NORTH CAROLINA'S STATE FLEET TOTAL COST OF OWNERSHIP SAVINGS ANALYSIS

Total Cost of Ownership analysis for state fleet vehicles

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Executive Summary

North Carolina can save millions of dollars by electrifying half of its fleet by 2030. As of August 2024, the state fleet comprised nearly 8,000 light- and medium-duty vehicles (Class 1-6). On a total cost of ownership (TCO) basis, approximately 3,852 vehicles in the fleet can be cost-effectively electrified by 2030, achieving nearly $19 million in savings between 2025 and 2030 on a net present value basis, averaging just under $8,200 in savings per vehicle. Immediate opportunities exist to begin this transition. In 2025, 1,367 vehicles, 17 percent of the fleet, can be cost-effectively electrified, and an additional 2,485 vehicles, 31 percent of the fleet, can be cost-effectively electrified by 2030, driven largely by electric vehicle (EV) technology.

The potential for cost savings varies by vehicle type, with sedans and minivans offering the greatest potential savings from electrification, due primarily to these vehicles' high mileage and lower upfront costs. Table 1 shows how many vehicles North Carolina could electrify by 2030 if they replace vehicles with EVs when it becomes economically advantageous to do so and when vehicles are slated for replacement based on current fleet turnover schedules. The table also presents the TCO for each vehicle type on a net present value basis and the total savings achieved through electrification.

Table 1: Fleet Savings from Electrification by Vehicle Type

Vehicle Type	Total Vehicles in Fleet	Total Vehicles with EV Savings	Total Net Present Value Savings by Vehicle Type (million $)	Average Savings by Vehicle Type ($)
Sedan	3,975	3,017	$14.93	$4,949.40
SUV	2,185	182	$0.64	$3,557.03
Minivan	832	453	$1.37	$3,017.16
Pickup Truck	761	110	$0.34	$3,085.80
Vans and Cargo Vans	89	51	$1.57	$30,764.87
Other Vehicle Types	128	39	$0.14	$3,698.54

Vehicle Type	Total Vehicles in Fleet	Total Vehicles with EV Savings	Total Net Present Value Savings by Vehicle Type (million $)	Average Savings by Vehicle Type ($)
(Hatchbacks, Crossover)[1]				
Total	7,970	3,852	$18.99	$8,178.80

These findings show that North Carolina can save money by electrifying half of its state fleet. By prioritizing cost-effective vehicles, the state can lower operating costs and save taxpayer dollars. Immediate action would provide substantial savings, and future EV technology advancements will offer more opportunities. This strategic approach ensures fiscal responsibility and operational efficiency.

Background and Methodology

For many public fleets, the potential to enhance operations and save taxpayers' dollars has spurred increased interest in understanding the total cost of ownership (TCO) of different vehicles. TCO is a comprehensive measure that aims to account for all expenses associated with purchasing and operating a vehicle over its useful life. This includes initial purchase price, fuel costs, maintenance expenses, charging infrastructure, and residual value at the end of the vehicle's life.

EVs can present a lower TCO compared to their ICE counterparts due to several factors:

- **Lower fuel costs**: Electricity is generally less expensive than gasoline or diesel on a per-mile basis.
- **Reduced maintenance costs**: EVs have fewer moving parts than ICE vehicles, resulting in lower maintenance and repair costs.
- **Incentives and tax credits**: Federal tax credits can reduce the upfront cost of EVs, improving their overall economic appeal.

[1] Due to limitations of the DRVE tool, crossovers and hatchbacks were identified by VINs and listed separately to avoid categorization errors.

This study evaluates the potential for North Carolina to save money by electrifying its fleet. For each vehicle in the fleet that is due for replacement, the study compares the TCO of a replacement ICE vehicle with the TCO of a comparable replacement EV. The study then quantifies the total savings North Carolina could achieve by choosing EV replacements whenever the TCO is at least five percent lower than the TCO of the ICE vehicle. To do this analysis, Atlas Public Policy (Atlas) used actual fleet Vehicle Identification Numbers (VINs) and annual vehicle miles traveled (VMT) from North Carolina's state fleet as inputs in a TCO calculation tool developed by Atlas and the Electrification Coalition called the Dashboard for Rapid Vehicle Electrification (DRVE).[2]

This study follows North Carolina's existing replacement schedule of eight years or 100,000 miles to identify which vehicles were due for replacement in each year considered in the analysis (2025 – 2030). For each year and for each vehicle due for replacement, the study assesses whether it is economically beneficial to electrify that vehicle on a TCO basis during that year. A vehicle is considered cost-effective to electrify if it demonstrates TCO savings greater than five percent compared to its ICE counterpart. Additional inputs and assumptions are listed and described in *Appendix A*.

Overall Findings

The analysis identified substantial savings opportunities for North Carolina's state fleet by transitioning half of fleet vehicles to EVs, mainly driven by operational savings and declining EV costs over time. Of the 7,970 vehicles analyzed, approximately 3,852 vehicles, 48 percent of the fleet, can be cost-effectively electrified by 2030, resulting in cumulative savings of about $19 million from 2025 to 2030 on a net present value basis, averaging nearly $8,200 in savings per vehicle.

The economic feasibility of electrifying both light- and medium-duty vehicles improves further in later years, due to anticipated cost reductions. Declines in EV purchase prices are expected as battery technology advances and manufacturing efficiencies increase, creating more affordable options in harder to electrify vehicle segments. Additionally, rising gasoline and diesel costs and ongoing maintenance savings enhance EVs' TCO advantage over ICE vehicles as vehicles accumulate mileage. See *Appendix A* for details on the inputs and assumptions used in this analysis.

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[2] For more information on how the DRVE tool was in this analysis, see https://atlaspolicy.com/dashboard-for-rapid-vehicle-electrification-drve.

Table 2 provides a detailed look at fleet savings by vehicle type. It shows how many vehicles North Carolina could electrify by 2030 based on economic advantages and current replacement schedules. The table also includes the total cost of ownership and net present value savings from electrification.

Table 2. Fleet Savings from Electrification by Vehicle Type

Vehicle Type	Total Vehicles in Fleet	Total Vehicles with EV Savings	Total Net Present Value Savings by Vehicle Type (million $)	Average Savings by Vehicle Type ($)
Sedan	3,975	3,017	$14.93	$4,949.40
SUV	2,185	182	$0.64	$3,557.03
Minivan	832	453	$1.37	$3,017.16
Pickup Truck	761	110	$0.34	$3,085.80
Vans and Cargo Vans	89	51	$1.57	$30,764.87
Other Vehicle Types (Hatchbacks, Crossover)[3]	128	39	$0.14	$3,698.54
Total	7,970	3,852	$18.99	$8,178.80

Savings by Vehicle Type

The potential cost savings from electrification varies by different vehicle type due to vehicle usage patterns, initial purchase costs, maintenance expenses, and fuel economy. Nearly all the sedans in North Carolina's fleet can be cost-effectively electrified at their first replacement opportunity. This is largely due to the mature and scaled EV market in the sedan segment. SUVs and pickups currently face higher initial costs and fewer affordable

[3] Due to limitations of the DRVE tool, crossovers and hatchbacks were identified by VINs and listed separately to avoid categorization errors.

EV options, making them less cost-effective to electrify early on. The analysis shows that, as technology advances and production costs decrease over time, there will be an increase in the cost-effectiveness of electrifying these vehicles. Table 3 summarizes the number and percentage of vehicles that are cost effective to electrify by 2030 as well as the potential lifetime savings from electrification, for each vehicle type. This section provides additional details about what factors are driving the potential savings from electrification for each vehicle type.

Table 3: Electrification Savings by 2030 by Vehicle Type

Vehicle Type	Total Vehicles with EV Savings	Total Vehicles in the Fleet	Percent of Vehicle Type with EV Savings	Average Percent Lifetime Savings
Sedans	3,017	3,975	76%	13%
Minivans	453	832	54%	7%
Pickups	110	761	14%	6%
SUVs	182	2,185	8%	8%
Medium-Duty Vans	51	89	57%	32%

Sedans

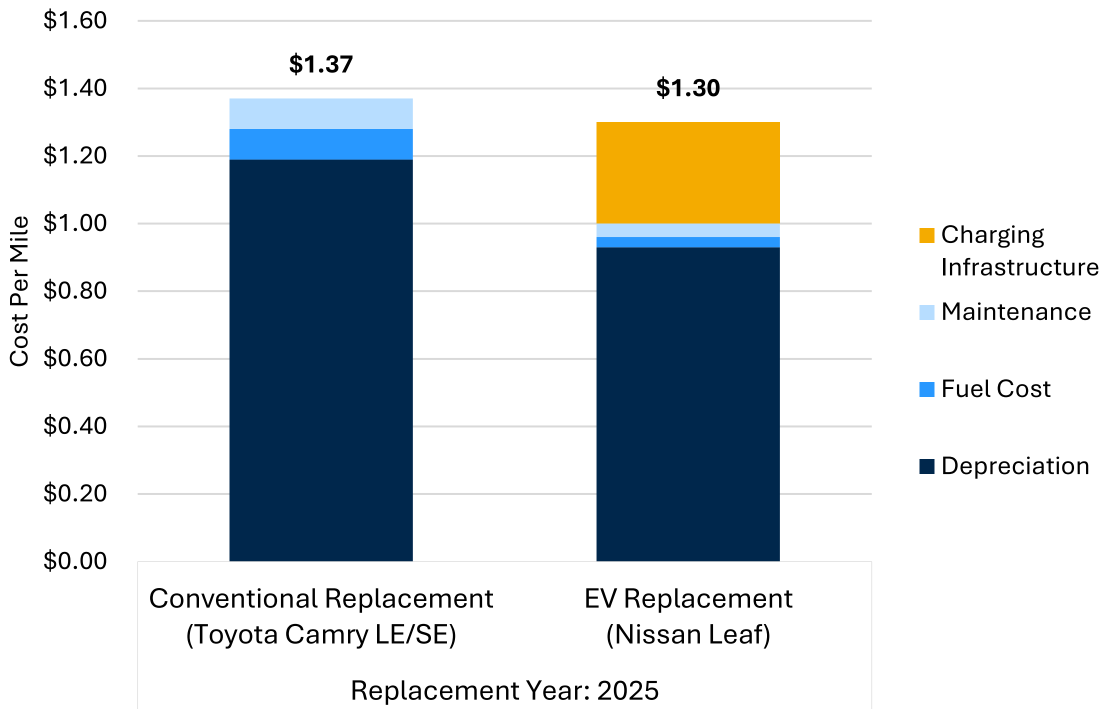
Sedans stand out as the most favorable category for electrification within the fleet. With 3,017 vehicles (76 percent) identified as cost-effective to replace with electric models, sedans offer the second highest lifetime average savings at 13 percent. Several factors contribute to this favorable outcome. These factors are listed below and shown in Figure 1, which compares the cost per mile of the most common sedan in the fleet, the Toyota Camry, with a comparable EV alternative.

- **Competitive Upfront Costs**: The price gap between EVs and their conventional counterparts is narrowing, especially in the sedan category. For example, the electric alternative to the most common sedan in the fleet – the Nissan Leaf – has an upfront purchase price of $27,283. This price is only $1,144 more than the conventional replacement's price of $26,139. When including the 45W Tax Credit, the

Nissan Leaf purchase price drops to $24,677. This relatively small difference in purchase price makes the initial investment more attractive.

- **High Utilization Rates**: Sedans in the fleet often have high annual mileage, averaging 10,687 miles per year, which makes maximizing fuel cost savings from cheaper cost of electricity more attractive.
- **Reduced Maintenance Expenses**: Electric sedans have lower maintenance costs due to factors such as the absence of oil changes, spark plugs, and other ICE-specific components.
- **More Mature Market Segment**: The electric sedan market has been active for more than a decade, allowing automakers to benefit from economic savings more by improving manufacturing processes.

Figure 1. Comparative Cost per Mile for Replacement of Toyota Camry by Cost Category



This figure compares the cost per mile, by cost category, for an electric and ICE replacement for the most common sedan in North Carolina's fleet, the Toyota Camry. Calculations are based on average annual VMT for all Toyota Camrys in the fleet, 10,031 miles per year.

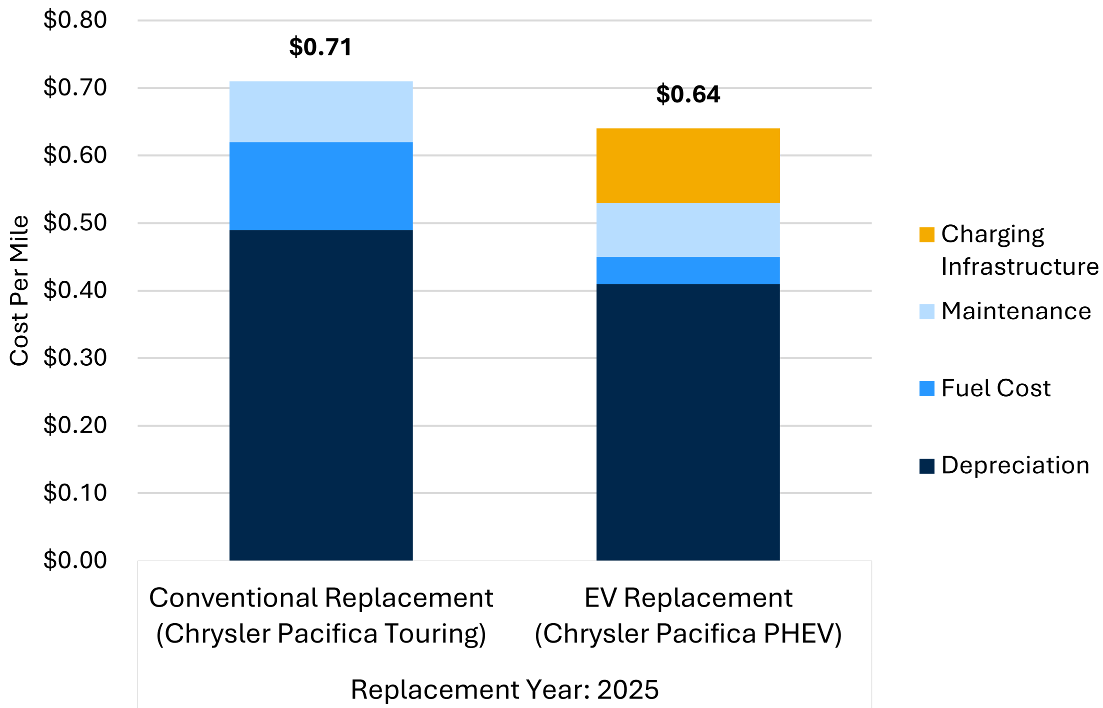
Minivans

Electrifying 453 minivans, 54 percent of the minivans in the fleet, can lead to an average lifetime cost savings of seven percent. Figure 2 compares the cost per mile, by cost category, for electric and ICE replacements for a Dodge Grand Caravan, the most common minivan in the fleet, using the average annual VMT for Dodge Grand Caravans in the fleet. Key factors influencing the cost-effectiveness of electrifying minivans are below.

- **Moderate Initial Costs**: The price gap between electric minivans and their conventional counterparts is moderate. The EV alternative used in the analysis for minivans, the Chrysler Pacifica Plug-in Hybrid, has an upfront cost premium of only $1,456 compared to the gasoline-powered Chrysler Pacifica.
- **Operational Efficiency**: Minivans in the fleet average 10,331 miles per year, or less than 45 miles per day.[4] Much of this daily mileage is within the Pacifica electric-only range of 32 miles.
- **Maintenance Savings**: North Carolina's procurement contract does not include any fully electric minivans, so a PHEV was used for this analysis. While PHEVs have similar maintenance requirements to those of conventional vehicles, their parts last longer before needing replacement due to features such as regenerative braking.

[4] Assuming an average state agency work year of 249 days excluding weekends and federal holidays.

Figure 2. Comparative Cost per Mile for Replacement of Dodge Grand Caravan by Cost Category



This figure compares the cost per mile, by cost category, for an electric and ICE replacement for the most common minivan in North Carolina's fleet, the Dodge Grand Caravan. Calculations are based on average annual VMT for all Dodge Grand Caravans in the fleet, 9,708 miles per year.

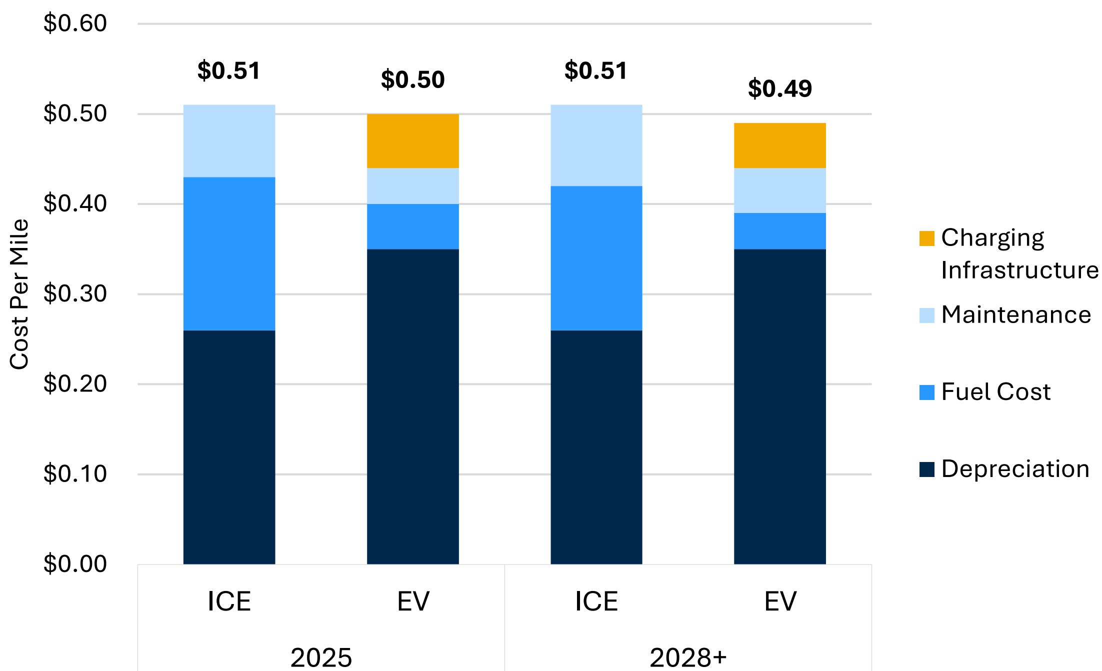
Light-Duty Pickups

Among light-duty pickups, 110 vehicles, 14 percent of the light-duty pickups in the fleet, are cost advantageous to electrify by 2030, offering an average lifetime savings of six percent. Figure 3 compares the cost per mile, by cost category, for the electric and ICE replacements for a Chevrolet Silverado, the pickup truck with the highest average VMT in the fleet, using average annual VMT for all Chevrolet Silverado's in the fleet. Below is a description of factors affecting the cost-effectiveness of electrification for light-duty pickups.

- **High Upfront Costs in Early Years**: Most pickups under current cost scenarios are ineffective to electrify, due to high initial purchase prices and high depreciation costs.[5] An example of those that currently are cost-effective to electrify is shown in Figure 3.

- **Anticipated Cost Reductions**: A growing market for electric pickups is expected that will continue to reduce the purchase price over time, improving their cost-effectiveness.
- **Fuel and Maintenance Savings**: Electric pickups offer significant operational savings due to lower fuel and maintenance expenses.

Figure 3. Comparative Cost per Mile for Replacement of Chevrolet Silverado by Cost Category



This figure compares the cost per mile, by cost category, for the Ford F-150 Lightning and the Chevrolet Silverado, using average annual VMT for all Chevrolet Silverado's in the fleet. The replacement vehicles modeled are the Chevrolet Silverado 2WD (ICE) and the Ford F-150 Lightning 4WD (EV). While the Ford F-150 Lightning has an upfront purchase premium of nearly $1,500 including tax credits and a higher depreciation cost, the high number of miles driven by these pickups (nearly 15,000 per year) makes the EV more cost effective.

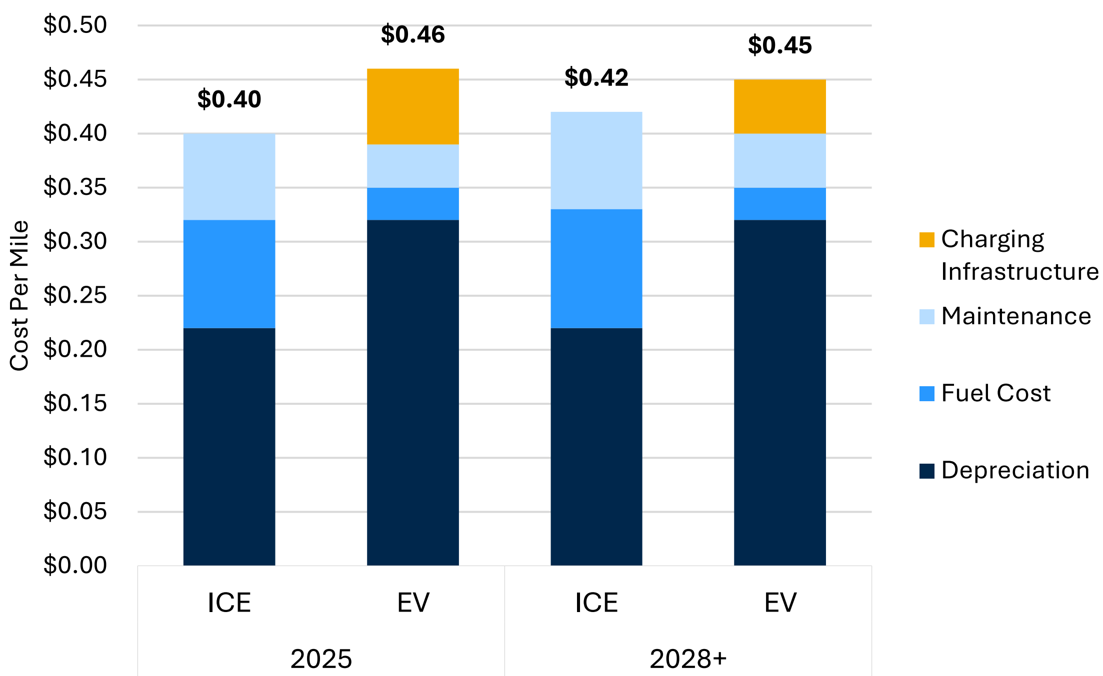
[5] Both ICE and EV pickup trucks have higher depreciation costs than other vehicle types in the fleet due to higher initial purchase prices.

SUVs

Electric SUVs have the lowest fleet electrification potential among light-duty vehicles, with only 182 vehicles, eight percent of the SUVs in the fleet, being cost-effective to electrify at an average lifetime savings of eight percent. In 2025, only about six percent of the SUVs due for replacement were cost-effective to electrify, rising to 16 percent by 2028. The factors that make SUVs less cost-effective to electrify than other vehicle types are listed and described in more detail below. Figure 4 compares the cost per mile, by cost category, for electric and ICE replacements for a Chevrolet Traverse, the most common SUV in the fleet, using the average annual VMT for all Chevrolet Traverse SUVs in the fleet of 17,761 miles.

- **Higher Initial Purchase Prices**: Due to the limited number of EVs in the state’s purchasing contract to select from, the current EV replacement has an upfront cost premium of over $13,500 compared to its ICE counterpart. More affordable electric SUVs—some initially priced around $4,000 to $14,000 lower than current SUVs available in the state procurement contract—do exist in the market. While exact procurement prices may differ from the current MSRP, expanding the state’s available EV offerings could cut upfront costs. See *Opportunities for Further Savings* for details.
- **Delayed Cost-Effectiveness**: Anticipated advancements in EV technology and reductions in vehicle costs during later years (2028+) are expected to improve their cost-effectiveness.
- **Impact of Vehicle Usage**: SUVs with higher annual VMT—on average 13,000 miles or more—are more likely to yield cost savings when electrified. Increased use boosts fuel and maintenance savings, improving the TCO for an EV.

Figure 4. Comparative Cost per Mile for Replacement of Chevrolet Traverse by Cost Category



The replacement vehicles modeled in Figure 4 are the Chevrolet Equinox (ICE) and the Ford Mustang Mach-E (EV). Roughly one out of every four vehicles in the state fleet are Chevrolet Traverses, the most common SUV in the fleet.

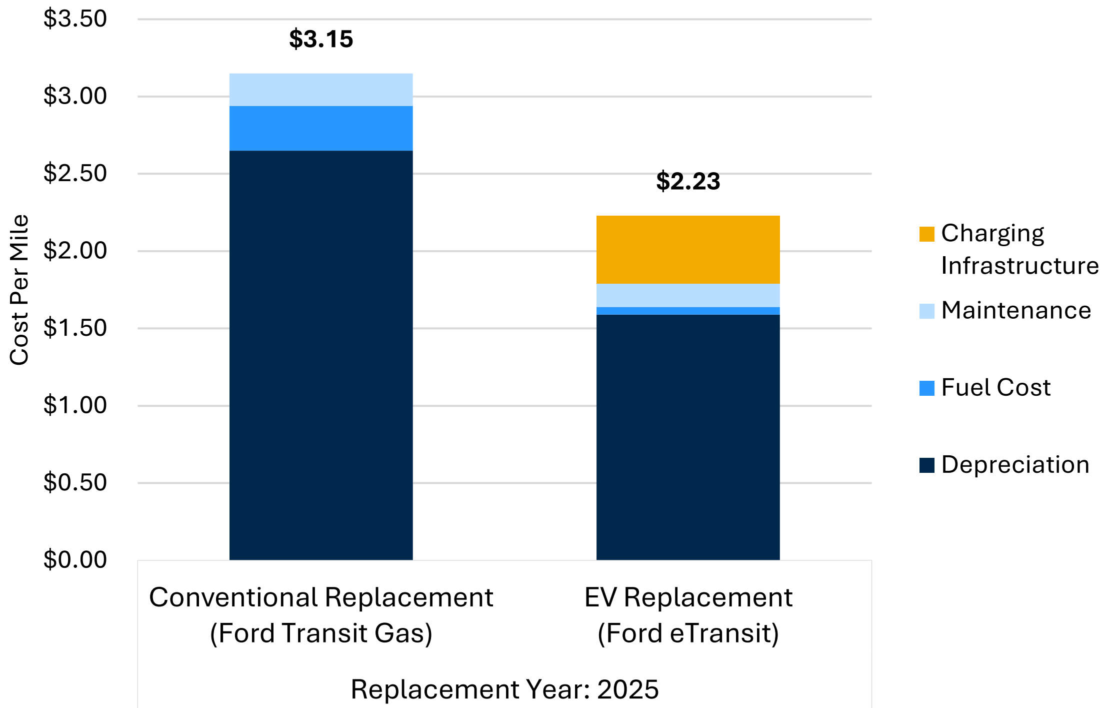
Medium-Duty Vans

The analysis identified 51 vans, representing 58 percent of the medium-duty van fleet, that can be cost-effectively replaced with electric models, offering an average lifetime savings of 33 percent. Figure 5 compares the cost per mile, by cost category, for electric and ICE replacements for a Ford Transit van, the most common van in the fleet, using the average annual VMT for all Ford Transit vans in the fleet. Key factors contributing to the potential savings from electric medium-duty vans are described below.

- **High Operational Mileage**: Medium-duty vans often accumulate substantial annual mileage. Higher usage amplifies the benefits of lower fuel and maintenance costs associated with EVs.
- **Competitive Operational Costs**: Electric vans benefit from reduced energy costs per mile and lower maintenance expenses due to simpler mechanical systems and regenerative braking.

- **Market Availability**: There is an increasing availability of electric van models suitable for medium-duty applications, providing options that meet operational needs without compromising performance.

Figure 5. Comparative Cost per Mile for Replacement of Ford Transit Cargo Van by Cost Category



This figure compares the cost per mile, by cost category, for an electric and ICE replacement for a Ford Transit van. Calculations are based on average annual VMT for all Ford Transit Vans in the fleet, 9,375 miles per year.

Work Trucks and Vocational Trucks

While electric vans present clear economic benefits, other medium-duty vehicle types face challenges that currently hinder cost-effective electrification. Out of the 130 medium-duty trucks in the fleet, none demonstrated sufficient cost savings to favor EV adoption within the analysis period. Several factors contributing to this outcome are described below.

- **High Upfront Costs**: Electric medium-duty trucks cost more when compared their ICE counterparts. For example, the EV alternative for the widely used Ford F-250, — which makes up nearly 88 percent of the medium-duty pickup trucks cost nearly $100,000 more than the ICE version.

- **Limited Model Availability**: The current market offers a limited selection of electric models suitable for medium-duty work truck applications. This lack of competitive options restricts the potential for cost-effective replacements.
- **Economic Viability**: Due to the substantial initial investment required, medium-duty pickups may not achieve a favorable TCO in the near-term without additional financial support, such as grants or incentives that offset the higher purchase prices.

Opportunities for Further Savings

Opportunities exist for North Carolina to achieve higher savings beyond what is reported in this analysis. This section considers how alternative assumptions and procurement strategies could increase savings from further electrification.

Technological Progress Scenarios

The current analysis assumes "Low Technology Progress" based on conservative technological advancement. However, a "High Technology Progress" scenario, with rapid improvements in battery efficiency and EV cost reductions, could boost fleet electrification potential. Advancements in battery technology, manufacturing, and economies of scale would make more vehicles cost-effective to electrify sooner, offering greater savings and improving operational efficiency.

Procurement Strategies

Including a variety of new and affordable EV models in procurement strategies can save costs. Adding options like the Chevrolet Bolt EUV, Equinox EV, or Silverado EV to state contracts could lead to competitive pricing and lower upfront expenses.

In addition, while analyzing cost-effective vehicle electrification, the state fleet could adopt a broader strategy. By using savings from vehicles with lower total costs of ownership, it can fund electrification for less cost-effective vehicles. This maximizes available funds and positions the fleet for long-term savings and efficiency.

Extended Incentives and Cost Reductions

Continued reductions in EV costs beyond 2030 are expected to yield additional savings. However, the renewal or extension of federal tax credits, such as the 30C (Alternative Fuel Infrastructure Tax Credit) and 45W (Qualified Commercial Clean Vehicle Credit), would further enhance cost-effectiveness by lowering upfront costs for both vehicles and charging infrastructure. This analysis assumes the availability of these federal incentives through 2032. If the 45W or 30C credits are reduced or repealed, vehicle TCOs listed in this report would change.

Cost Effectiveness for EV Adoption

The analysis considered a vehicle to be cost-effective to electrify if its TCO savings were greater than five percent compared to its ICE counterpart. North Carolina might consider vehicles that achieve a savings of less than five percent for electrification on a case-by-case basis to increase savings further. Table 4 shows the number of vehicles that achieved a savings of at least five percent for each time period considered in this analysis as well as the number that achieved savings, but of less than five percent. In particular, for light-duty vehicles, 17 percent of vehicles due for replacement are nearly cost-effective to electrify.

Table 4. Cost Effective Vehicles by Vehicle Segment

	2025 Vehicles	**2025 % of Fleet**[6]	**2026-2030 Vehicles**	**2026-2030 % of Fleet**	**By 2030 Vehicles**	**By 2030 % of Fleet**
Light-Duty - Cost Effective (>5% Savings)	1,355	17.5%	2,446	31.56%	3,801	49.0%
Light Duty - Near Cost Parity (±5% Savings)	258	3.3%	1,109	14.3%	1,367	17.6%

[6] "% of Fleet" in Table 2 represents the percentage of the respective vehicle type (Light-Duty, Medium-Duty) that can be cost effectively electrified.

	2025 Vehicles	2025 % of Fleet[6]	2026-2030 Vehicles	2026-2030 % of Fleet	By 2030 Vehicles	By 2030 % of Fleet
Medium-Duty - Cost Effective (>5% Savings)	12	5.7%	39	18.7%	51	24.4%
Medium-Duty - Near Cost Parity (±5% Savings)	6	2.7%	1	0.5%	7	3.3%

Conclusion

The analysis shows substantial economic benefits for North Carolina's state fleet through strategic electrification. By 2030, about 48 percent of the fleet (3,852 vehicles) can be cost-effectively electrified. This could save nearly $19 million between 2025 and 2030, averaging $8,200 per vehicle. These savings enhance fiscal efficiency and can be reinvested in further improvements or other budgetary needs.

Starting in 2025, about 20 percent of the fleet could be cost-effectively electrified, saving taxpayer dollars quickly. By 2030, North Carolina could electrify up to 49 percent of its light-duty fleet and 24 percent of its medium-duty fleet. These savings come from reduced fuel and maintenance costs, lower operational expenses, and decreasing electric vehicle costs due to technological advancements and market maturity.

Looking ahead, continued advancements in electric vehicle technology are anticipated to further reduce costs and improve performance. As battery technology evolves and manufacturing efficiencies increase, EVs are expected to become even more economically attractive. This fast-moving market progression underscores the importance of an adaptive fleet procurement policy. By staying informed about technological trends and market developments, the fleet can make timely decisions that align with fiscal objectives and operational requirements.

Appendix A: Inputs and Assumptions

Table 5. Fleet Import Inputs

Input Field	Description	Analysis Input
VIN	The Vehicle Identification Number for the vehicle. These VINs will be decoded to determine all information needed about the vehicle make, model, model year, and trim.	VINs were provided by the North Carolina state fleet. Importantly, the state’s fleet composition does not include vehicles Class 6 – 8.
Expected Years of Use	The expected number of years that the replacement vehicle will be in use by the fleet. Lifetime costs including depreciation will be calculated over this time span. Users can use one default value for all vehicles in the fleet or can set it for each vehicle using a column in their input data.	8 years or 100,000 miles.
Annual Vehicle Miles Traveled	The average number of miles the replacement vehicle is expected to be driven per year over its lifetime in the fleet. Users can use one default value for all vehicles in the fleet or can set it for each vehicle using a column in their input data.	The total miles traveled in FY 2023 – 2024 for each vehicle in the fleet file was used, with no adjustments for seasonal or low-mileage vehicles.
Vehicle Location	(Optional) The location where the vehicle is domiciled. This field is used to assess charging needs at specific facilities. This is a plain text field that does not need to be an address.	(N/A for this analysis).
ZIP Code	The ZIP Code where the fleet is domiciled. For fleets that span	ZIP 27601 from Raleigh, North Caolina was used.

Input Field	Description	Analysis Input
	multiple ZIP Codes, the ZIP where the majority of the fleet is located. This field is used to determine default inputs for fuel prices, check the availability of state incentives, and calculate electricity emissions.	

Table 6. Vehicle Inputs

Input Field	Description	Analysis Input
MSRP/Price	The price per vehicle before incentives or financing. If available, the tool will load an estimated price based on the make/model/year selection. It is recommended that users set a custom value based on their fleet's procurement options and/or necessary upfits.	NC State procurement contract vehicle purchase prices will be used. Vehicle purchase price inputs were scaled based on forecasted changes in technology and market conditions for each year of the analysis (2025-2030).
Fuel Economy	The average number of miles driven on one gallon of gas or diesel under city driving conditions. This will be used to calculate fuel use based on vehicle miles traveled. The default value is from www.fueleconomy.gov. This field is not relevant for battery electric vehicles.	Default vehicle fuel economy values were used. Vehicle fuel economy inputs were scaled based on forecasted changes in technology for each year of the analysis (2025-2030).
State Incentive ($/Vehicle)	The total state or local incentives available for the vehicle. This value will be used to reduce the purchase price of the vehicle. Users can load in specific incentive programs during the Fleet Import step or customize values for each replacement vehicle in the Fleet Mapping step.	N/A

Table 7. Market Factor Inputs

Input Field	Description	Analysis Input
Gasoline Price ($/Gallon)	The price of gasoline that is paid for by the fleet. Default gasoline price is the average price for the last year available from the U.S. Energy Information Administration and set based on ZIP code. Some prices are available at the state level, while others are available at the regional level (PADD).	The default price of $3.28/gal was used for this analysis, based on annual retail gas prices for Lower Atlantic (PADD 1C) region. Vehicle fuel price inputs were scaled based on forecasted changes in market conditions for each year of the analysis (2025-2030).
Diesel Price ($/Gallon)	The price of diesel that is paid for by the fleet. Default diesel price is the average price for the last year available from the U.S. Energy Information Administration and set based on ZIP code. Some prices are available at the state level, while others are available at the regional level (PADD).	The default price of $4.21/gal was used for this analysis, was used for this analysis, based on annual retail gas prices for Lower Atlantic (PADD 1C) region. Vehicle fuel price inputs were scaled based on forecasted changes in market conditions for each year of the analysis (2025-2030).
Inflation Rate (Excluding Fuel)	The inflation rate determines the increase in maintenance and other operating costs over time, excluding fuel. The default inflation rate is two percent per year based on the Federal Reserve's inflation target. Inflation for fuel is calculated separately based on projections from the U.S. Energy Information Administration.	The default rate of two percent was used.
Discount Rate	The annual percentage rate to discount future cash flows for net present value calculations.	The default rate of two percent was used.

Input Field	Description	Analysis Input
	The default value is two percent.	
Cost of Carbon ($/Ton)	The social cost of each ton of carbon emitted by the fleet. Fleet emissions are calculated on a well-to-wheel basis including upstream emissions from electricity generation and oil and gas production. The default cost of carbon is $0, meaning that the social cost of carbon is not included in the analysis.	The cost of carbon was not included in this report.

Table 8. Charging Infrastructure Inputs

Input Field	Description	Analysis Inputs
Port Type	The type of charger and approximate power level. Level 2 ports are measured in amps (A) while DCFC are measured in kilowatts (kW). This is used to set default per-port costs and to group the results.	Port types were assigned to each use case based on estimated infrastructure needs of a typical vehicle. See Table 9.
Charging Ratio (Vehicles/Port)	The number of vehicles that will be used on each charger. The cost of charging infrastructure included in each vehicle’s TCO is divided by the charging ratio.	Charging ratios were assigned to each use case based on estimated infrastructure needs of a typical vehicle. See Table 9.
Per-Port Upfront Cost	The per-port cost to procure charging infrastructure. This could include equipment, installation, electrical upgrades, or other	See Table 9.

Input Field	Description	Analysis Inputs
	associated costs depending on what costs the fleet would like to include in the vehicle's TCO.	
Per-Port Annual Cost	The annual, per-port cost to maintain charging infrastructure. This could include warranty, networking, anticipated maintenance, or other associated costs depending on what costs the fleet would like to include in the vehicle's TCO.	Default costs can be found in Table 9.
Include Alternative Fuel Vehicle Refueling Property Credit (30C)?	Binary field indicating if the [Alternative Fuel Vehicle Refueling Property Credit (30C)]() should be applied to the upfront cost of charging infrastructure. Eligibility for this credit depends on the census tract where the charging station is located. The value of the credit depends on the *Wage and Apprenticeship* selection.	Yes
Include 30C Prevailing Wage and Apprenticeship Bonus?	Binary field indicating if the [prevailing wage and apprenticeship requirements]() stipulated in the 30C credit should be included. If the requirements are met the credit is increased from 6% to 30% of the upfront cost, not to exceed $100,000. Note: the value of the credit is calculated based on the upfront cost before any additional state/local/utility incentives are applied.	No
Additional State/Utility/ Local Incentives	Total additional per-port incentives to be applied to the upfront cost of charging infrastructure. These incentives will be used to reduce the upfront cost of charging infrastructure.	N/A
Ownership Strategy	The fleet's purchasing approach for the charging infrastructure. Either: • Purchase (Cash), or • Purchase (Loan)	Cash

Input Field	Description	Analysis Inputs
	If loan is selected, then the financing costs will be included.	
Down Payment	(Loan Only) The per-port down payment on the charging infrastructure loan.	N/A
Interest Rate (APR - %)	(Loan Only) The annual interest rate for the charging infrastructure loan.	N/A
Loan Term (Years)	(Loan Only) The length of the charging infrastructure loan in years. This cannot exceed the expected years of use of the vehicle.	N/A

Table 9. Charging Infrastructure Cost Inputs

Use Case	Port Type	Per Port Capital Cost	Per Port Annual Operating Cost	Vehicles per Port
Car SUV/MPV Minivan Pickup	Single 30A L2	Default inputs, where 30 percent of the infrastructure is assumed equipment costs while 70 percent is assumed Make-Ready Costs.	Default inputs.	2
Cargo Van Medium-Duty Pickup	Single 48A L2	Default inputs, where 30 percent of the infrastructure is assumed equipment costs while 70 percent is assumed Make-Ready Costs.	Default inputs.	2
Medium-Duty Straight Truck	Single 80A L2	Default inputs, where 30 percent of the infrastructure is assumed	Default inputs.	2

Use Case	Port Type	Per Port Capital Cost	Per Port Annual Operating Cost	Vehicles per Port
		equipment costs while 70 percent is assumed Make-Rea		

Table 10. Charging Strategy Inputs

Input Field	Description	Analysis Input
% Depot Charging	The share of fleet charging that occurs at fleet depots. The default is 100%.	100%
Electricity Price ($/kWh)	The average cost per kWh for electricity used at fleet depots, inclusive of energy and demand charges as well as all applicable taxes, riders, and fees. The default price is set based on the state where the fleet is located and calculated using total revenue and energy delivered for commercial customers for the most recent year available from U.S. Energy Information Administration's survey of electric utilities (EIA-861M).	$0.10 / kW$0.10 / kWh was used based on the default electricity price for Commercial end use customers. Price is the average annual rate for the last year available from the U.S. Energy Information Administration for the state of North Carolina. Electricity price inputs were scaled based on forecasted changes in market conditions for each year of the analysis (2
% Public Charging	The share of charging done at publicly available charging stations. The default is 0%.	0%

Input Field	Description	Analysis Input
Public Charging Price ($/kWh)	The average cost per kWh for charging at public chargers. The default is $0.50 per kWh based on a national sample of publicly listed public charging prices.	N/A
Maximum Power for Public Charging Only (kW)	The maximum power for public charging stations typically used by the fleet. This field is used to calculate the amount of time that drivers spend charging at public charging stations while "on the clock."	N/A
Public Charging Downtime Cost ($/hour)	The cost of wages incurred by the fleet for each hour spent by drivers charging at public charging stations. The default is $35 per hour.	N/A
% En-Route Charging	The share of charging done at company-owned charging stations away from the vehicle's home base. The default is 0%.	0%
En-Route Charging Price	The average cost per kWh of charging done at company-owned charging stations away from the vehicle's home base.	N/A

Table 11. Procurement Strategy Inputs

Input Field	Description	Analysis Input
Ownership Strategy	The ownership structure for fleet procurements. Choose from: • Purchase (Cash) • Purchase (Loan) • FMV (Closed-End) Lease • FMV (Closed-End) Lease w/ Cash Purchase	Purchase (Cash)

Input Field	Description	Analysis Input
	• FMV (Closed-End) Lease w/ Loan Purchase • TRAC (Open-End) Lease • TRAC (Open-End) Lease w/ Cash Purchase • TRAC (Open-End) Lease w/ Loan Purchase • Tax-Exempt Lease Purchase (Cash) The default is a cash purchase.	
Monetize Tax Credit?	Binary field indicating if the commercial vehicle (45W) tax credit should be included in the analysis federal tax credit to the fleet as part of the procurement.	Yes
Sales Tax	The tax to be paid as a percentage of the vehicles upfront purchase price at the time of purchase. The default is based on the vehicle sales tax in the state selected.	N/A
Include 12% excise tax on HD trucks?	Binary field to indicate if the analysis should include the federal Heavy Highway Vehicle Use Tax for the "tractor" use case.	N/A, as no HD trucks are present in the current fleet analysis.

Table 12: Loan Inputs

Input Field	Description	Analysis Input
Loan Term (Years)	The length of the loan repayment in years. Loan term cannot exceed the expected years of ownership.	N/A

Input Field	Description	Analysis Input
	The default is seven years.	
Loan Interest Rate (APR - %)	The annual interest rate charged on loan principle, The default is seven percent.	N/A

Table 13: Maintenance and Insurance Inputs

Input Field	Description	Analysis Input
Maintenance and Repair Cost - Years 1 - 5 ($ per Mile)	Maintenance and repair costs per vehicle per mile for the first five years of ownership. Default costs are from Argonne National Laboratory's Comprehensive Total Cost of Ownership Quantification for Vehicles with Different Size Classes and Powertrains.	The default maintenance costs were used for the purposes of this analysis, with discounted parts and maintenance from fleet file factored into final maintenance cost. See Table 14.
Maintenance and Repair Cost - Years 5+ ($ per Mile)	Maintenance and repair costs per vehicle per mile for sixth and subsequent years of ownership. Default costs are from Argonne National Laboratory's Comprehensive Total Cost of Ownership Quantification for Vehicles with Different Size Classes and Powertrains.	The default maintenance costs were used for the purposes of this analysis, with discounted parts and maintenance from fleet file factored into final maintenance cost. See Table 14.
Cost to Insure ($/Year)	The annual cost to insure a vehicle. Default costs are from Argonne National Laboratory's Comprehensive Total Cost of Ownership Quantification for Vehicles with Different Size Classes and Powertrains:	N/A

Input Field	Description	Analysis Input
	Light-Duty: $600 per year Medium-Duty: $4,000 per year Heavy-Duty: $6,000 per year	

Table 14. Maintenance Cost ($/Mile) Inputs

Technology		BEV	PHEV	ICE
Light-Duty Vehicles	Years 1-5	$0.04	$0.0778	$0.08
	Years 6+	$0.052	$0.0778	$0.104
Medium-Duty Vehicles	Years 1-5	$0.142	N/A	$0.201
	Years 6+	$0.1846		$0.2613
Heavy-Duty Vehicles	Years 1-5	$0.1700*	N/A	$0.3099
	Years 6+	$0.1700*		$0.3099

*The fleet does not currently have any heavy-duty electric vehicles, so the default value was used.

Appendix B: Fleet Vehicle Mappings

Fleet Vehicle	Use Case	ICE Replacement	EV Alternative	Count
Dodge Grand Caravan	Minivan	2024 CHRYSLER PACIFICA GAS	2024 CHRYSLER PACIFICA HYBRID PHEV	668
Toyota Sienna	Minivan	2024 CHRYSLER PACIFICA GAS	2024 CHRYSLER PACIFICA HYBRID PHEV	162
Honda Odyssey	Minivan	2024 CHRYSLER PACIFICA GAS	2024 CHRYSLER PACIFICA HYBRID PHEV	2
Toyota Camry	Car	2024 TOYOTA CAMRY LE/SE GAS	2024 NISSAN LEAF BEV	1646
Ford Fusion	Car	2023 CHEVROLET MALIBU GAS	2024 NISSAN LEAF BEV	1415
Ford Focus	Car	2023 CHEVROLET MALIBU GAS	2024 NISSAN LEAF BEV	236
Ford Escape	SUV/MPV	2024 FORD ESCAPE FWD GAS	2023 FORD ESCAPE FWD PHEV	70
Chevrolet Equinox	SUV/MPV	2024 CHEVROLET EQUINOX FWD GAS	2023 FORD MUSTANG MACH-E RWD BEV	70

Fleet Vehicle	Use Case	ICE Replacement	EV Alternative	Count
Ford Explorer	SUV/MPV	2024 FORD EXPLORER RWD GAS	2023 FORD MUSTANG MACH-E RWD BEV	324
Dodge Durango	SUV/MPV	2024 DODGE DURANGO RWD GAS	2023 FORD MUSTANG MACH-E RWD BEV	96
Chevrolet Tahoe	SUV/MPV	2024 CHEVROLET TAHOE 2WD GAS	2024 CHEVROLET BLAZER EV AWD BEV	231
Chevrolet Silverado	Light Pickup	2024 CHEVROLET SILVERADO 2WD GAS	2023 FORD F-150 LIGHTNING 4WD BEV	47
Ford F-150	Light Pickup	2024 FORD F150 PICKUP 2WD GAS	2023 FORD F-150 LIGHTNING 4WD BEV	588
Ford Transit	Cargo Van	2024 FORD TRANSIT VAN CARGO GAS	2023 FORD TRANSIT VAN CARGO BEV	70
Ford F-250	Medium-Duty Pickup	2024 FORD F250 XL GAS	2023 LIGHTNING SYSTEMS ZEV4 BEV	115
Ford F-350	Medium-Duty Pickup	2024 FORD F350 XL GAS	2023 LIGHTNING SYSTEMS ZEV4 BEV	9

Fleet Vehicle	Use Case	ICE Replacement	EV Alternative	Count
Chevrolet Colorado	Light Pickup	2024 CHEVROLET SILVERADO 2WD GAS	2023 FORD F-150 LIGHTNING 4WD BEV	1
Chevrolet Suburban	SUV/MPV	2024 CHEVROLET SUBURBAN 2WD GAS	2024 CHEVROLET BLAZER EV AWD BEV	5
Ford E-350	Cargo Van	2024 FORD TRANSIT VAN CUTAWAY GAS	2023 FORD TRANSIT VAN CUTAWAY BEV	2
Dodge Charger	Car	2023 DODGE CHARGER GAS	2023 FORD MUSTANG MACH-E RWD BEV	27
Ford F-550	Medium-Duty Straight Truck	2024 FORD F550 XL DIESEL	2023 ROUSH FORD F-650 BEV	2
Dodge Journey	SUV/MPV	2024 DODGE DURANGO RWD GAS	2023 FORD MUSTANG MACH-E RWD BEV	493
Ford Taurus	Car	2023 CHEVROLET MALIBU GAS	2024 NISSAN LEAF BEV	262
Ford Expedition	SUV/MPV	2024 FORD EXPEDITION 2WD GAS	2024 CHEVROLET BLAZER EV AWD BEV	15
Ford F-350	Medium-Duty Straight Truck	2024 FORD F350 XL DIESEL	2023 LIGHTNING	1

Fleet Vehicle	Use Case	ICE Replacement	EV Alternative	Count
			SYSTEMS ZEV4 BEV	
Ford F-450	Medium-Duty Straight Truck	2024 FORD F450 XL DIESEL	2023 PHOENIX MOTORCARS FORD E-450 BEV	2
Toyota Corolla Cross	SUV/MPV	2024 TOYOTA COROLLA CROSS GAS	2023 FORD MUSTANG MACH-E RWD BEV	18
Ford Expedition Max	SUV/MPV	2024 FORD EXPEDITION 2WD GAS	2024 CHEVROLET BLAZER EV AWD BEV	34
Chevrolet Bolt EV	Car	2023 CHEVROLET MALIBU GAS	2024 NISSAN LEAF BEV	69
Toyota Camry	Car	2024 TOYOTA CAMRY LE/SE GAS	2024 NISSAN LEAF BEV	1
Chevrolet Volt	Car	2023 CHEVROLET MALIBU GAS	2024 NISSAN LEAF BEV	3
Ford F-150	Medium-Duty Pickup	2024 FORD F150 PICKUP 2WD GAS	2023 FORD F-150 LIGHTNING 4WD BEV	1
Ford F-550	Medium-Duty Pickup	2024 FORD F550 XL GAS	2023 ROUSH FORD F-650 BEV	1
Chevrolet Traverse	SUV/MPV	2024 CHEVROLET	2023 FORD MUSTANG	565

Fleet Vehicle	Use Case	ICE Replacement	EV Alternative	Count
		EQUINOX FWD GAS	MACH-E RWD BEV	
Nissan Pathfinder	SUV/MPV	2024 NISSAN PATHFINDER 2WD GAS	2023 FORD MUSTANG MACH-E RWD BEV	312
Chevrolet Caprice Police Vehicle	Car	2023 DODGE CHARGER GAS	2024 CHEVROLET BLAZER EV AWD BEV	43
Chevrolet Impala Limited	Car	2024 TOYOTA CAMRY LE/SE GAS	2024 NISSAN LEAF BEV	346
Nissan NV200	Minivan	2024 CHRYSLER PACIFICA GAS	2024 CHRYSLER PACIFICA HYBRID PHEV	12
Nissan NV200	Cargo Van	2024 FORD TRANSIT VAN CARGO GAS	2023 FORD TRANSIT VAN CARGO BEV	4
Chevrolet Bolt (EUV)	SUV/MPV	2024 CHEVROLET EQUINOX FWD GAS	2023 FORD MUSTANG MACH-E RWD BEV	1
Ford Transit	Shuttle Bus	2024 FORD TRANSIT VAN PASSENGER GAS	2023 FORD 2023 FORD TRANSIT VAN C	1

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