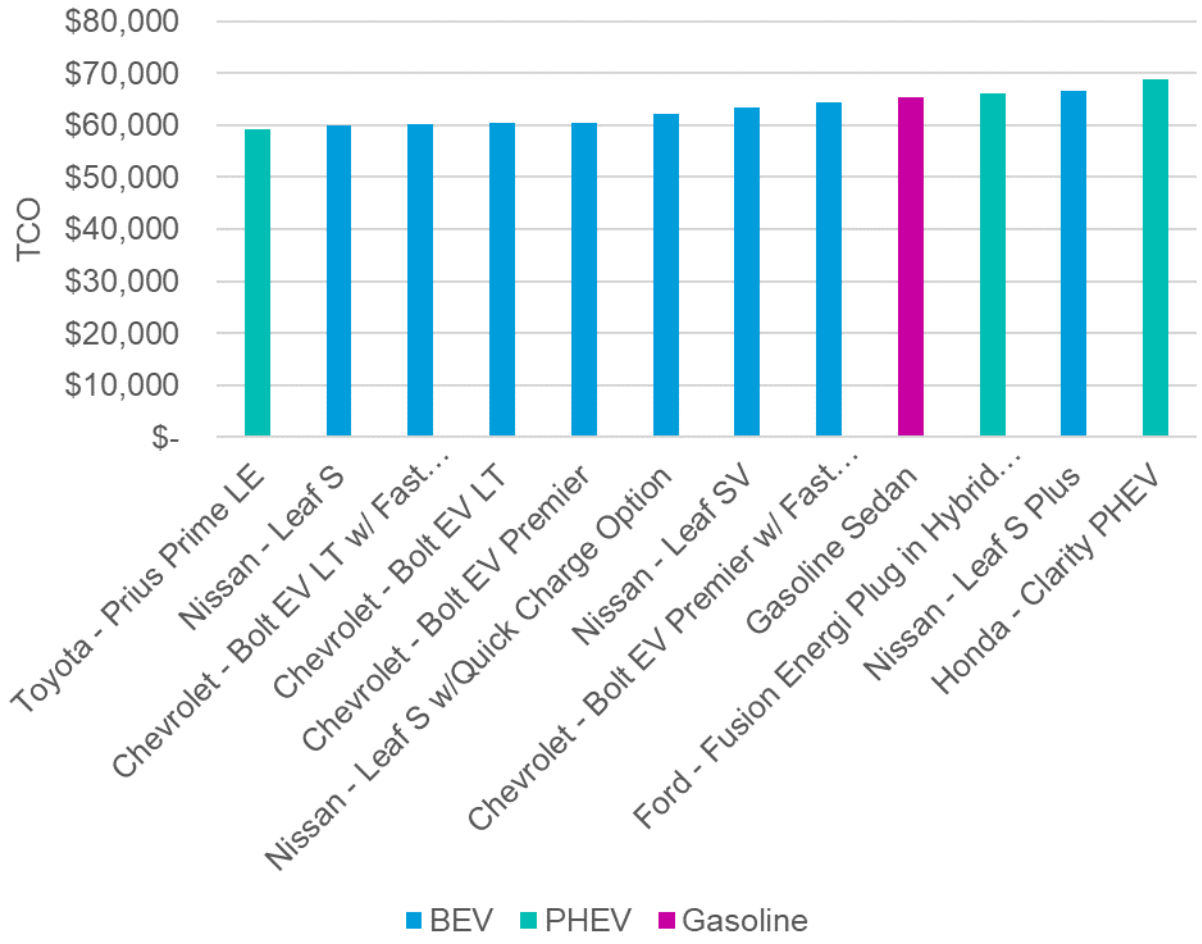


CHART I. SUV EV Model TCO Comparison

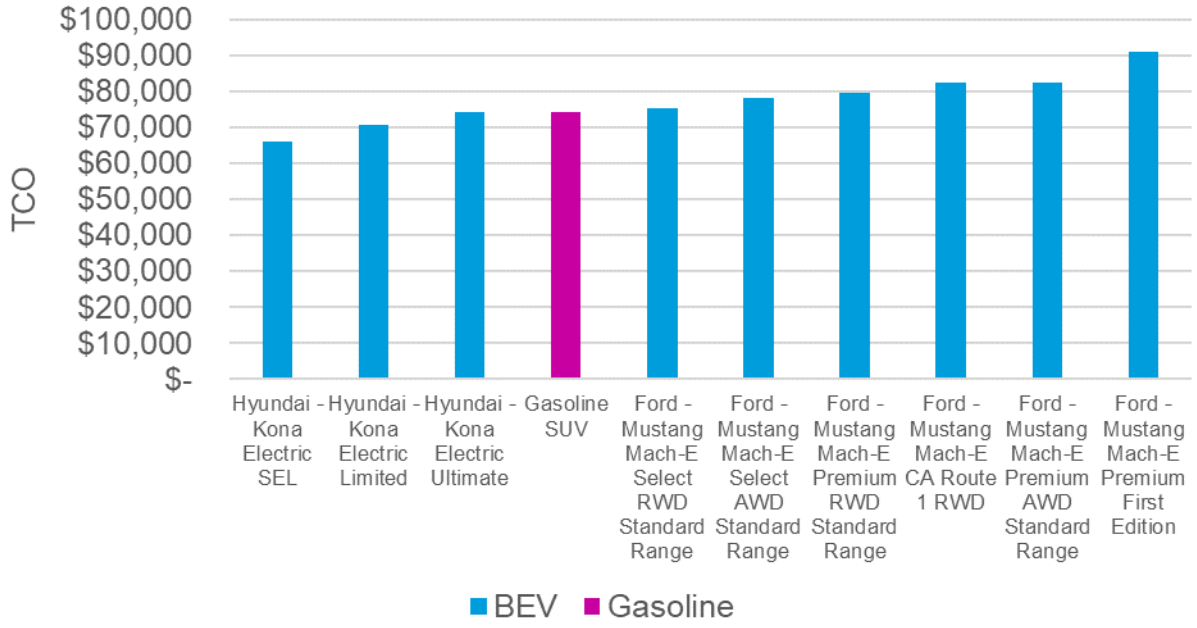


CHART J. Light-Duty Pickup EV Model TCO Comparison

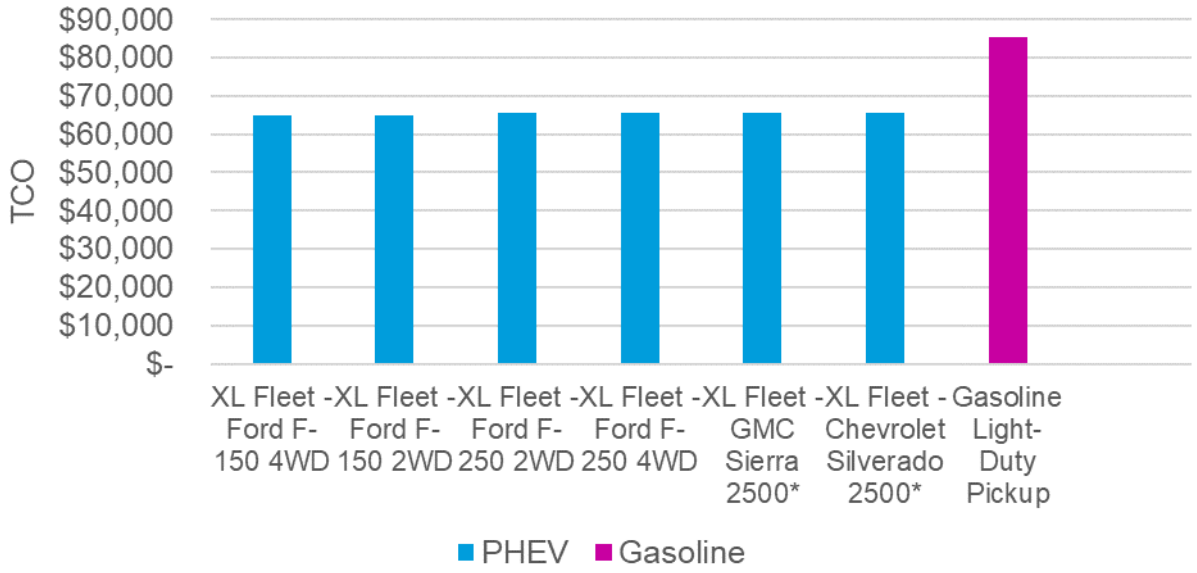


CHART K. Medium-Duty Pickup EV Model TCO Comparison

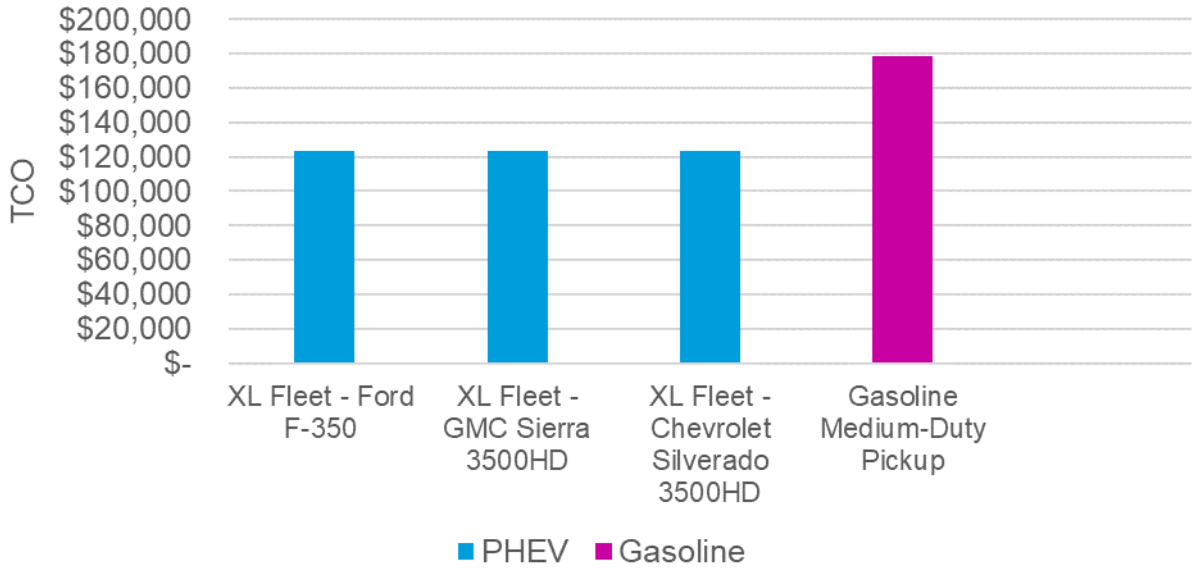
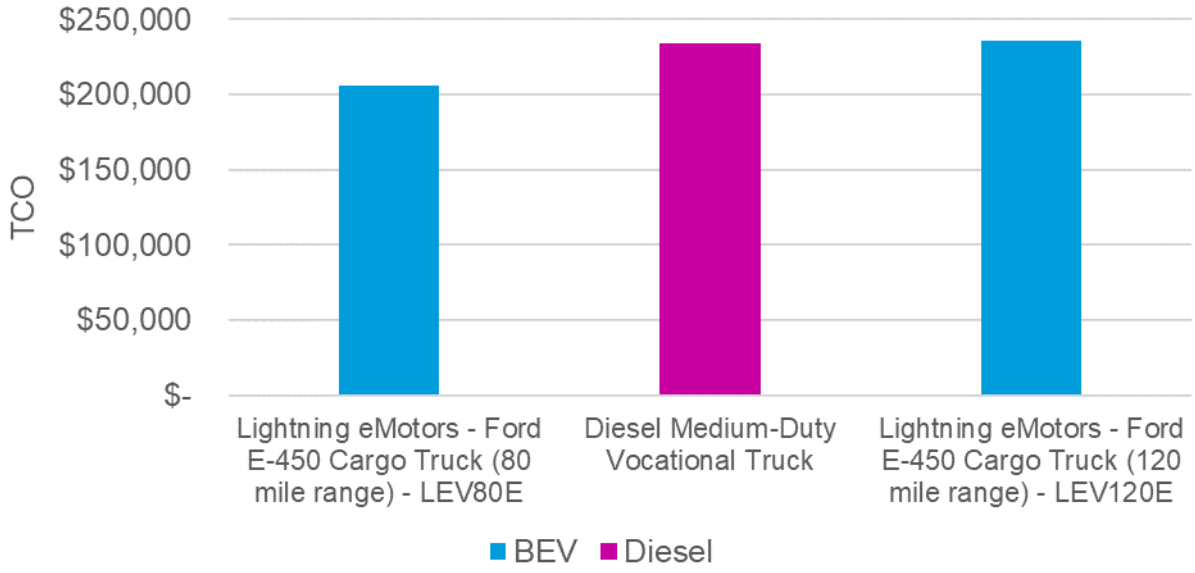


CHART L. Medium-Duty Vocational Truck EV Model TCO Comparison



Electric Motorcycles

While not available through the state contracts, there are several commercially available electric motorcycles for fleet use. There are also police fleets, such as the Los Angeles Police Department in California, piloting electric motorcycles for patrol use. The vehicle capital costs for electric motorcycles range from $9,295 to $29,799, with TCO savings from converting from an ICE motorcycle ranging from $2,957 to $5,143 per motorcycle. While not included in the initial vehicle recommendation analysis, future report updates will include motorcycle TCO analysis. Electric motorcycle manufacturers include:

- Zero
- Harley-Davidson
- Energica
- Brutus

Sample Sedan Financial Analysis

Table E provides a sample TCO comparison for a single, purchased sedan. This analysis uses a 15-year vehicle life and a 12,400 annual mileage assumption.

TABLE E. Sedan TCO Comparison

	Gasoline	PHEV (Toyota Prius Prime LE)	BEV (Nissan Leaf S)
Vehicle Capital Cost	$20,000	$26,450	$28,295
Charging Infrastructure Hardware (L2)	N/A	$3,450	$3,450
Charging Infrastructure Installation	N/A	$6,650	$6,650
Incentives[11]	N/A	($12,070)	($25,100)
Annual Fuel/Energy Costs	$1,164	$542	$632
Annual Maintenance Costs	$1,860	$1,803	$1,651
15-Year Total Costs[12]	$50,439	$49,338	$36,335

Charts M and N provide a visual representation of the annual and cumulative cost comparisons across a gasoline, PHEV, and BEV sedan. The PHEV has a higher upfront cost than both the gasoline and BEV options because the available incentives only partially cover the charging infrastructure costs. The EV options have higher upfront capital costs, but the maintenance and fuel cost savings of the BEV make up for this resulting in an overall lower TCO when compared to the gasoline vehicle.

[11] Assumes MassEVIP Vehicle Incentive ($7,500 per BEV, $5000 per PHEV), MassEVIP EVSE Incentive (60% of EVSE hardware costs), Green Communities ($7,500 per BEV, $5000 per PHEV), and National Grid Electric Vehicle Charging Station Program (100% of BEV EVSE installation costs). EV capital and infrastructure costs shown in table does not have incentives applied.
[12] NPV assumes a 5% discount rate.

CHART M. Sedan 15 Year Cumulative Cost Comparison

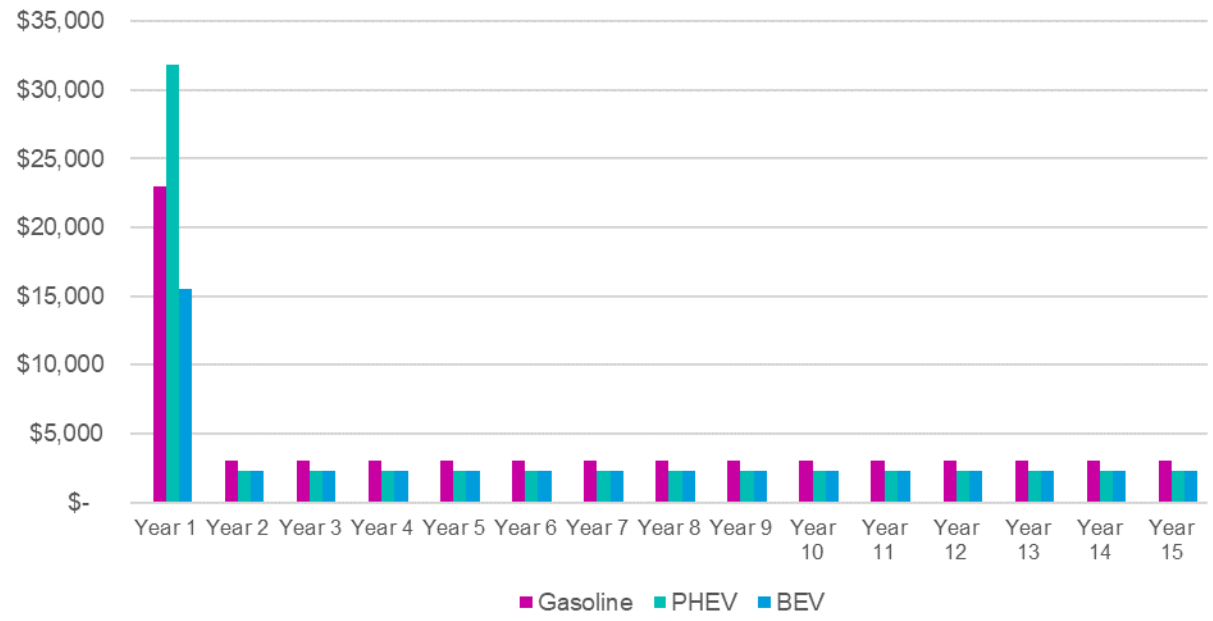
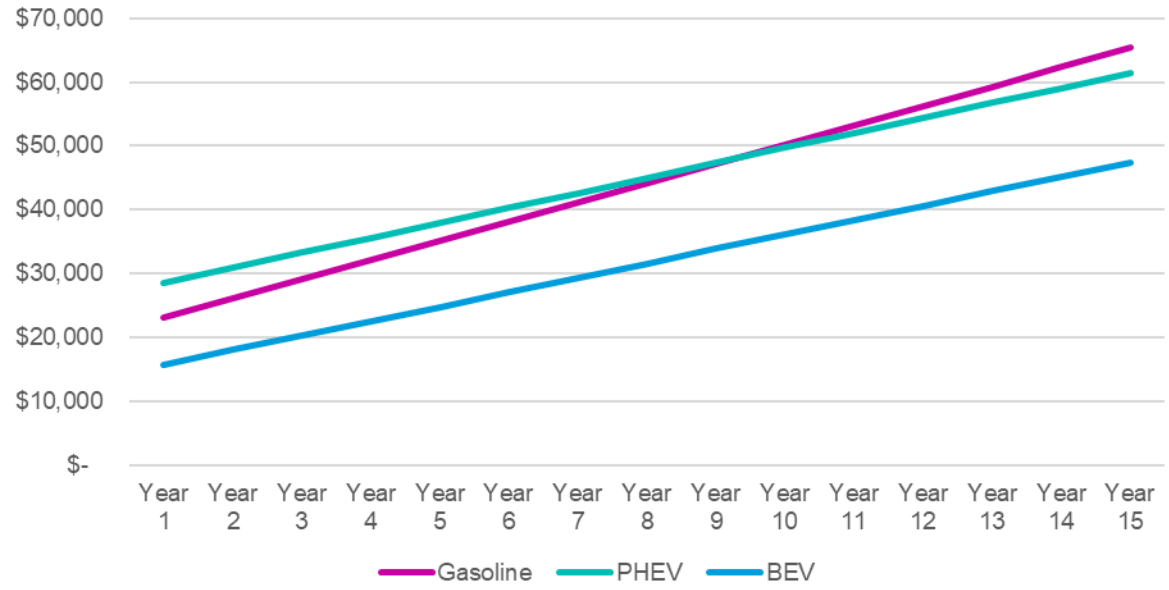


CHART N. Sedan 15 Year Cumulative Cost Comparison



Sample SUV Financial Analysis

Table F provides a sample TCO comparison for a single, purchased SUV. This analysis uses a 15-year vehicle life and a 13,000 annual mileage assumption. While there are PHEV SUVs commercially available, the state contracts currently only offers BEV SUV options.

TABLE F. SUV TCO Comparison (Purchased)

	Gasoline	BEV (Hyundai Kona Electric)
Vehicle Capital Cost	$27,500	$37,495
Charging Infrastructure Hardware (L2)	N/A	$3,450
Charging Infrastructure Installation	N/A	$6,650
Incentives[13]	N/A	($25,100)
Annual Fuel/Energy Costs	$1,591	$597
Annual Maintenance Costs	$1,963	$1,743
15-Year Total Costs[14]	$80,811	$45,714

Charts O and P provide a visual representation of the annual and cumulative cost comparisons across a purchased gasoline and BEV SUV. Both have high initial capital costs in year 1, with incentives playing a role in reducing BEV costs, but the BEV fuel and maintenance savings result in a lower overall TCO by year 2.

[13] Assumes MassEVIP Vehicle Incentive ($7,500 per BEV), MassEVIP EVSE Incentive (60% of EVSE hardware costs), Green Communities ($7,500 per BEV), and National Grid Electric Vehicle Charging Station Program (100% of BEV EVSE installation costs). EV capital and infrastructure costs shown in table does not have incentives applied.
[14] NPV assumes a 5% discount rate.

CHART O. SUV 15 YEAR Cumulative Cost Comparison

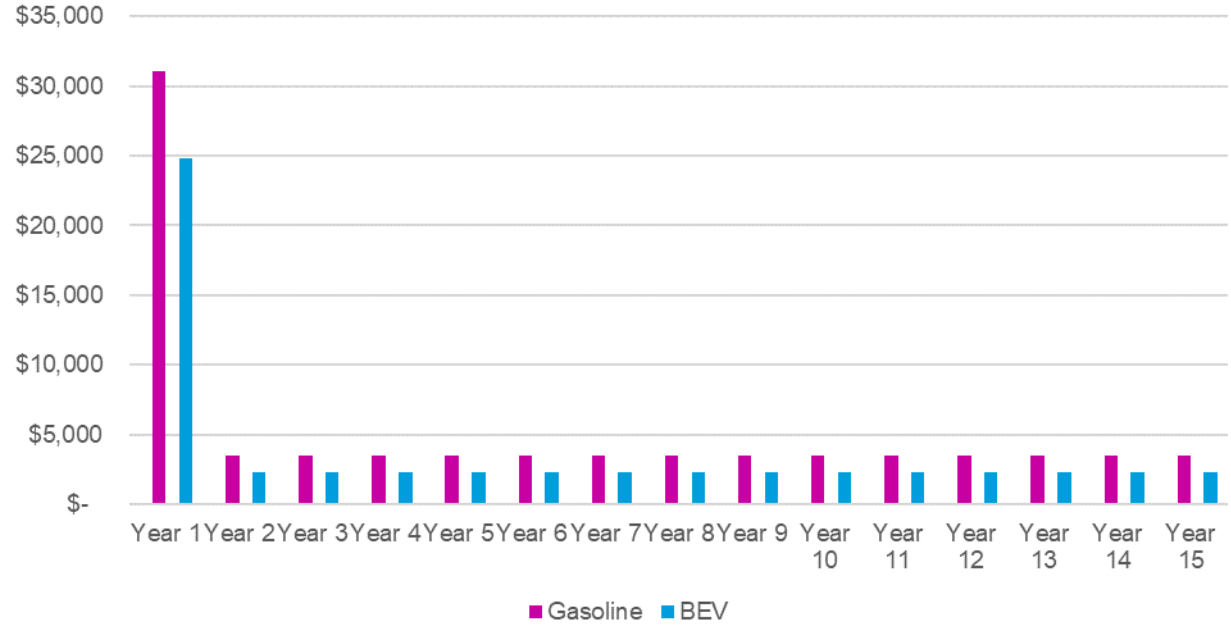
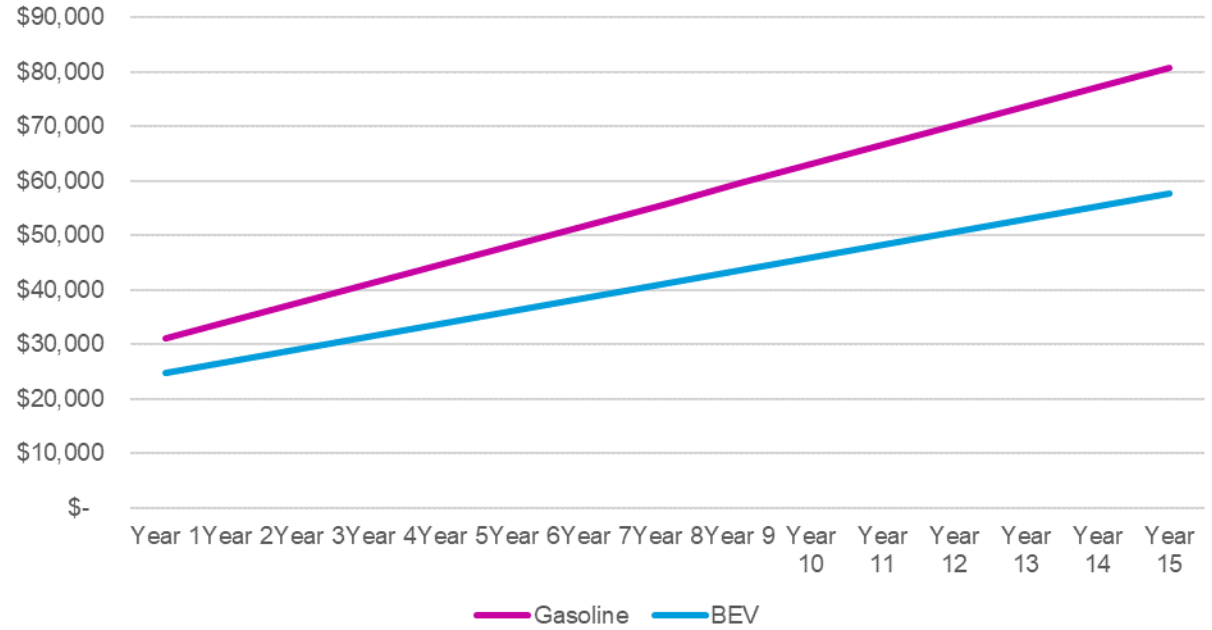


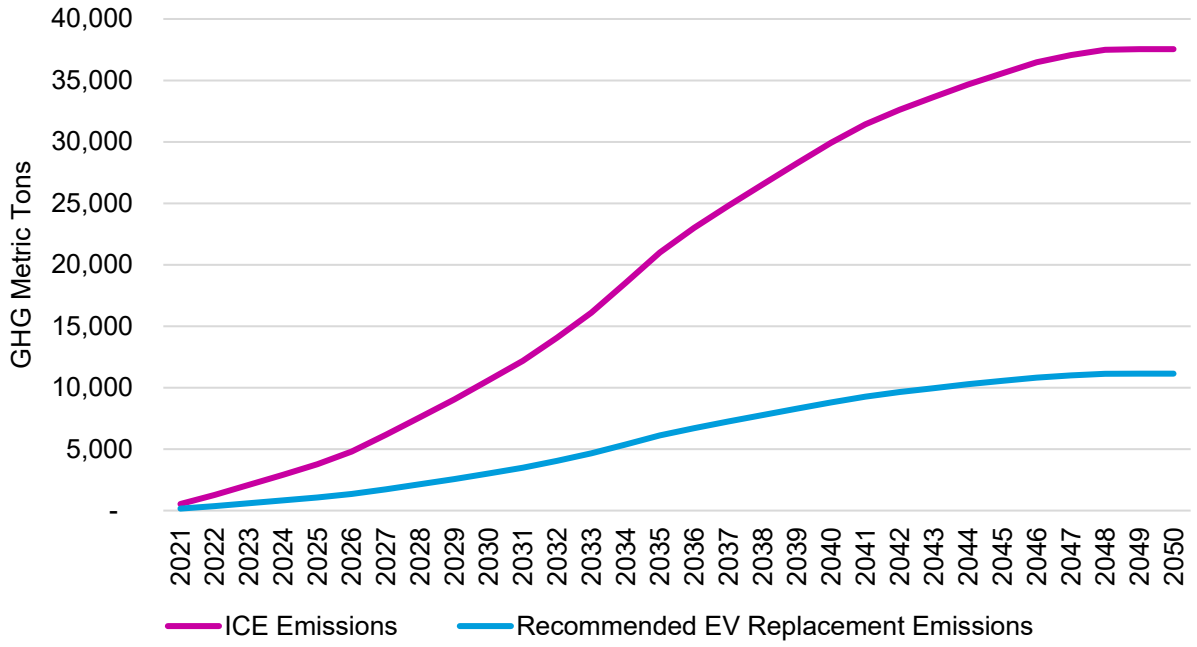
CHART P. SUV 15 YEAR Cumulative Cost Comparison



Fleet Environmental Impact Analysis

By converting the 83 recommended vehicles to EVs you could reduce GHG emissions by 13,117 MT and NOx emissions by 34,849 pounds (lbs) over 30 years. Chart Q 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. Q Cumulative Fleet Green House Gas Emissions



13,117 GHG Emission Reductions (MT over 30 years)

2,833 Equivalent to removing passenger vehicles from the road for one year

34,849 NOx Emission Reductions (Lbs. over 30 years)

216,424 Equivalent to tree seedlings grown for 10 years

Non-Road Equipment

There are 33 vehicles in Methuen's fleet identified as non-road equipment, summarized in Table G below. Of these vehicle types, 3 were identified with commercially available electric alternatives: forklifts, all-terrain vehicles (ATVs), and mowers. Electric non-road equipment could help Methuen further reduce fuel costs, maintenance costs, and site emissions.

The fuel type of the existing forklift was not provided, but the vehicle make was listed as "Big Joe," a manufacturer only makes manual or electric lifts. As such, we assumed it was not a candidate for an electric replacement.

TABLE G. Non-Road Equipment

Vehicle Type	Quantity	Quantity Recommended to Convert to Electric	Vehicle Type	Quantity	Quantity Recommended to Convert to Electric
Light Tower	3	N/A	Stumper	3	N/A
Motorhome	2	N/A	Boat	2	N/A
Chipper	2	N/A	Hot Box	2	N/A
Signboard	2	N/A	VAC	2	N/A
Snow Groomer	2	N/A	Welder	2	N/A
Roller	2	N/A	Log Splitter	2	N/A
Pump	1	N/A	**Forklift**	1	N/A
Grader	1	N/A	**ATV**	1	1
Mixer	1	N/A	**Mower**	1	1

ATVs

Methuen's current ATV is a 2016 diesel powered KUBOTA RTV-X900. We recommend Methuen explore electric ATV options when looking to replace this ATV. Electric ATVs are cost competitive with diesel ATVs, as seen in Chart J, and can help reduce fuel and maintenance costs by up to 60%. In the sample ATV TCO Comparison shown in Table H, the electric ATV results in an overall $9,822 TCO savings.

Chart J. Comparable ATV Capital Costs

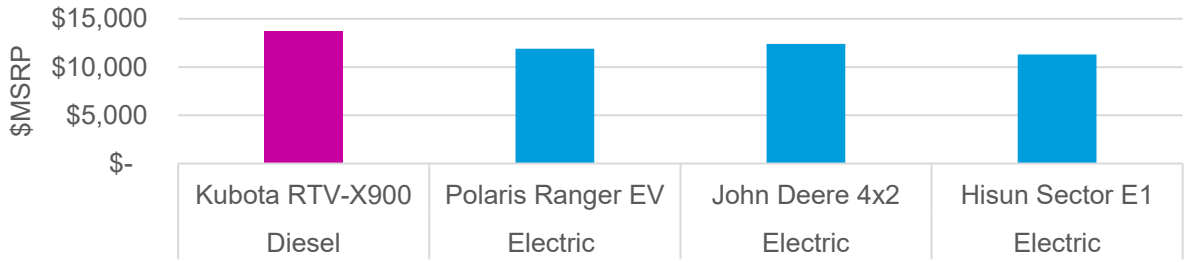


TABLE H. ATV TCO Comparison

	Diesel	Electric
Capital Cost	$13,700	$11,900
Annual Fuel/Energy Costs	$1,700	$850
Annual Maintenance Costs	$500	$300
10-Year Total Costs[15]	$30,035	$20,213

Mowers

Methuen's current mower is a 1990 Kubota. While the fuel or model type was not identified, it is assumed this is a gas or diesel commercial lawn mower which could be replaced with an electric mower. A high-user commercial lawn mower can consume more fuel than a typical car.[16] Electric mowers are quiet, require little maintenance, and produce no site emissions. Some electric mower examples include Ariens AMP Rider (MSRP $2,329) and Hustler Turf's Zeon (MSRP $6,999).

[15] NPV assumes a 5% discount rate.
[16] Clean Cities Guide to Alternative Fuel Commercial Lawn Equipment

Next Steps

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

☐ **Explore Resources for Electrifying.**
Log onto the MA Fleet Advisory Services Program's online portal 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.

Your Fleet Advisory Portal has the tools you need to succeed.

Log in at www.FleetAdvisoryMA.NationalGrid.com and you can:

- See your MA Fleet Advisory Services reports
- 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: www.FleetAdvisoryMA.NationalGrid.com

Email: FleetAdvisoryMA@icf.com

Phone: 617-218-2100

Appendix A: TCO Procurement Comparison

The comparison below highlights the potential impacts of looking at vehicle procurement options outside of the state contracts. Your Account Manager is here to help you navigate independent purchasing and connect you to helpful resources to explore these options.

Recommendation impacts using the available state contracts for vehicle procurement:

83
Vehicles converted over **15** years

$1,462,656
TCO savings over **30** years*

$2,006,109
fuel cost savings over **30** years*

$2,473,503
maintenance savings over **30** years

13,117
metric tons (MT) of CO_2 eliminated over **30** years

Recommendation impacts using purchasing options outside of state contracts for vehicle procurement:

95
Vehicles converted over **15** years

$2,879,662
TCO savings over **30** years*

$3,620,818
fuel cost savings over **30** years*

$2,558,774
maintenance savings over **30** years

26,281
metric tons (MT) of CO_2 eliminated over **30** years

* NPV assumes a 5% discount rate.

Appendix B: Frequently Asked Questions

Will additional training be needed for our drivers or maintenance staff?
Driving an EV is very similar to an internal combustion engine, 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. The MA Fleet Advisory Services Program portal (*www.FleetAdvisoryMA.NationalGrid.com)* provides training materials to help address your needs.

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 New England, 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 (i.e., temperatures not often seen in Massachusetts).

How long do EVs last?
A manufacturer's warranty of an 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 National Grid EV Implementation Team, to better understand the costs of upgrades. We will also estimate the cost of charging infrastructure in the TCO calculation in this report.

Which Massachusetts fleets have gone electric and what funding did they receive?
The MA Fleet Advisory Services Program portal (*www.FleetAdvisoryMA.NationalGrid.com)* provides links to case studies of EV fleet deployment in Massachusetts. If you would like additional or more specific examples, please contact your Account Manager.

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. You and your Account Manager will develop a schedule for report refreshes over the next few years, as more funding and vehicle models become available.