EV Smart Fleets

ELECTRIC VEHICLE PROCUREMENTS FOR PUBLIC FLEETS

APPROACHES TO OVERCOMING ADOPTION BARRIERS OF PLUG-IN ELECTRIC VEHICLES IN PUBLIC FLEETS

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A NATIONWIDE INITIATIVE TO ACCELERATE ELECTRIC VEHICLE ADOPTION IN PUBLIC FLEETS

ABOUT EV SMART FLEETS

Public fleets are realizing significant benefits from the deployment of plug-in electric vehicles (EVs), and many public fleets want to 'lead by example' by showing the public the benefits of transitioning to EVs. Although EVs are increasingly becoming a cost-effective and viable opportunity for fleets, higher purchase costs, complex procurement processes, and insufficient charging infrastructure remain barriers to adoption.

EV Smart Fleets seeks to overcome these challenges and increase state and local fleet EV adoption by educating public fleets about EV benefits, conducting research on important elements for a new vehicle procurement, and developing and implementing a multi-state EV agreement. EV Smart Fleets goals include:

- Acceleration of electric vehicle adoption by public fleets
- Lowering the purchase price of electric vehicles for public fleets by at least 15 percent below MSRP through volume purchases, creative financing and ownership tools
- Increasing access to a wider range of electric models

EV Smart Fleets will also seek to improve access to EV charging stations for public fleets.

CLEAN CITIES COALITION PARTNERS

Clean Cities Coalitions nationwide will play an integral role in this project. Below are the current project partners:

- Columbia-Willamette Clean Cities Coalition
- Denver Metro Clean Cities Organization
- Granite State Clean Cities Coalition
- Long Beach Clean Cities
- New Jersey Clean Cities
- Greater New Haven Clean Cities Coalition
- Ocean State Clean Cities
- Sacramento Clean Cities Coalition
- Western Washington Clean Cities

PROJECT TEAM

EV Smart Fleets is funded by the U.S. Department of Energy Clean Cities Program and the Rockefeller Brothers Fund, and supported by the California Department of General Services. Find out more at www.evsmartfleets.com.

EXECUTIVE SUMMARY

Public fleets can procure electric vehicles (EVs) at a cost that is competitive with, or lower than, conventional vehicles under several conditions, according to the research and analysis conducted for this report. Declining costs of battery technology combined with incentives such as rebates or tax credits that public fleets can capture make EVs a viable alternative to conventional vehicles now, even in an era of low gasoline prices.

This report was prepared for the EV Smart Fleets project, a collaborative effort to develop and implement a multi-state EV agreement (see Box ES-1) that improves the value proposition of EVs for public fleets.

EV Smart Fleets seeks to overcome barriers to EV adoption faced by state and local fleets through educating public fleet and procurement managers about the benefits of EVs, researching key elements needed for a successful electric vehicle procurement, and developing a multi-state EV agreement that will meet the needs of public sector fleets. The goals of the EV Smart Fleets project include:

- Accelerating electric vehicle adoption by public fleets;
- Lowering the purchase price of electric vehicles for public fleets by at least 15 percent below the manufacturer's suggested retail price (MSRP) through volume purchases and creative financing and ownership tools; and
- Increasing access to a wider range of electric models.

Box ES-1. Term Definitions: Solicitation and Procurement

Solicitation, when used in this document, refers to the multi-state government request for proposals for sale or lease of electric vehicles being led by the State of California as part of a multi-state Sourcing Team in cooperation with the NASPO ValuePoint Cooperative Purchasing Organization. The solicitation process may include an initial Request for Information (RFI) from vendors to survey the market. The intent of the solicitation process will be to establish a multi-state EV agreement to be used as a mechanism for state and local public fleets to procure EVs.

Procurement, when used in this document, refers to the individual purchases/contracts that state and local public fleets will execute for EVs.

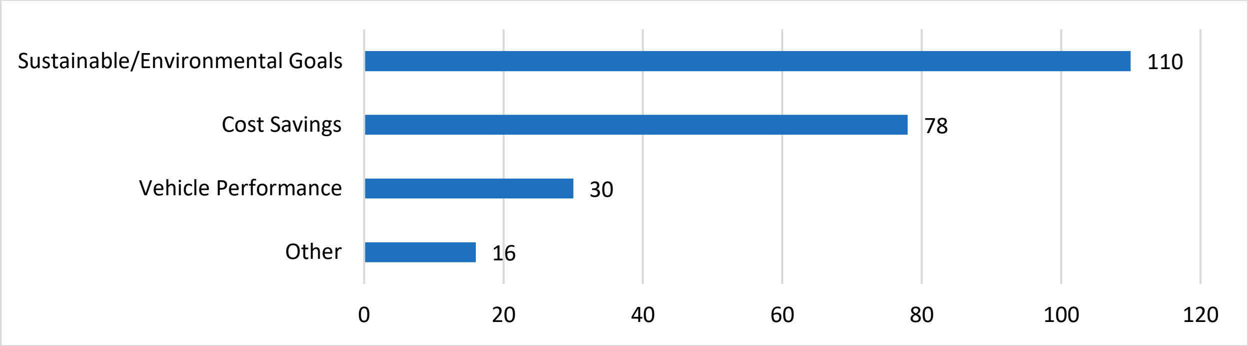
The objective of this report is to identify opportunities to achieve the EV Smart Fleets goals through research, stakeholder outreach, and financial and environmental performance analysis. The report finds that a multi-state EV solicitation can increase the likelihood of favorable terms for acquiring EVs for both small and large public fleets. The research and analysis presented in this report highlight important considerations to improve the likelihood that a solicitation and resulting multi-state agreement achieves the project goals.

INSIGHTS FROM STAKEHOLDER OUTREACH

The EV Smart Fleets team conducted a nationwide survey of fleets through its website in the fall of 2016. An interactive version of the survey results is available on the EV Smart Fleets website at http://evsmartfleets.com/materials/fleet-survey-results.

Fleet and Procurement Manager Outreach. More than 100 state, municipal, and county fleets from 18 states responded to the survey. Fleets in all but one of the states expressed interest in the multi-state EV agreement. Over 85 percent of fleets reported that cost savings and/or sustainability goals were the drivers for interest in fleet electrification. Achieving sustainability goals was the most frequently cited reason for fleet interest in EVs. This could mean that higher upfront purchase prices might not be a barrier in some cases if resources exist at a public agency to meet an environmental goal (see Figure ES-1).

FIGURE ES-1: REASON FOR INTEREST IN EVS



Survey respondents could select more than one reason. More than 100 respondents selected sustainability and/or cost savings as the reason for their interest in EVs.

Following the survey and with the help of several Clean Cities Coalitions, the EV Smart fleets team conducted direct outreach to several local government fleet and procurement managers to identify key procurement elements needed to accommodate a large number of fleets, as well as to gauge the fleets' levels of familiarity with EVs and charging infrastructure. The targeted outreach revealed that fleet procurement policies vary both within states and across state lines. Additionally, the ability of state and local fleets to acquire EVs through existing government contracts is greater in some regions than in others. For example, one-third of total survey respondents said they do not have a government contract in place that could support EV procurements; however, two-thirds of respondents from California fleets reported that they have access to EVs on government contracts. According to the California Department of General Services, all public fleets have access to EVs through the state contract, which highlights a potential information gap at some fleets in the state.

Targeted Dealership Outreach. A key objective for the project is for tax exempt public sector fleets to benefit from state and federal tax credits to the maximum extent possible. Targeted dealer outreach revealed that public fleets have captured federal and state purchase incentives in both leases and purchases. For example, Nissan dealers worked with the automaker's financing arm to enable leasing and/or financing in California, Washington, and Massachusetts. In some cases, this allowed fleets to capture federal and state rebates and/or tax incentives. One dealer reported that it captured the federal EV tax credit for Washington State government's recent purchase of Chevrolet Bolt EVs.

Dealer agreements with automakers play a central role in determining the availability of EVs, flexible ownership structures, financing, and cost reducing measures, such as discounts and the capture of tax incentives. National fleet dealer groups said that drop-shipping, a customary practice where a dealer ships a vehicle from the automaker to a dealer in another state, to states nationwide is widely practiced by these groups and is available for a fee.

EVALUATION OF A MULTI-STATE EV AGREEMENT ELEMENTS

The elements recommended for incorporation into the multi-state EV agreement were selected based on their ability to address the initiative goals. These elements must also align with the National Association of State Procurement Officials (NASPO) ValuePoint Cooperative Purchasing Program process.

TABLE ES-1: ELEMENTS OF A POTENTIAL SOLICITATION FOR A MULTI-STATE EV AGREEMENT

Element	Initiative Goal Addressed
1. Encourage capture of the federal EV tax credit and all available state EV incentives	• Achieve cost savings for fleets.
2. Provide flexibility to lease or own vehicles	• Achieve cost savings for fleets. • Be useful to a wide variety of public fleets. • Increase a fleet's access to a wider range of plug-in hybrid and battery electric vehicle models.
3. Allow fleets to finance vehicles through a third-party	• Achieve cost savings for fleets. • Maximize the number of eligible EVs.
4. Require pricing from the dealer's cost up and seek discounts	• Achieve cost savings for fleets. • Be replicable in future years.
5. Solicit bids from networked auto dealers rather than individual auto dealers.	• Achieve cost savings for fleets. • Maximize the number of eligible EVs. • Increase a fleet's access to a wider range of plug-in hybrid and battery electric vehicle models.

Several factors can affect the feasibility of each of the elements being considered for the multi-state EV agreement. Capturing the federal EV tax credit and/or some state incentives in a purchase or a lease is possible but can be difficult given the scarcity of dealers with the requisite tax appetite. At the time of this report, the federal EV tax credit was more accessible for fleets than state incentives. Incentives are unavailable in most states and where they do exist, requirements must be met for fleets to obtain the benefit. For example, in California purchase/lease incentives are limited to 30 per fleet per year and are only available if the vehicle is operated in the state for 30 consecutive months.

Dealer cost plus pricing, which is the dealer's invoice price minus any benefits that the dealer receives from the automaker when buying a vehicle, is a potentially valuable way to reduce the upfront costs of EVs.

Vehicle deliveries between dealers and direct from the automaker, through both informal and established networks, are common practice. For network dealers with large tax appetites, they might be able to more easily pass along the federal EV tax incentive than individual dealers with small or no tax appetites.

SCENARIO-BASED PROCUREMENT ANALYSIS

This report includes an analysis of various procurement structures for small and large fleets to inform ordering agencies of EV procurement strategies. The scenario-based analysis, which includes a sensitivity analysis of key inputs, considered the economic and environmental implications using the Fleet Procurement Analysis Tool (see Box ES-2).

Box ES-2. Fleet Procurement Analysis Tool

The Fleet Procurement Analysis Tool equips users with decision-relevant information on the financial viability and environmental impact of light-duty vehicle fleet procurements. The Microsoft Excel-based tool can evaluate a variety of procurement ownership structures, vehicle types, and procurement scenarios. The tool compares procurements side-by-side on a cost-per-mile basis and provides an analysis of cash flows and location-specific lifecycle emissions. The tool is highly flexible, supports customizable sensitivity variables, and produces user-friendly results summaries as shown below. The tool was built as part of the EV Smart Fleets initiative. The tool can be downloaded at http://evsmartfleets.com/materials/fleet-procurement-analysis-tool.

For each scenario described below, an analysis was conducted on the financial and environmental performance of the procurement by small and large fleets for four different vehicle types. The vehicles analyzed, all model year 2017, were: the Chevrolet Cruze (conventional vehicle), Ford Fusion Energi (plug-in hybrid electric vehicle), Nissan Leaf (100-mile range battery electric vehicle), and Chevrolet Bolt (200-mile range battery electric vehicle).

- **Scenario 1: Purchase with Federal Incentive.** This procurement is a cash purchase that captures the federal EV tax credit. This scenario assumed that an auto dealer captured the credit and passed the full value along to the public fleet.
- **Scenario 2: Financed Purchase.** This procurement is a debt financed purchase with no incentives. This scenario assumed that the purchase was financed with public debt (e.g., a municipal bond) and did not capture any available incentives.
- **Scenario 3: Lease Hybrid with Federal Incentive.** This procurement is a tax-exempt lease purchase that captures the federal EV tax credit. This scenario assumed that under a tax-exempt lease purchase, the full value of the available tax credit was captured. This scenario assumed a lease period of three years, after which the fleet purchased each vehicle for $1.

The market, vehicle, and procurement inputs for the tool have been tailored where possible to reflect procurement variations between small and large fleets. The input assumptions rely on publicly available data and feedback from fleet managers connected to the EV Smart Fleets project.

FINANCIAL ANALYSIS RESULTS

The financial analysis was focused on questions that are key to understanding the advantages and disadvantages of various procurement structures, and highlighted the value of individual procurement elements and how each can influence the cost-effectiveness of different vehicle drivetrains.

Without incentives, EV upfront purchase prices are often higher than comparable gasoline vehicles. However, fleets can realize operational savings that may make the total cost of ownership of EVs competitive on a per-mile basis. Insights on the cost competitiveness of EVs are summarized in Figure ES-2.

FIGURE ES-2: INSIGHTS ON EV COST COMPETITIVENESS

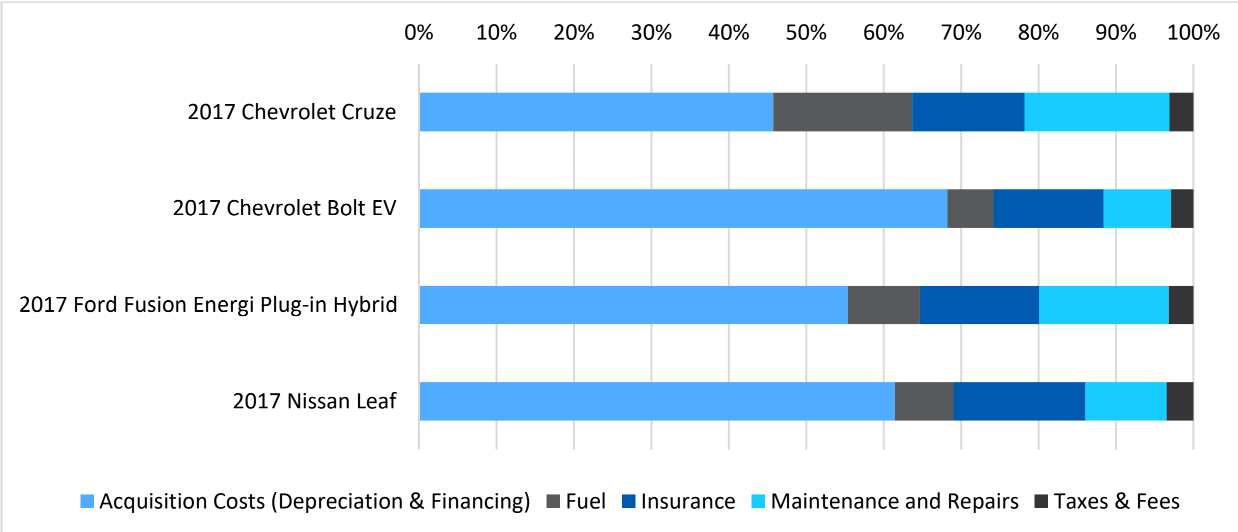
Large Fleets	Small Fleets
• The federal EV tax credit results in the EVs being lower cost than the Cruze in Scenario 1 and Scenario 3 • The Nissan Leaf is the least expensive EV in every scenario • Using dealer cost plus pricing approach can improve the cost competitiveness of EVs	• EVs are cost competitive with the Cruze in most cases • The lowest cost EV in all scenarios is the Ford Fusion Energi Plug-in Hybrid • Increasing annual miles traveled improves EV competitiveness

For both large and small fleets, opportunities exist for public fleets to acquire EVs at a cost competitive to conventional vehicles.

On average, vehicle acquisition costs (depreciation and financing) made up more than 60 percent of the total costs for battery electric vehicles (see Figure ES-3). For the conventional vehicle modeled, the Chevrolet Cruze, less than half of the total cost was attributable to depreciation and financing. Because EVs have higher relative upfront costs, any actions that reduce the acquisition costs of vehicles may lower the total cost of ownership for EVs more so than for gasoline vehicles.

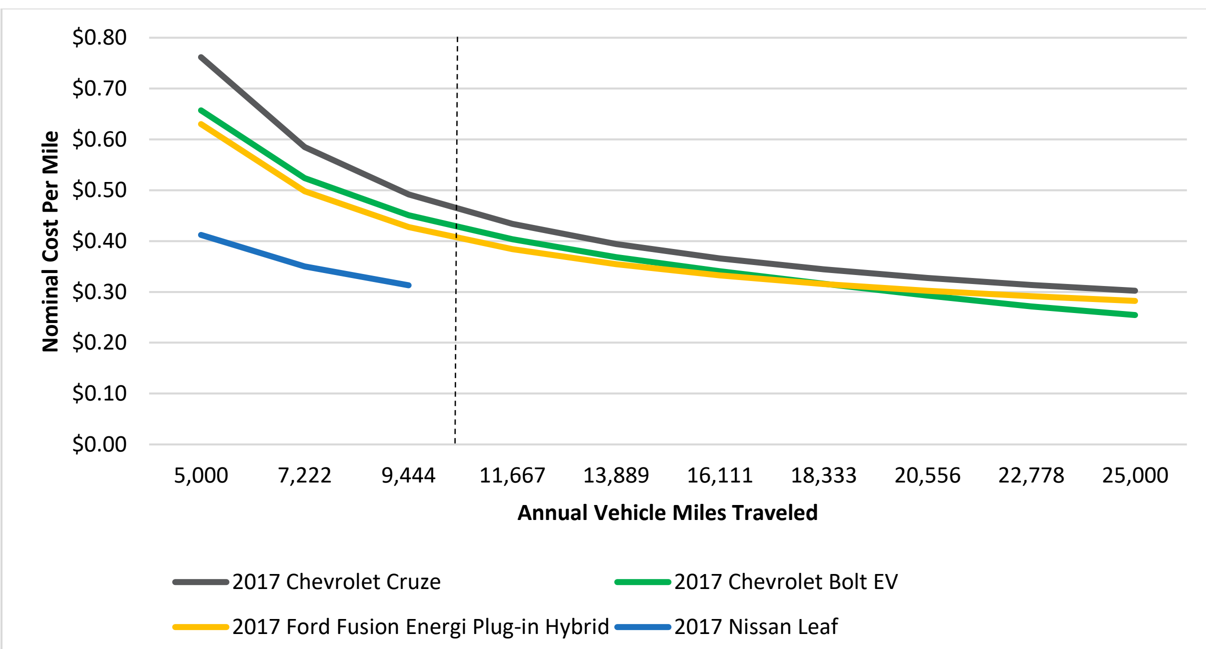
As miles traveled increases, the cost per mile for maintenance and fuel should stay the same, but depreciation, insurance, and taxes and fees will decrease because they are mostly per-vehicle fixed costs. This effect advantages EVs on a total cost basis, because they generally have higher acquisition costs, which make up a large share of the total cost of ownership. For the large fleet in Scenario 1, the per-mile cost reduced more for the Cruze than the Bolt between 5,000 and 25,000 miles. As a percentage difference, however, the Bolt's cost fell more than the Cruze at 25,000 miles (19 percent lower cost) than at 5,000 miles (16 percent lower cost). This relationship is consistent for all procurements of the Cruze and Bolt for both fleet types. As a result, the argument for procuring the Bolt improves when comparing it to the Cruze as annual miles traveled increases.

Figure ES-3: Share of Costs for all Scenarios by Vehicle



Vehicle acquisition costs (depreciation and financing) make up most of the costs for EVs on average.

Figure ES-4: Annual Vehicle Miles Traveled For Large Fleets (Scenario 1)

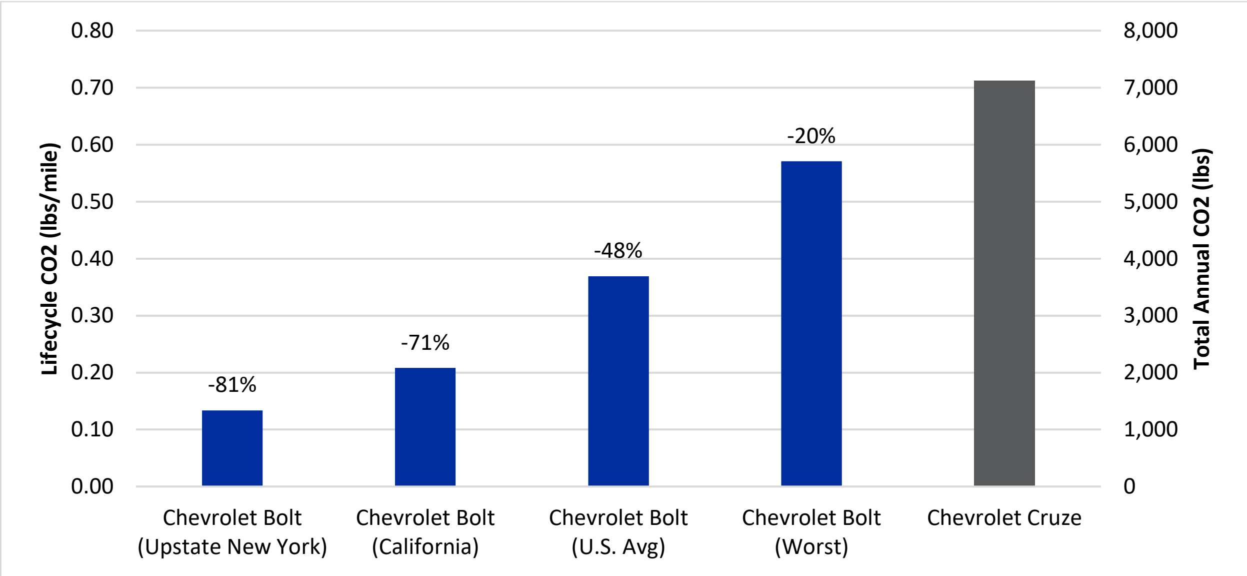


This figure shows the relative improvement in the total cost of ownership as annual VMT increases for the Bolt versus the Cruze. The Nissan Leaf is modelled to consider the reasonable limitation of 10,000 annual VMT for a vehicle with less than 100 miles of range. The default annual VMT, denoted by a dotted line in the figure, was 10,000 miles.

ENVIRONMENTAL PERFORMANCE ANALYSIS RESULTS

All EVs evaluated in this report have significantly fewer carbon dioxide emissions (CO_2) than comparable conventional vehicles on average, with the Bolt EV having 50 percent lower CO_2 emissions than the Chevrolet Cruze. EVs that charge on low-emitting grids, such as those in upstate New York or California, have considerably lower carbon footprints than vehicles charging in the region of the United States with highest carbon intensity grid. A Bolt EV that charges in upstate New York, for example, could emit up to 80 percent fewer emissions than a Cruze (see Figure ES-5).

FIGURE ES-5: LIFECYCLE CO_2 EMISSIONS FOR CHEVROLET BOLT AND CRUZE



Carbon intensity and total annual emissions, assuming 10,000 miles traveled. The percent decline in emissions from the Cruze is shown in the figure. Even when charged on the grid with the highest carbon intensity, the Bolt emits 20 percent fewer CO_2 emissions.

CONCLUSIONS AND GUIDANCE ON PROCUREMENT STRATEGIES

The findings and guidance are based on factors specific to large and small fleets that drive procurement decisions, which were identified through surveys, research, and stakeholder outreach. Both small and large fleets cited the importance of achieving sustainability goals and cost savings as key drivers of their interest in EVs. Large fleets said sustainability goals outweighed cost savings while small fleets weighed the two factors equally. Large fleets also said executive orders were a key driver and both fleet types said reducing greenhouse gases and saving petroleum were important.

FINDING: PUBLIC FLEETS CAN CAPTURE THE FEDERAL EV TAX CREDIT AND MAKE EVS LESS EXPENSIVE THAN GASOLINE VEHICLES

Capturing the federal EV tax credit in a procurement can result in EVs costing less to own than gasoline vehicles by as much as 30 percent. Vehicle acquisition costs (depreciation and financing) for battery electric vehicles make up a much larger share of the total cost of ownership than for conventional vehicles. The federal tax credit can lower these costs for EVs by up to $7,500 and have a noticeably positive effect on the total cost of ownership for EVs.

Several public fleets have demonstrated the ability to capture this incentive in procurements, and research confirmed that capturing the credit is possible for vehicle leases or purchases. A solicitation effort to establish a multi-state EV agreement that encourages the capturing of this credit for either leases or purchases could attract participation from auto dealers or dealer networks with large tax appetites. These groups could also support drop-shipping vehicles to public agencies across the country and increase vehicle model availability to agencies in jurisdictions with limited availability.

FINDING: A VOLUME PURCHASE CAN ENCOURAGE FAVORABLE PRICING APPROACHES AND INCREASE VEHICLE MODEL AVAILABILITY

Large fleets often use the *triple net*, or *dealer cost plus pricing* approach, which greatly improves the cost competitiveness of EVs. While pricing for vehicles can vary by fleet size, location, vehicle type, and more, large fleets could procure vehicles at 25 percent below the MSRP through dealer cost plus pricing. Small fleets can often only attain minor discounts from auto dealers, making EVs more challenging to purchase. As with capturing the federal tax credit, the fleet's pricing approach can lower the total cost of an EV more than a conventional vehicle. A multi-state agreement can help small fleets attain more competitive vehicle pricing through scale and leveraging the purchasing power of large fleets.

In addition to improved vehicle pricing, a solicitation effort to establish a multi-state EV agreement that encourages the participation of large fleets can increase vehicle model availability in some cases. At the time of this report, model availability is limited in many states, making it difficult for fleets of all sizes to acquire suitable EVs. With the participation of large fleets in states like California, that have a large vehicle selection, a volume purchase could provide more choices for fleets in other states through drop shipping. Automaker restrictions, however, could still limit vehicle availability.

FINDING: INCREASING THE ANNUAL MILEAGE OF VEHICLES CAN IMPROVE EV COMPETITIVENESS

EVs have significantly lower fuel and maintenance costs than conventional vehicles and increasing vehicle annual vehicle miles traveled (VMT) can make EVs more cost competitive over conventional vehicles. Fuel costs for battery electric vehicles can be one-third of the cost for a conventional vehicle when gasoline prices are below $2.50 per gallon and electricity is the U.S. average price; maintenance can be half as expensive. For plug-in hybrid electric vehicles, fuel costs can run about 40 percent less than fuel costs for gasoline vehicles, while maintenance can cost about the same.

The cost per mile for maintenance and fuel should stay the same as annual mileage increases, but depreciation, insurance, and taxes and fees should decrease because they are mostly per-vehicle fixed costs. As a result, increasing annual mileage favors EVs, particularly battery electric vehicles, over conventional vehicles.

Greater awareness about the suitability of EVs in fleets and their potential to achieve total cost savings for high use applications could encourage greater participation from large and small fleets.

FINDING: EVS CAN PLAY A LEADING ROLE IN ACHIEVING THE ENVIRONMENTAL GOALS OF PUBLIC AGENCIES

EVs operating in any region of the United States have superior environmental performance compared to conventional vehicles. In regions with low-carbon electrical grids, a switch to EVs can reduce carbon dioxide emissions by up to 80 percent and significantly reduce some criteria pollutants. EVs operating in these regions are less dependent on fossil fuels and can help public agencies achieve environmental goals cost effectively.

A multi-state EV agreement could attract greater participation from small and large fleets with sustainability objectives, particularly in regions with low-carbon electrical grids. Fleet participation in the multi-state EV agreement is an important "lead by example" initiative and can help achieve climate and air quality goals.

The findings in this report highlight possible opportunities for establishment of a multi-state EV agreement that may help lower the cost of EV ownership for fleets of all sizes. An EV can have a lower total cost of ownership than a comparable conventional vehicle in many cases, even in a period of low gasoline prices. EVs can also greatly reduce air pollution from public fleets, including both greenhouse gas emissions and criteria pollutants. The EV Smart Fleets Team's goal is to implement a multi-state EV agreement that improves the value proposition of EVs for public agencies through the capture of public incentives like the federal EV tax credit, improved vehicle pricing, and a greater selection of vehicle models.

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INTRODUCTION

State and local governments are increasingly setting ambitious goals to reduce harmful emissions from transportation in their jurisdictions. The electrification of public vehicle fleets stands to play a central role in helping governments reach these goals, but barriers exist to widespread adoption of plug-in electric vehicles (EVs). Some of the more pressing barriers include the higher upfront cost of EVs relative to comparable gasoline vehicles and limited access to a variety of EV models. The EV Smart Fleets initiative aims to address these barriers through an improved method for procuring light-duty EVs for public agencies nationwide (see Box 1).

Box 1. About EV Smart Fleets

EV Smart Fleets seeks to overcome challenges to EV adoption in state and local fleets by educating public fleets about EV benefits, conducting research on important elements for a new vehicle procurement, and developing a multi-state EV agreement. EV Smart Fleets goals include:

- Accelerate electric vehicle adoption by public fleets
- Lower the purchase price of electric vehicles for public fleets by at least 15 percent below MSRP through volume purchases and creative financing and ownership tools
- Increase access to a wider range of electric models

EV Smart Fleets will also seek to improve access to EV charging stations for public fleets.

EV Smart Fleets is funded by the U.S. Department of Energy (EERE Program), with support from the California Department of General Services, and Rockefeller Brothers Fund. Find out more at www.evsmartfleets.com.

EV Smart Fleets aims to develop a replicable procurement mechanism for state and local government fleets to acquire EVs at a discount from the manufacturer's suggested retail price (MSRP), improve availability of EV models, and reduce the costs of administering an EV procurement for fleets. The primary challenge for this effort is designing a solicitation that meets the needs of participating public agencies. To make the multi-state EV agreement available to the broadest number of jurisdictions (see Box 2), it may allow for participating jurisdictions to negotiate their own financing terms.

EV Smart Fleets will use a solicitation process to establish a multi-state agreement through the National Association of State Procurement Officials (NASPO) ValuePoint Cooperative Purchasing Organization. The NASPO ValuePoint program has the following advantages for state and local fleets that participate in the resulting agreement(s):

1. NASPO ValuePoint is an established platform that convenes states to create multi-state agreements and allows public agencies to leverage their spending through a single solicitation at lower cost and improved contract terms.
2. Municipal, county, and other local fleets may be able to utilize the resulting multi-state EV agreement if authorized by the State Procurement Official.

3. A multi-state solicitation process may increase the chance that automakers will offer more vehicle models for public fleets than through normal procurement channels.
4. The cooperative purchasing program will save state and local agencies the administrative costs of setting up and processing multiple individual solicitations for EVs.
5. The solicitation and resulting multi-state EV agreement can facilitate widespread participation across many states which, given the purchasing potential, may encourage vendors to offer more favorable financial terms than individual state and local fleets could attain otherwise. [1]

Box 2. Term Definition: Solicitation and Procurement

Solicitation, when used in this document, refers to the multi-state government request for proposals for sale or lease of electric vehicles being led by the State of California as part of a multi-state Sourcing Team in cooperation with the NASPO ValuePoint Cooperative Purchasing Organization. The solicitation process may include an initial Request for Information (RFI) from vendors to survey the market. The intent of the solicitation process will be to establish a multi-state EV agreement to be used as a mechanism for state and local public fleets to procure EVs [2].

Procurement, when used in this document, refers to the individual purchases/contracts that state and local public fleets will execute for EVs [1].

This report is divided into four chapters. Chapter 1 summarizes the EV Smart Fleets team's outreach effort targeted at state and local fleets to assess public fleet interest in EV adoption and identify the current barriers to electrification of public fleets. Based on more targeted research and outreach on the procurement practices of public fleets, Chapter 2 describes the key requirements and practices that can help reduce adoption barriers and considers which of these practices can be incorporated in a multi-state EV agreement. Chapter 3 of the report informs a solicitation effort to establish a multi-state agreement by analyzing procurement scenarios that can offer potential economic and environmental benefits, and thereby demonstrate the value proposition of fleet electrification for both large and small public fleets. Finally, Chapter 4 summarizes the report's conclusions and offers guidance on procurement strategies for a multi-state EV agreement and for individual fleets.

I. INSIGHTS FROM STAKEHOLDER OUTREACH

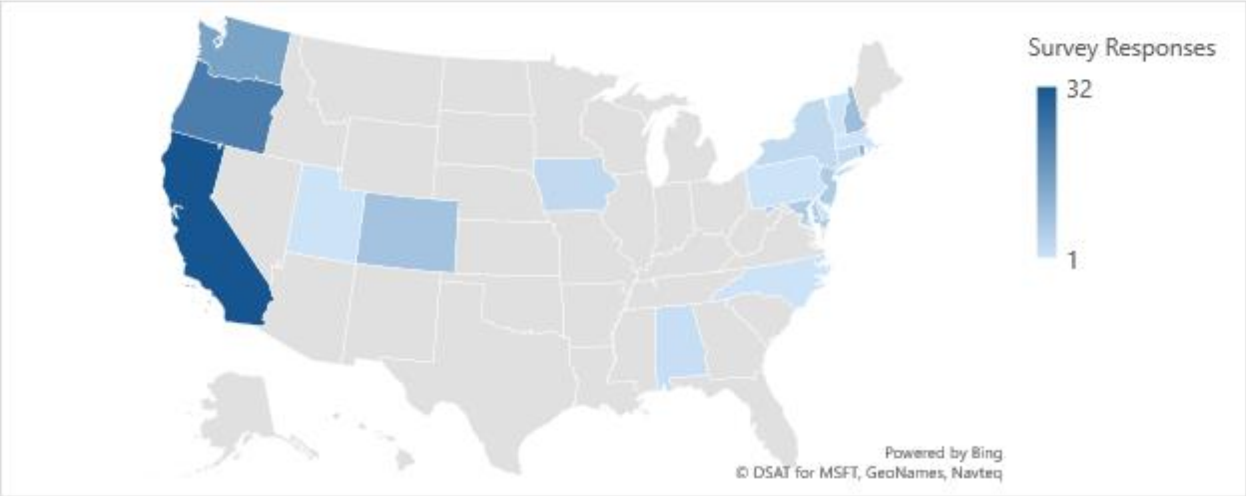
This chapter summarizes opportunities for and implementation challenges of a multi-state solicitation, which were derived from direct engagement with state and local public fleet and procurement managers, auto makers and dealers, and dealer networks. The EV Smart Fleets team conducted an on-line survey of more than 100 fleets in 18 states to better understand the characteristics of public fleets interested in acquiring EVs, as well as the fleets' reasons for such interest and charging infrastructure needs. The results of the survey informed the development of key components of the solicitation. Following consideration of the survey responses, the EV Smart Fleets team conducted targeted outreach to public fleets, auto manufacturers, individual dealers, and dealer networks to address any remaining uncertainties and determine the procurement elements most suitable for the solicitation.

ONLINE FLEET SURVEY

The EV Smart Fleets team conducted a nationwide survey of fleets through its website in the fall of 2016. The survey results offered insights into fleet procurement and resulted in the identification of the opportunities and challenges associated with implementation of a multi-state EV agreement. An interactive version of the survey results is available on the EV Smart Fleets website at http://evsmartfleets.com/materials/fleet-survey-results.

More than 100 state, municipal, and county fleets from 18 states responded to the survey. Fleets in all but one of the states expressed interest in the multi-state agreement. More than half of the respondents were located on the West Coast (see Figure 1).

FIGURE 1: FLEET SURVEY RESPONDENTS BY STATE

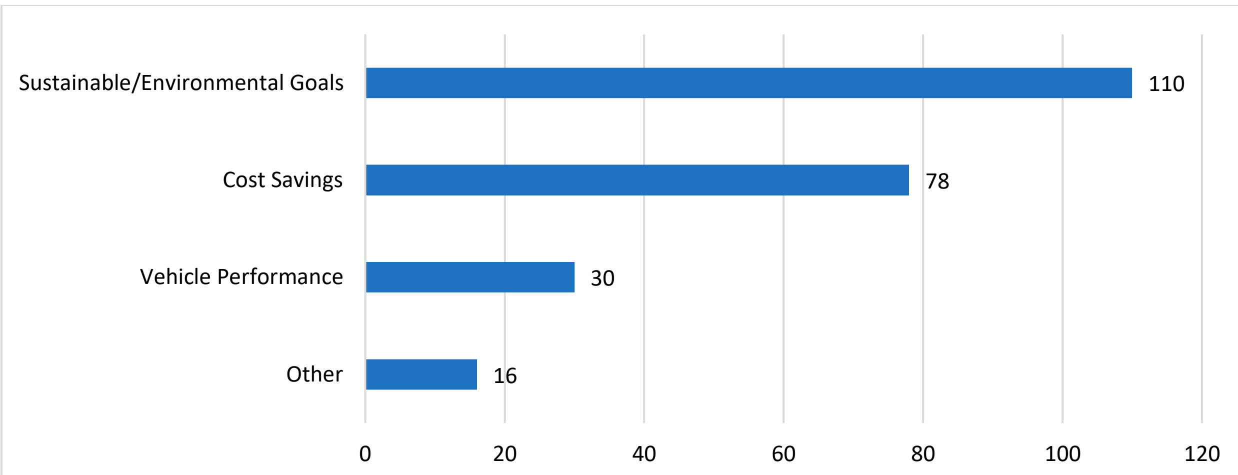


More than 100 fleets in 18 states responded to the online survey. The shade of the state corresponds to the number of survey respondents.

For many public fleets, the higher upfront purchase price of EVs (compared to conventional vehicles) is a barrier to fleet EV adoption. However, the survey data revealed a key opportunity to realize potential total cost of ownership savings through lower EV operating costs. Nearly all surveyed fleets hold on to vehicles for more than five years, which increases the likelihood that EVs will achieve total cost of ownership savings compared to conventional vehicles.

More than 100 fleets reported that cost savings and/or sustainability goals were the drivers for interest in fleet electrification. Achieving sustainability goals was the most frequently cited reason for fleet interest in EVs. This could mean that higher upfront purchase prices might not be a barrier in some cases if resources exist at a public agency to meet an environmental goal. See Figure 2 for the top reasons for fleet interest in EVs.

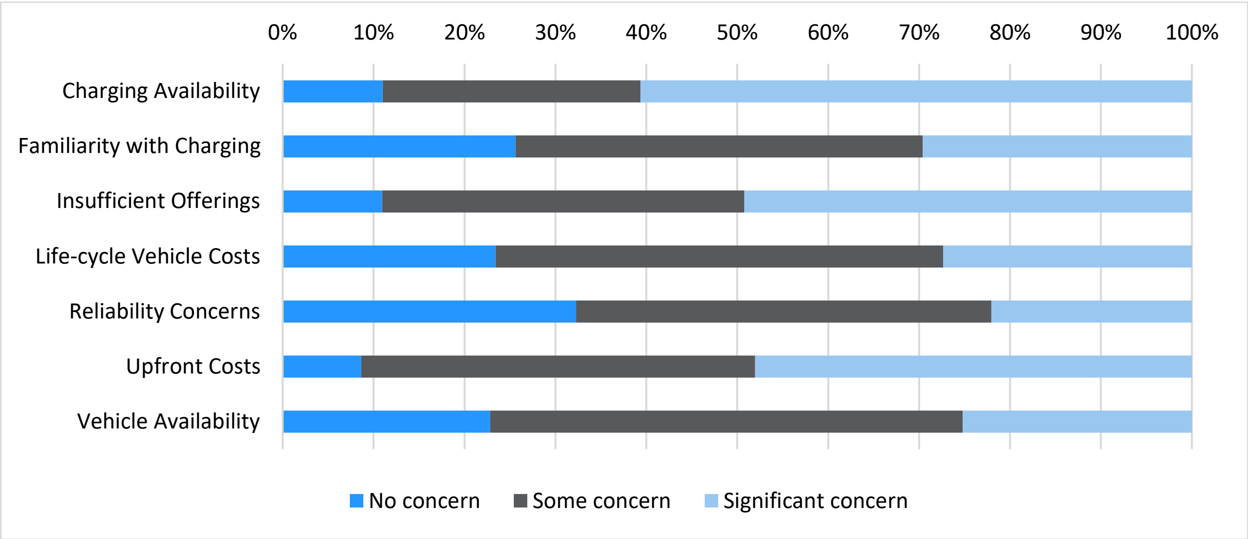
FIGURE 2: REASON FOR INTEREST IN EVS



Survey respondents could select more than one reason. More than 100 respondents selected sustainability and/or cost savings as the reason for their interest in EVs.

Regarding adoption barriers, survey respondents reported that access to charging infrastructure, vehicle model availability (insufficient offerings) and upfront costs were the top challenges. The multi-state EV solicitation process is being designed to address vehicle cost and availability challenges. Charging stations will not be included in the solicitation, therefore, so the resulting multi-state EV agreement will not directly address this barrier. Barriers of least concern to responding fleets included potential for higher lifecycle costs from owning an EV and the reliability of EVs. See Figure 3 for more information.

FIGURE 3: BARRIERS TO EV ADOPTION



Access to charging infrastructure, insufficient vehicle offerings, and upfront costs are the greatest concerns of fleets.

TARGETED STATE AND LOCAL FLEET OUTREACH

To maximize the effectiveness of the EV Smart Fleets initiative in increasing public fleet electrification, the multi-state agreement will need to enable broad participation by state and local fleets and meet the diverse needs of individual fleets. With the help of several Clean Cities Coalitions, the EV Smart fleets team conducted direct outreach to several local government fleet and procurement managers to identify key procurement elements needed to accommodate a large number of fleets, as well as to gauge the fleets' levels of familiarity with EVs and charging infrastructure.

The targeted outreach effort revealed that fleet procurement policies vary both within states and across state lines. Additionally, state and local fleets' ability to acquire EVs through existing contracts varies by region. For example, one-third of fleets contacted through direct outreach said they do not have a contract in place that could support EV procurements (e.g., none of the responding New Hampshire fleets said they could procure EVs from an existing contract); however, two-thirds of fleets from California contacted claimed to have access to EVs. According to the California Department of General Services, all public fleets have access to EVs through the state contract, which highlights a potential information gap at some fleets in the state.

Commonalities in practices and policies are evident among fleets that responded to the outreach questions.

The information in Table 1 provides an aggregated summary of fleet responses for the key questions asked regarding procurement practices and options for EVs. Responses are further detailed and assessed in the sections below. While not a comprehensive, nationwide survey, the information collected from fleets gave useful insights into the creation of a multi-state agreement for EVs.

TABLE 1: CLEAN CITIES OUTREACH RESPONSES

Clean Cities Coalition	State	EVs on current procurement contract	State policy prohibiting out-of-state purchase	Multi-state agreement efforts	Availability of low-cost financing	Leasing is an option	Access to existing charging infrastructure procurements
Columbia-Willamette	WA, OR	7/8	0/10	9/9	0/10	4/10	2/7
Denver	CO	10/14	1/14	9/14	8/14	9/14	12/14
Granite State	NH	0/5	3/5	2/5	0/5	4/5	0/5
Greater New Haven	CT	Unknown	0/15	14/15	Unknown	14/15	Unknown
Long Beach	CA	11/15	3/15	9/15	9/15	5/15	11/15
Ocean State	RI	0/4	0/4	Unknown	3/3	Unknown	5/5
Sacramento	CA	10/15	4/15	1/15	1/15	5/15	15/15
Western Washington	WA	18/18	1/18	10/18	10/18	11/18	18/18
Total		**56/79**	**12/96**	**54/91**	**31/80**	**52/92**	**63/79**

Fleet responses collected by Clean Cities Coalitions were analyzed and aggregated. Responses were then tallied for key questions. The denominator is the total number of responses that were received from the Coalition for each question. Cells in the table are marked Unknown if the data could not be extrapolated from fleet responses.

EVS ON CURRENT PROCUREMENT CONTRACT

Based on information from fleet respondents, EV availability is generally limited for fleets and varies by region, though many fleets polled do have access to EVs on their current vehicle contracts.[1] The fleets that responded from New England and New York reported no EV availability on existing contracts at the time of outreach, whereas the Washington, California, and Oregon fleets all had some level of EV availability on existing contracts (see Table). These results are consistent with a 2016 study from the Union of Concerned Scientists, which found that 16 EV models were available in West Coast states whereas only eight models were available in New England and New York [3].

For those fleets that go to bid, some responded that they do not have access to EVs, because they have not requested EVs in a bid solicitation to dealers. Responses varied by state primarily, but noticeable variation existed within a few states. For example, at the time of outreach, fleets polled in New Hampshire and Rhode Island unanimously responded that they cannot purchase EVs on current contracts, while the vast majority of respondents from California, Oregon, Colorado, and Washington said EVs are available. In Colorado, more than one quarter of fleets combined reported that they do not have access to EVs on current contracts. The establishment of a multi-state EV agreement may provide a

[1] 56 of 79 fleets said that they have some level of EV availability on current contracts or can go to bid for EVs.

purchasing mechanism for those state and local fleets without current contracts. As of April 2017, both New Hampshire and Rhode Island statewide had contracts where EVs could be purchased [4, 5].

STATE POLICY PROHIBITING OUT-OF-STATE PURCHASE

The ability for fleets to purchase from out-of-state dealers was also explored. A large majority of fleets said that there is no prohibition on purchasing vehicles from out-of-state dealers, unless a contract specified a 'buy local' agreement.[2] Other fleets reported that they are unsure about policies on out-of-state purchases. Even so, many fleets said that they prefer to procure vehicles from in-state or regional vendors. Many fleets also indicated that they are permitted to procure EVs outside of existing contracts, if those contracts do not offer access to EVs.

MULTI-STATE AGREEMENT EFFORTS

Fleets respondents said that they either use state contracts or go to bid separately. Two-thirds of respondents said that they can use a multi-state or national contract.[3] While many of these same fleets said that using multi-state contracts is uncommon, it would likely appear no different than the commonly-used state contracts. Some fleets were unsure if they are allowed to participate in a multi-state agreement, which indicates that these fleets may not understand the barriers and opportunities involved in using a multi-state agreement. Additionally, some fleets reported that even if there is a policy in place requiring fleets to use a state or local contract, there may be an internal process in place for allowing a multi-state contract so long as use of the contract can be justified.

AVAILABILITY OF LOW COST FINANCING

For many fleets, outright purchase is the standard practice and third-party financing is not utilized. Additionally, more than two-thirds of state and local public fleets surveyed across eight states said they either do not finance or do not have access to low-cost financing for EVs.[4]

LEASING IS AN OPTION

The ability to lease vehicles varies on a fleet-to-fleet basis, due to local procurement policies. Many fleets do not lease, even where the option exists.[5] Reasons offered include a desire to stick to traditional practices, or the lack of clear benefits to leasing over other forms of ownership. Many fleets in the Northeast (Rhode Island, New Hampshire, and Connecticut) said that leasing is not prohibited, however, and is being used to procure vehicles in some cases.

ACCESS TO EXISTING CHARGING INFRASTRUCTURE PROCUREMENTS

Access to charging infrastructure is a necessity for fleet electrification, although procurement of charging infrastructure will not be included in the multi-state agreement. Of the local government fleets contacted by the Clean Cities Coalitions that are partners in EV Smart Fleets, most fleets in five of the eight jurisdictions are aware of, or have access to, a state or local mechanism for acquiring charging infrastructure. In the other three jurisdictions, most fleets said either that infrastructure procurements are widely unavailable, or that they are uncertain about availability. Fleets in New Hampshire, for example, do not have access to a charging infrastructure procurement mechanism.

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[2] Only 12 of 96 fleets said that they are aware of a state policy prohibiting vehicle purchases from out-of-state dealers.
[3] 54 of 91 fleets said that they are not restricted to state or local procurement contracts.
[4] Only 31 of 80 fleets that responded to this outreach question have access to low cost financing.
[5] Of fleets that responded, 52 of 92 indicated that there was either no policy against leasing or that leasing was an option.

TARGETED AUTO DEALER OUTREACH

Clean Cities Coalitions also helped the EV Smart Fleets conduct targeted outreach to sales managers and local auto dealerships in Illinois, Massachusetts, New York, and Colorado. While not a comprehensive nationwide survey, this outreach gave insights into dealers' experiences with local fleet EV procurements. Further outreach was also conducted with select state dealer associations and national fleet dealerships to identify opportunities and barriers for regional fleet EV procurements and distribution. The outreach indicated that dealers have varied experiences working with fleets to procure EVs, as well as with leasing vehicles to fleets. Additional outreach to dealerships will be conducted by the State of California during the solicitation process.

Dealer outreach further revealed that public fleets have captured federal and state purchase incentives in both leases and purchases. For example, Nissan dealers worked with the automaker's financing arm to enable leasing and/or financing in California, Washington, and Massachusetts [6, 7]. In some cases, this allowed fleets to capture federal and state rebates and/or tax incentives. Nissan was the only automaker cited in the outreach as having experience offering discounts, financing, and flexible ownership arrangements to reduce costs for public fleets. Two Chevrolet dealers said that they have not leased vehicles to public fleets, and one of them said they captured the tax credit for Washington State government's recent purchase of Chevrolet Bolt EVs.

Dealer agreements with automakers play a central role in determining the availability of EVs, flexible ownership structures, financing, and cost reducing measures, such as discounts and the capture of tax incentives.

Two national dealer groups from Illinois and New York that work with fleets were interviewed. The Illinois fleet dealer group indicated that approximately 10 national dealerships have experience organizing passenger vehicle procurements for fleets.

National fleet dealer groups said that drop-shipping to states nationwide is widely practiced by these groups and is available for a fee. The Illinois group has agreements with dealerships in every state to accept drop-shipments and the group works exclusively with Ford, General Motors, and Toyota. The New York dealer group said drop-shipments and "piggyback" provisions can improve EV offerings for a wide segment of state and local fleets.

II. EVALUATION OF PROCUREMENT ELEMENTS

This chapter considers the strategies a public fleet might use in procuring an EV and provides recommendations for the use of these strategies within the architecture of a multi-state EV agreement. Each of these strategies, or procurement elements, is assessed based on its value to the solicitation and to ordering agency fleets. A feasibility analysis of the procurement elements follows detailed assessments of each element and addresses how these strategies might be combined.

METHODOLOGY FOR SELECTING ELEMENTS TO INCLUDE IN THE AGREEMENT

The procurement elements recommended for incorporation into the multi-state agreement have been selected based on their ability to address the initiative goals. Overall, the agreement aims to: (1) achieve cost savings for fleets; (2) be replicable in future years; (3) be useful to a wide variety of state and local fleets; and (4) increase a fleet's access to a wider range of plug-in hybrid and battery electric vehicle models. Research on the elements that could be incorporated into a public fleet procurement included a review of published literature, an examination of previous solicitations and procurements, and direct outreach to automakers, dealers, fleet managers, and procurement officials.

The procurement elements that will be incorporated into the multi-state solicitation must also align with the NASPO ValuePoint Cooperative Purchasing Program process.

ASSESSMENT OF POTENTIAL PROCUREMENT ELEMENTS FOR THE AGREEMENT

Accommodation of all the elements described below in the multi-state solicitation is not necessary. Instead, the following elements comprise a modular set of methods that can be used by fleets to optimize acquisition of EVs. The most promising elements of an individual fleet procurement, which are not listed in order of priority, are presented in the table below.

TABLE 2: ELEMENTS OF A POTENTIAL SOLICITATION FOR A MULTI-STATE EV AGREEMENT

Element	Initiative Goal Addressed
1. Encourage capture of the federal EV tax credit and all available state EV incentives	• Achieve cost savings for fleets.
2. Provide flexibility to lease or own vehicles	• Achieve cost savings for fleets. • Be useful to a wide variety of public fleets. • Increase a fleet's access to a wider range of plug-in hybrid and battery electric vehicle models.
3. Allow fleets to finance vehicles through a third-party	• Achieve cost savings for fleets. • Maximize the number of eligible EVs.
4. Require pricing from the dealer's cost up and seek discounts	• Achieve cost savings for fleets. • Be replicable in future years.
5. Solicit bids from networked auto dealers rather than individual auto dealers.	• Achieve cost savings for fleets. • Maximize the number of eligible EVs. • Increase a fleet's access to a wider range of plug-in hybrid and battery electric vehicle models.

1. ENCOURAGE CAPTURE OF THE FEDERAL EV TAX CREDIT AND ALL AVAILABLE STATE EV INCENTIVES

The federal EV tax credit offers the single largest savings for consumers leasing or purchasing new EVs. For vehicles with an upfront cost of $35,000 and under, application of the $7,500 credit will achieve a 20 percent cost savings. Battery electric vehicles are eligible for the maximum $7,500 credit, while plug-in hybrids can be eligible for a lower credit, depending on the vehicle's battery capacity (see Box 3).

Box 3. Federal EV Tax Credit

Incentive Amount: The federal EV tax credit or "Plug-In Electric Drive Vehicle Credit (IRC 30D)" maximum value per vehicle is $7,500. The value is $2,500, plus $417 for vehicles with battery capacity of 5 kilowatt hours (kWh), and $417 for each additional kWh in battery capacity. [8].

Phase-Out: When an auto manufacturer has sold 200,000 qualifying EVs, the credit begins to phase out for that auto manufacturer over a subsequent one-year period. Vehicles from that auto manufacturer can receive reduced credits depending on when they are purchased during the phase-out period. No vehicles from that manufacturer can receive credit after the phase-out period [8].

State and local fleets cannot directly take advantage of this benefit since they are not taxable entities, but there is a provision in the federal tax code that allows the credit's value to be transferred to public agencies from auto dealers and third-parties. The federal tax code states that when an EV is purchased by a tax-exempt entity, including "any State or political subdivision thereof," the vehicle seller can be treated as the taxpayer and can capture the value of the tax credit, so long as the seller discloses the value of the tax credit to the buyer. All or a portion of this value can then be shared with the public agency, which can lead to significant cost savings for state and local fleets. Automakers can work with dealers to ensure that the federal EV tax credit is captured for purchases [9].

Additionally, some states offer incentives for public sector EV fleet purchases and/or leases. These can take the form of grants and rebates, and are administered by state government agencies. The use of state incentives can further increase cost savings for eligible state and local fleets, though restrictions may exist as detailed below.

IMPLEMENTATION CHALLENGES

No precedent exists for capturing a tax credit in a public procurement conducted through the NASPO ValuePoint program. Capturing the federal EV tax credit in a multi-state agreement is possible, but doing so should not be a requirement of the solicitation due to uncertainty around the availability of the credit due to manufacturer-specific phase outs, and the ability of a participating third party to take advantage of the credit (see Box 3).

Because businesses typically try to limit their tax "appetite," third-parties may not be able to take advantage of the federal tax credit, even in small volumes. For example, auto dealers can structure their businesses in a way that benefits their tax position by separating the less lucrative, sales side of the business from the more profitable, maintenance side. Thus, the sales part of the business, the one that would bid on the solicitation, may not have a sufficient tax appetite to benefit from the federal tax credit.

Auto dealers and third-party financiers (including the financing arms of automakers) can capture federal tax credits and possible state incentives and pass them along to state and local fleets. Doing so, however, requires that contracts address the uncertainties associated with these incentives, such as the per-automaker phase-out limit of federal EV tax credit. The solicitation should only request or encourage that incentives be captured if they are available, making them an optional element that bidders could include to improve the chances of winning a contract.

Auto dealers, financiers, and other third parties would be wary of committing to pass along the federal EV tax credit's savings to the public fleet, only to have the credit be unavailable at the time the taxable entity can exercise it. The IRS does not provide information on the current aggregate sales of qualifying EVs for most major auto manufacturers [10], but does provide the incentive amounts for qualifying EV models and model years [11]. Therefore, it is unlikely that a third-party bidder will guarantee capturing the credit given the uncertainty about the availability of the credit. As a solution, a bidder could specify terms that apply only if the credit is captured.

Additional challenges to combining the federal EV tax credit and other procurement elements that could be incorporated into the solicitation (i.e., flexibility to lease or own vehicles, financing vehicles through a third-party, and using an auto dealer network instead of individual auto dealers) are discussed in the subsequent element sections below.

For state-based grants or rebates, the availability and structure of incentives varies greatly. Restrictions for use of these incentives can include:

- Not all grants and rebate programs are available for public fleets.
- The incentive is available for a purchase, but not a lease.
- Only certain vehicles are eligible, such as vehicles that cost under a certain amount.
- Only certain fleets are eligible based on location.
- Incentive amount is a percentage of the incremental cost differential between an EV and a comparable gasoline vehicle up to a certain dollar amount.

- Incentive amount is the lesser of two values (e.g., a fixed percentage of the purchase price and a specified dollar amount).
- Incentive amount is fixed based on vehicle technology (battery electric or plug-in hybrid) or based on the vehicle's battery capacity ($/kWh) up to a certain dollar amount.
- Total incentive amounts allocated or number of rebates are capped for a fleet, a public entity, or a municipality.
- Funding is either capped by an amount or available until a specific date.
- Vehicles must be used within the state for a certain number of months or years.
- Vehicle purchases must also be accompanied by the purchase of charging infrastructure.
- Procurement of vehicles must meet the funding body's specified procurement requirements.

State-based tax incentives for consumers and businesses also exist, but public fleets that are exempt from tax liability would not be able to directly take advantage of these benefits.

2. PROVIDE FLEXIBILITY TO LEASE OR OWN VEHICLES

To accommodate the procurement requirements and practices for states, the multi-state solicitation should have the flexibility to allow fleets to acquire vehicles through a purchase or lease. Providing fleets with ownership model flexibility can help achieve cost savings, can improve replicability in future years, and increase usability for fleets across more states.

Public entities can buy vehicles directly from the vendor or fund the purchase with debt through a bond issuance or third-party financing.

Leasing is possible, and in some cases preferred, as an ownership structure for some state and local fleets; however, not all agencies will be able to take advantage of a leasing option even if the option is offered by the winning contractor(s). For example, some public agencies may have specific policies dictating whether a public agency can use bond financing for operating expenses, which is how vehicles leases may be treated [12].

An agency's ability to lease or own a vehicle can depend on whether acquisitions are treated as operating or capital expenses and whether vehicle acquisitions are funded with debt or cash. Until recently, depending on how they were structured, leases could be categorized as operating or capital leases. This accounting categorization determined how the vehicle asset was treated on a fleet's balance sheet. Starting with fiscal years beginning after December 15, 2019, all leases will be treated as capital leases, as explained below.

ACCOUNTING TREATMENTS

As dictated in the Generally Accepted Accounting Principles (GAAP), the accounting treatment determines whether or not the vehicle is legally considered an asset of the lessee or the lessor.[6]

- **Capital Lease:** Vehicles are treated as assets of the fleet and must be depreciated on the fleet's balance sheet. According to GAAP, if a lease meets any of the four criteria below then it is categorized as a capital lease:
    1. There is an ownership transfer to the lessee at the end of the lease.
    2. The lease contains a bargain purchase option.

[6] FASB GAAP Codification 840 Leases

3. The lease life exceeds 75 percent of the economic life of the asset.
4. The present value of the lease payments exceeds 90 percent of the fair market value of the asset.[7]

- **Operating Lease:** Currently, if none of the conditions of a capital lease are met, then the lease must be classified as an operating lease, which keeps vehicles off a fleet's balance sheet. However, recent changes to GAAP by the Financial Accounting Standards Board (FASB) will result in leases that were traditionally considered operating leases being categorized as capital leases going forward. In February 2016, the Board issued guidance that lessees will no longer be able to keep vehicle leases off their balance sheets. The provision takes effect for public agencies in fiscal years beginning after December 15, 2019, and will result in all existing leases being treated as capital leases, since vehicles will be treated as fleet assets.

LEASE STRUCTURES

Leases are generally structured around which party bears the cost of depreciation and can either be open-ended or closed-ended, as defined below:

- **Closed-End Lease**: Lease has a fixed term and the lessor has ownership of the vehicle, is liable for depreciation, funding, and responsible for some agreed upon administrative costs or expenses (e.g., licensing, maintenance, insurance, registration, etc.). Contract clauses typically stipulate price adjustments based on usage (per mile) past an agreed-upon threshold. At the end of the lease term, the lessee is not obligated to purchase the leases upon lease expiration and can turn in the vehicle to the lessor. The lessee may purchase the vehicle at the end of the lease term.
- **Open-End Lease**: After an initial lease period, the lessee is able to extend the term of the lease at will. The lessee assumes responsibilities of ownership and depreciation in exchange for a more flexible lease arrangement that does not include a fixed term of lease. The lessee is responsible to pay for the difference between the residual value and the fair market value of the vehicle. The lessee may purchase the vehicle at the end of the lease term.

Where leasing is possible, there are realistically three lease products that state and local fleets have been able to implement:

1. **Fair Market Value (FMV)**: This is a closed-end lease titled in the lessor's name. The lessor realizes depreciation on the asset and can impose mileage restrictions and fee assessments for damages to the vehicle. Historically, closed-end lease types, like an FMV lease, have been structured as operating leases, however the accounting treatment will be changing in two years, as discussed above.
2. **Terminal Rental Adjustment Clause (TRAC)**: This is an open-end lease. The lessee realizes depreciation of the asset, so the lessor does not impose mileage restrictions or damage fees. At the end of the lease the lessee might buy the vehicle or the lessor would sell the vehicle in a

[7] FASB GAAP Paragraph 840-10-25-1

secondary market and the lessee would have to pay the difference between the sale price and the book value if the sale price is lower.

3. **Tax-exempt lease-purchase**: This is a capital lease and this is the only known structure where the vehicle asset is titled in the lessee's name when the lease is signed. Payments on the lease can be structured to have the vehicle paid off over an agreed upon term, after which the lessee can exercise the bargain purchase option and gain free and clear ownership for as little as $1 [13].

ADVANTAGES OF INCLUDING THIS PROCUREMENT ELEMENT IN A SOLICITATION

Flexibility for fleets to own or lease allows fleets to use the ownership structure that best fits their needs and current practices. Leases offer predictable expenses for fleets and terms can be customized to consider a fleet's vehicle usage and the duration the fleet expects to hold the vehicles. An open-end lease could provide fleets with the option to trade in the vehicle for a more advanced vehicle in the future. Leasing companies could also offer a service that helps fleets decide which vehicles to retire based on mileage, fuel type, and usage. This can result in additional cost savings for a fleet especially when working with leasing companies that have experience and data on EV maintenance costs and residual values, and may therefore be able to better manage EV costs.

Aside from being standard practice for many public fleets, vehicle purchases can be advantageous for fleets looking to capture the savings from the federal EV tax credit (see *1. Encourage capture of the federal EV tax credit and all available state EV incentives*).

IMPLEMENTATION CHALLENGES

Ownership flexibility in a multi-state agreement can lead to an increase in administrative complexity for the contract administrator if multiple lease and/or purchase structures are being managed. For public agencies, bond issuance or financing for vehicles purchased or leased could lead to increased administrative complexity or the need to involve legal counsel.

For vehicle leases that require third-party maintenance, public fleets may incur higher maintenance costs than if they own the vehicles and have onsite maintenance facilities, where vehicles can often be serviced at a lower cost. Thus, leases that require regular servicing from a third-party may not make financial sense for the following use cases: low-mileage fleets that do not need frequent servicing; fleets that have in-house, low cost maintenance; or fleets that anticipate performing minimal maintenance during the lease term.

In a lease, lessors can mitigate the risk of the low residual value of an EV by charging higher lease payments than they would for a conventional vehicle with a more established secondary market [14]. Fleets, particularly those with a policy of selling vehicles prior to the end of their useful life, can use leasing to mitigate concerns with the low residual value of an EV; additionally, leasing more easily allows fleets to upgrade to newer models of EVs as the vehicle technology continues to improve.

A lease-purchase agreement that is financed can raise issues if the fleet typically funds vehicle acquisitions with debt (public bonds), as funds from debt cannot typically be used to cover operating expenses. In some cases, the fleet must also insure or maintain vehicles through a third- party, which can raise costs above business as usual.

3. ALLOW FLEETS TO FINANCE VEHICLES THROUGH A THIRD-PARTY

Funding from a third-party financier could be made available for EVs through the financing arm of an automaker, dealer-arranged financing, a bank, or in limited cases, a state-based green bank.

ADVANTAGES OF INCLUDING THIS PROCUREMENT ELEMENT IN A SOLICITATION

Inclusion of this element in the solicitation could result in a lower total cost of ownership for public fleets through low-cost financing. This financing can address high upfront cost of EVs and can potentially allow for the federal EV tax credit to be passed along to state and local fleets (see *1. Encourage capture of the federal EV tax credit and all available state EV incentives*).

For fleets, financing can help address a public agency's operating or capital budget constraints and may allow fleets to offset the higher marginal purchase cost of an EV through the vehicle's lower total cost of ownership. By avoiding upfront capital expenses for vehicles through financing, fleets can avoid bond issuance and free up capital funds for EV charging infrastructure or other projects. Financing payments are predictable and straightforward and allow public agencies to spread upfront costs over many years. Financiers typically avoid repossessing vehicles, so they are not dissuaded by the current, low residual values of EVs [15].

Financing from banks is available for vehicle purchases, though the availability of financing and the interest rate at which the purchase is financed will vary based on the credit rating of the borrower (or borrowers) and the size of the procurement. Third party financiers can pass along all or part of the federal EV tax credit to non-taxable entities (public fleets).

IMPLEMENTATION CHALLENGES

The willingness of a single large financier (a bank) to provide low cost financing that is widely available for participating fleets, without a set number of vehicles specified, is unknown. Alternatively, individual fleets may be able to negotiate their own financing rather than participating in an aggregated financing agreement. A bank's ability to lend is reflected in the interest rate of the loan offered. The larger the scale of the procurement, the lower the cost of financing will be assuming the borrower or borrowers has an excellent credit rating [15]. Negotiations with a financier must address 1) procurement volume, 2) cost of financing, and 3) payment schedule.

To capture the federal tax credit in an ownership transfer with a third-party financier, the vehicles would have to be sold to the state as early as the next day after purchase. This can present logistical issues for fleets and financiers, and the uncertain availability of the credit may dissuade lenders from agreeing to capture the credit. Transferring the title of the vehicle from the financier to the fleet requires significant paperwork at a fixed cost, as each vehicle must be processed individually. The ability for a public fleet to take ownership of the vehicle quickly depends on processing at a state department of motor vehicles. Although some DMVs allow agencies to submit a one-day title transfer online, others require that paperwork be submitted at the office, potentially resulting in a lengthy delay.

To obtain the federal EV tax credit, purchase orders must be placed through the financier. Although fleets may attain superior financing terms from a third party, the processing of these purchases may take longer than if financing is done directly through an automaker's financing arm. Finally, a bank may want to conduct a quality control assessment of some vehicles given the investment size before delivering the vehicles to the public agency. In this case, agencies could take issue with vehicles not being directly transferred to them.

Some state or local government agencies may have a "non-appropriation clause" that allows future governments to choose not to take on the financing payments for vehicles incurred by past governments. That said, there is very low risk of these clauses being exercised, because doing so would be detrimental to the agency's bond rating. Financiers are therefore unlikely to be deterred by a "non-appropriation clause" unless they have reason to think that an agency would exercise it [15].

Lastly, “green” financing options such as green banks or green revolving funds could provide low-cost financing for clean energy projects where available. In this case, funding from a green revolving fund would likely need to be organized by a public agency rather than an individual fleet or a potential bidder. The funding would then be widely available to department fleets. As of early 2017, only one green revolving fund has identified zero emission vehicle procurement as a possible funding recipient.[8] Because these banks are largely state-based and are not available in most states, this financing option would only be a potential funding source for a select group fleets.[9]

4. Require pricing from the dealer’s cost up and seek discounts

Public fleets can negotiate vehicle prices with the dealer from the retail price (or MSRP) down or from the dealer’s cost up. The dealer’s cost (referred to as triple-net pricing) is the invoice price minus any benefits that the dealer receives from the automaker when buying the vehicles, which can result in a noticeably lower starting price for negotiations. In triple-net pricing, all add-on options (e.g., power windows) are priced as-is from the automaker.

The lack of transparency surrounding the value of dealer discounts off MSRP may prevent fleets from getting the best deal possible on an EV. A dealer can increase the retail price of a vehicle through add-ons and other options, and promote a reduction in price from that level as a discount. Price transparency can be improved by structuring the solicitation to require dealer pricing to be based on the dealer’s cost.

Triple-net pricing is common practice in the private sector and for state agencies that conduct large, centralized procurement efforts, though public agencies may not use the same terminology. Public fleets that buy vehicles from existing dealer inventories may find it more difficult to negotiate using this scheme. Triple-net pricing reduces the costs of conducting future procurements for fleets by simplifying the negotiation process with dealers, which improves the replicability of future procurements at a lower cost.

The dealer’s bid will ultimately be an increase or markup over the “triple-net” as detailed below:

$$\begin{aligned} &Triple\ Net\ Price\ Bid \\ &\qquad = Dealer\ Invoice - Dealer\ Holdback - Advertising - \ Fleet\ Discounts \\ &\qquad + Dealer\ Markup \end{aligned}$$

- **Dealer Invoice**: Vehicle invoice from the automaker.
- **Dealer Holdback**: Percentage of dealer invoice or suggested MSRP.
- **Advertising**: Marketing funding from the automaker.
- **Fleet Discounts**: Intra-transit credit, automaker bid assistance, or fleet-specific discount. Policies for government bid assistance may vary by automaker.[10]
- **Dealer Markup**: A bid above the cost to the dealer.

The structure of pricing dictates how discounts are applied to the final price. For pricing from the retail price down discounts would come off the MSRP. Discounts under triple net pricing could take the form of

[8] Use of a green fund to fund ZEV procurements has been applied in Oregon where a fund was established through the legislature using the state’s loan program for energy efficiency. The program was approved in 2013 and as of March 2016, it had not been used [33].
[9] Some universities have established funding programs that may be available to fleets in some communities [34].
[10] General Motor’s Government Bid Assistance Policy stipulates that to qualify for government bid assistance, eligible public agencies must be eligible to purchase vehicles off a state contract (for state contract holder only) or receive 50 percent or greater funding for their annual operating budget from federal or state grant monies (excludes fee-for-service). To comply with the 50 percent or greater funding rule, a dealer must secure and retain written proof of the customer’s funding source [17].

a reduced dealer markup and/or fleet discounts directly from the automaker. Discounts from the automaker (i.e., dealer holdback, advertising, and fleet discounts) help reduce cost for dealers organizing fleet purchases.

The automaker can assist the dealer in acquisition of the vehicles for the fleet in the form of incentives and support in their purchase orders for public fleets. This assistance from the automaker to the dealer is typically holdback (usually about three percent of suggested MSRP or dealer invoice), an in-transit interest credit that covers the interest accrued on the vehicle during delivery from the automaker to the dealer, funding for marketing, and automaker bid assistance [16]. For example, General Motors offers incentives to dealers as part of its Dealer Fleet Ordering and Assistance Program [17].

Additionally, fleets can achieve cost savings from discounts from the dealer and/or the automaker. Fleets typically have a special fleet identification number (FIN) or fleet account number (FAN) that are associated with direct discounts off the MSRP attached to the purchasing order [18]. Depending on the circumstance, further discounts may be negotiated with the dealer and additional direct discounts may be offered by the automaker.

Regardless of pricing structure, there is the possibility that an automaker could offer further discounts off the price for a fleet, but such discounts are infrequent and unpredictable. State franchise laws can prohibit automakers from negotiating discounts directly with public agencies and the private sector; however, automakers may offer significant incentives to both government agencies in the form of a competitive pricing allowance (CPA). Typically, government fleet discounts are less volume driven and more dependent on the automaker’s desire to reduce vehicle inventories at the end of a calendar year to make way for newer models, to meet government mandates, or to promote vehicles locally. In situations where volume is significant, then an automaker can arrange a CPA with a public agency [16].

Finally, automakers can encourage dealers to sell new vehicles through volume-based incentives for new vehicle purchases, financing revenue for retail sales, and “back-end” sales products like warranties. Many dealers receive most of their revenue from servicing vehicles, making body-work repairs, and selling used vehicles; therefore, incentives from automakers to dealers to sell new vehicles, like EVs, can be crucial to dealer engagement.

IMPLEMENTATION CHALLENGES

Some dealers may not bid on solicitations for public fleets with a triple-net pricing structure because it offers dealers less flexibility in how they can bid. The effect of this pricing structure on the quality and size of the bidding pool is unknown; however, it is possible that any reductions to the size of the bidding pool due to the bid structure might be mitigated if the bid is open to dealers across multiple regions and states through dealer networks. While dealers are familiar with this pricing structure, public sector fleets may not use the term “triple-net pricing” when referring to this approach.

The feasibility and replicability of a significant discount from either the automaker or a dealer is unknown. For example, Nissan offered a fleet discount of $9,000 in addition to the federal EV tax credit in 2016.[11] The continued availability of these discounts is uncertain, as automakers have made major investments to launch their EVs and may elect not to offer steep discounts for extended periods. Furthermore, auto dealers would be unlikely to guarantee the federal tax credit and a discount (i.e., either discounts off MSRP or reduced dealer markup) because of the required tax appetite on the part of the dealer, uncertain availability of the credit, and the low margins on EV sales.

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[11] Nissan Fleet Offer August 2016

Finally, if a purchase is financed, logistical barriers could prevent a fleet from receiving its typical discount using fleet ordering codes because the financier must be placed on the purchase order.

5. SOLICIT BIDS FROM NETWORKED AUTO DEALERS RATHER THAN INDIVIDUAL AUTO DEALERS

The use of auto dealer networks, which include large auto dealer conglomerates and the automaker-specific dealer shipment networks, could lower the cost of vehicles, and/or increase vehicle availability. Auto dealer conglomerates may own several dealerships in a region and/or nationwide. The reach and scope of these conglomerates can potentially result in volume discounts for aggregated fleet purchases. If revenues are great enough for a conglomerate, they may be able to centrally capture the federal EV tax credit for many fleet purchases.

Automaker dealer networks could also give fleets access to dealers outside of their local base of bidders, which has two significant benefits. First, a dealer selected for the procurement may be able to offer fleets cost savings through the capture of the federal EV tax credit and/or a discount for vehicle purchases. Second, dealer networks can increase the availability of EV models for fleet purchases, especially for vehicle models that automakers have made available in only select markets. Dealers can "drop-ship" a vehicle from the automaker to a dealer in another state, a common practice for fleet purchases of new vehicles. For example, Toyota's Executive Delivery program requires dealers to a) accept vehicle deliveries from other dealers and to b) deliver vehicles to other dealers. Commercial fleet accounts like public and state fleets can request courtesy deliveries on a nationwide basis [19]. This mechanism has the potential to increase access to EVs nationwide and could allow dealers that can capture the tax credit to have a wider reach [16]. Automaker restrictions, however, could still limit vehicle availability.

IMPLEMENTATION CHALLENGES

For fleets soliciting purchases from out-of-state dealers through auto dealer networks, an agency's "buy American" and/or "buy local" policies may create barriers to soliciting the best possible bids, including reduced vehicle model availability and the ability to capture the federal EV tax credit. If deliveries from out of state dealers to local dealers through dealer networks satisfy buy local policies, an opportunity may exist to leverage.

FEASIBILITY ANALYSIS OF PROCUREMENT ELEMENTS

This section draws from the previous research and analysis of procurement elements to assess whether each element can be feasibly implemented by a majority of fleets. The previous section evaluated the degree to which the procurement elements could meet the EV Smart Fleets goals and identified implementation challenges for each element. As a reminder, the goals of the solicitation are: (1) to achieve cost savings for fleets; (2) be replicable in future years; (3) be useful to a wide variety of state and local fleets; and (4) to increase a fleet's access to a wider range of plug-in hybrid and battery electric vehicle models.

Fleets may be able to execute a procurement with any of the elements considered in this analysis. While some elements are widely available options for most fleets, such as outright vehicle purchases, other elements are only available to a smaller number of fleets, such as access to low-cost financing.

Below are the key factors affecting feasibility for each of the five procurement elements being considered for the multi-state agreement.

1. Encourage capture of the federal EV tax credit and all available state EV incentives

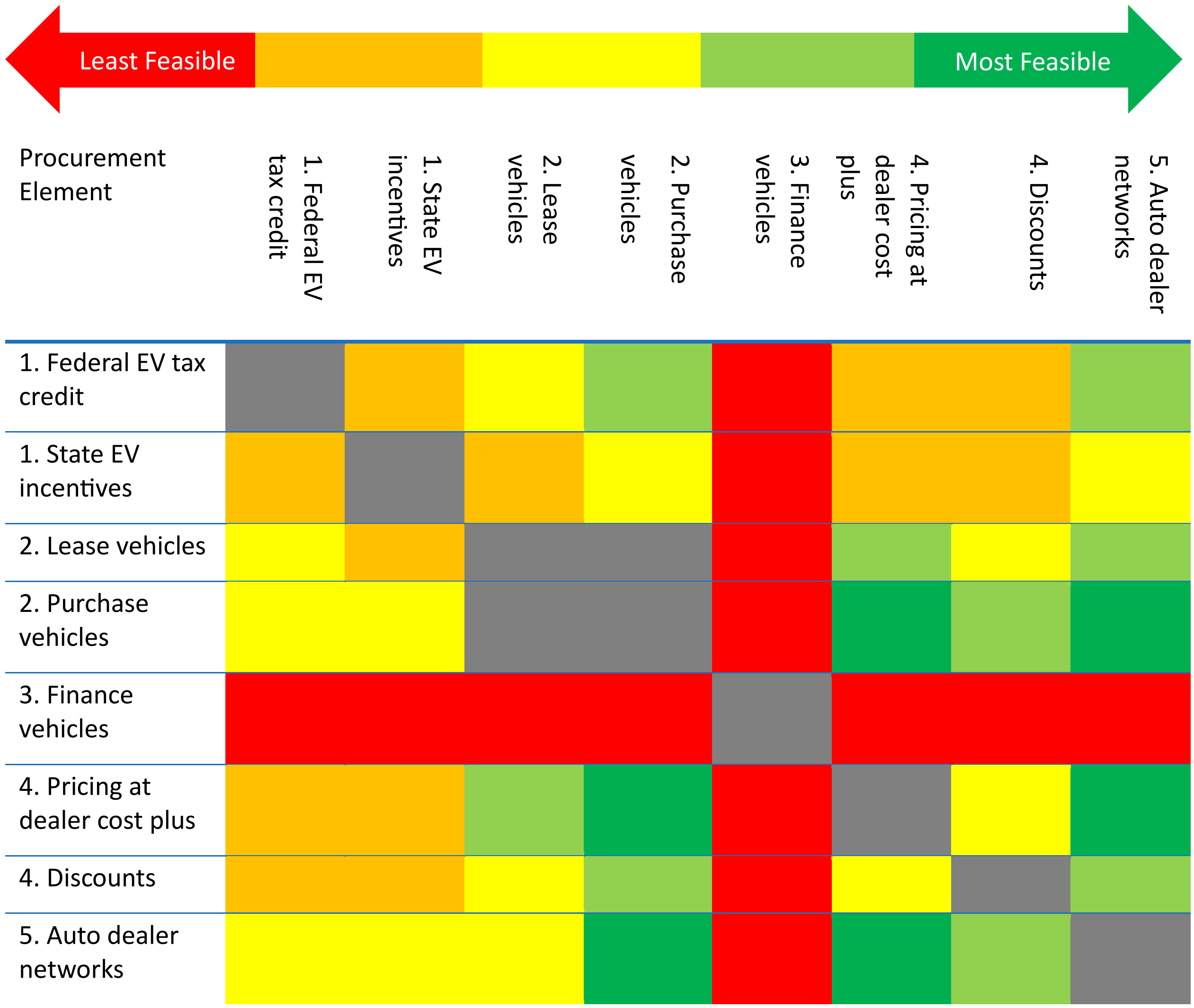
    a. It is possible to capture the federal EV tax credit and/or some state incentives in a purchase or a lease. Capturing either of these incentives, however, can be difficult given the scarcity of dealers with the requisite tax appetite. Few fleets will be able to capture both federal and state incentives.
    b. The availability of federal and state incentives is dependent on government policy, fleet policies, and procurement size. Availability is generally uncertain, because governments can eliminate incentives unexpectedly, and a fleet's ability to receive incentives is dependent on the procurement approach and the incentive requirements.
    c. At the time of this report, more instances of capturing the federal EV tax credit were identified than state incentives. Incentives are unavailable in most states and where they do exist, requirements must be met for fleets to obtain the benefit. For example, in California purchase/lease incentives are limited to 30 per fleet per year and are only available if the vehicle is operated in the state for 30 consecutive months.
2. Provide flexibility to lease or own vehicles
    a. Purchasing is a more common practice than leasing for most fleets. Any procurement structured around a purchase will be more widely replicable than one structured around a lease.
3. Allow fleets to finance vehicles through a third-party
    a. Financing vehicle procurements through a third party is uncommon for most fleets and many fleets do not have access to low cost financing.
    b. Administrative costs of financing to capture the federal EV tax credit could be prohibitively expensive.
    c. Fleets that finance procurements may be unable to use debt to make lease payments.
4. Require pricing from the dealer's cost up and seek discounts
    a. There are no evident barriers to requiring dealer-cost-up (triple-net) pricing in the lease or purchase of a vehicle.
    b. Dealer-cost-up pricing may reduce the dealer bidding pool if required in a solicitation and in turn might limit the number of dealers with the tax appetite to capture the federal EV tax credit. Additionally, the uncertainty around the availability of the tax credit can make dealers hesitant to guarantee the capture of the credit.
    c. Vehicles priced at dealer cost plus would not receive additional discounts.
    d. Fleets are unlikely to receive discounts in addition to capturing public incentives and vice versa. Only select fleets will be able to negotiate discounts in addition to capturing incentives.
    e. Fleets are generally unlikely to receive discounts from automakers or auto dealers on EVs other than what is offered for typical fleet purchases of passenger vehicles, given the current low level of EV sales.
5. Solicit bids from networked auto dealers rather than individual auto dealers.
    a. Vehicle deliveries between dealers and direct from the automaker, through both informal and established networks, are common practice.

b. Network dealers might be able to more easily accommodate dealer cost plus bidding than individual dealers.
c. Chances of finding a dealer willing to pass along the federal EV tax incentive may be increased if working with a networked dealer.

The feasibility matrix shown in Table 3 aggregates the considerations above and exhibits the compatibility of each element in a procurement. The matrix shows the relative feasibility of the individual procurement elements, and which element combinations are least and most feasible for fleets to implement. A color is assigned at the nexus of each element combination to show whether the combination is more or less feasible relative to the other possible element combinations. Feasibility increases moving from left to right across the color-coded legend in the table; the least feasible combinations are shaded red and the most feasible combinations are shaded dark green.

Elements in a procurement that are relatively feasible as shown in the matrix below can form the basis for a successful multi-state agreement for EVs. A robust financial analysis was needed to assess the viability of various procurement structures, including elements identified as being less feasible for most public fleets. This financial analysis along with an environmental performance assessment is presented in the following chapter.

TABLE 3: FEASIBILITY MATRIX OF PROCUREMENT ELEMENT COMBINATIONS FOR ORDERING AGENCIES



This matrix draws on insights from the research analysis to assess which element combinations are most feasible for fleets to implement in a given procurement. The feasibility of each element presented here is not intended to represent the expected outcome of a multi-state EV agreement. The cells of the matrix are color-coded to depict the degree of feasibility; grey cells are not applicable.

III. SCENARIO-BASED PROCUREMENT ANALYSIS

This chapter details the analysis of various procurement structures for small and large fleets to inform the report's guidance on procurement strategies. Three scenarios, detailed in the methodology section below, have been constructed with consideration given to the feasibility of the various procurement elements as laid out in Table 3. The procurement analysis, which includes a sensitivity analysis of key inputs, considered the economic and environmental implications for each vehicle procurement modelled using the Fleet Procurement Analysis Tool (see Box 4). The market, vehicle, and procurement inputs for the tool have been tailored, where possible, to reflect procurement variations between small and large fleets. The input assumptions rely on publicly available data and feedback from fleet managers connected to the EV Smart Fleets project.

Box 4. Fleet Procurement Analysis Tool

The Fleet Procurement Analysis Tool equips users with decision-relevant information on the financial viability and environmental impact of light-duty vehicle fleet procurements. The Microsoft Excel-based tool can evaluate a variety of procurement ownership structures, vehicle types, and procurement scenarios. The tool compares procurements side-by-side on a cost-per-mile basis and provides an analysis of cash flows and location-specific lifecycle emissions. The tool is highly flexible, supports customizable sensitivity variables, and produces user-friendly result summaries as shown below. The tool was built as part of the EV Smart Fleets initiative. The analysis presented in this report used version 1.06 of the Fleet Procurement Analysis Tool. The tool can be downloaded at http://evsmartfleets.com/materials/fleet-procurement-analysis-tool.

METHODOLOGY FOR PROCUREMENT ANALYSIS

This section presents the structure of a comprehensive economic and environmental assessment of public fleet procurements. The analysis modelled and compared four vehicle procurements (gasoline passenger car, plug-in hybrid vehicle, and two battery electric vehicles) for a large and small fleet. The gasoline vehicle procurement offers a baseline for comparing EV acquisitions and assessing the cost effectiveness of an EV procurement. The analysis evaluated three procurement scenarios for both fleet types. The analysis also used the tool's sensitivity functionality to show the key factors driving EV viability, including the effect of regional market conditions and fleet usage patterns. A synthesis of the results considered the degree to which each procurement can meet the potential requirements and goals for either a large or small fleet. Guidance for fleet ordering agencies on procurement strategies has been offered based on this synthesis and is presented in the next chapter. Figure 4 shows an overview of the analysis process.

The analysis evaluated leasing and purchasing vehicle procurements for two representative fleets or fleet profiles, one large fleet and one small fleet. Large fleets (typically state-level fleets or large city fleets) can operate thousands of vehicles, acquire many vehicles annually, and can self-insure rather than purchase third-party vehicle insurance. Small fleets (for example, single agency or local government fleets) purchase fewer vehicles annually and have less purchasing power with auto dealers than large fleets. Regarding the procurement structure, large fleets can often negotiate with an auto dealer from the dealer's cost up, rather than from the MSRP down, as is likely done for smaller fleets. The inputs that are specific to each of the fleet profiles are outlined in Table 4 below.

FIGURE 4: PROCUREMENT ANALYSIS PROCESS

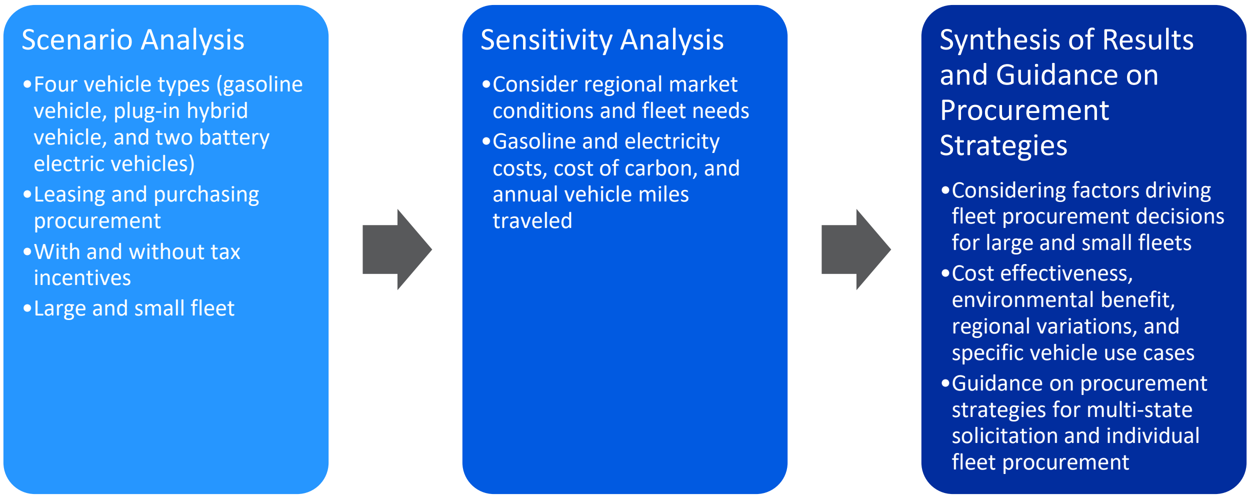


TABLE 4: KEY ASSUMPTIONS FOR SMALL AND LARGE FLEETS

	Large Fleet Profile	Small Fleet Profile
Vehicle Insurance ($/year)	Self-insured: $550	Third-party: [Default]
Number of Vehicles Procured	19	10
Vehicle Pricing Approach	Dealer Cost Plus Markup	MSRP Less Discounts
Pricing Inputs	Triple-Net Price/Dealer Cost ($/Vehicle): Varies by vehicle	MSRP ($/Vehicle): [Default]
	Dealer Markup ($/Vehicle): $200 for gasoline vehicles and $300 for EVs	Value of Negotiated Discounts off MSRP ($/Vehicle): 5% off MSRP

This table presents the assumptions used in the analysis that are specific to each of the two fleet profiles. Assumptions using the tool's internal values are noted by [Default]. A listing of all assumptions with sources is in Appendix A.

Source: [20, 21, 22, 23]. All factors in the Large Fleet Profile are from [20] except dealer markup, which is from [21]. For Small Fleet Profile factors, the number of vehicles is from [23], and discount is from [22].

For large fleets, vehicle pricing was the dealer cost plus or invoice price for each vehicle in the procurement, plus a markup. This is consistent with triple-net pricing, more common for state fleets and larger fleet vehicle purchases. The ‘Dealer Triple-Net Price’ input was specific to each vehicle and based on data collected through research and targeted outreach with fleet managers conducted by the EV Smart Fleets team. The dealer markup is a fixed cost above the triple net price that can vary by vehicle type. Cost inputs for insurance and maintenance assumed that larger fleets can self-insure and self-maintain vehicles at lower costs compared to smaller fleets that use third-party services. Self-insurance assumed that fleets absorb the risk internally.

For small fleets, vehicle pricing assumed that the fleet receives a discount off the tool’s default MSRP for each vehicle type. The value of the discount was based on research and outreach that can vary by vehicle type. Cost inputs for maintenance and insurance assume the default costs in the tool for each vehicle, which reflect costs of services arranged through a third party.

The following sections describe the most important assumptions used in the analysis, organized by the input categories of the Fleet Procurement Analysis Tool: Market Inputs, Vehicle Inputs, and Vehicle Procurement Inputs. See Appendix A for a comprehensive list of the assumptions.

MARKET INPUTS

Market inputs are fuel costs, inflation, electricity emissions, and the social cost of carbon. The tool includes regional data on fuel costs and electricity emissions along with national averages; the analysis used the national averages. All market inputs were held constant in the procurement analysis for both fleet profiles. The default value for inflation was used.

The only factor dependent on the user location is electricity emissions data. The tool relies on emissions data from the U.S. Environmental Protection Agency’s Emissions and Generation Resource Integrated Database (eGRID), which includes regional and U.S. average emissions, and a methodology to estimate electricity feedstock emissions developed by the Union of Concerned Scientists [24, 25].

VEHICLE INPUTS

The scenario and sensitivity analyses compared procurement viability for four light-duty vehicle types to allow for comparisons between EVs and conventional vehicles and among the types of EVs (see **TABLE 5**). The analysis used the default values in the tool associated with each vehicle, except for insurance and maintenance costs for the large fleet profile.

TABLE 5: VEHICLE MODELS FOR ANALYSIS

Vehicle Type	Make & Model (Year)	Electric Range (miles)	MSRP
Conventional Vehicle	Chevrolet Cruze (2017)	0	$19,525
PHEV	Ford Fusion Energi (2017)	20	$33,120
BEV-100	Nissan Leaf (2017)	107	$30,680
BEV-200	Chevrolet Bolt (2017)	238	$36,620

BEV-100 is a battery electric vehicle with an all-electric range of about 100 miles and a BEV-200 is a battery electric vehicle with an all-electric range of about 200 miles.

Fleets have vehicles with variable duty cycles: some travel hundreds of miles per day, and other that travel less than 100 miles per day. The Fleet Procurement Analysis Tool accounts for the use of the vehicle through annual vehicle miles traveled, the share of highway and city miles, and the share of miles travelled on gasoline for a plug-in hybrid. In order to account for the suitability of the BEV-100 and BEV-200, the sensitivity analysis assumed that a BEV-100 would not be used in situations requiring vehicles to travel more than 10,000 miles year [26]. As a result, the analysis assumed that each vehicle procured would travel up to 10,000 miles per year.

VEHICLE PROCUREMENT INPUTS

Procurement analysis of the following three scenarios was conducted for both fleet profiles and for each of the vehicle types—Conventional Vehicle, PHEV, BEV-100, and BEV-200—as discussed in the section above. For both fleet profiles, analysis of each potential procurement for the four vehicle types considered whether a purchase or lease was more attractive, based on the key financial and environmental outputs in the tool.

PROCUREMENT SCENARIO AND SENSITIVITY ANALYSIS

The three scenarios analyzed were as follows:

- **Scenario 1: Purchase with Federal Incentive.** This procurement is a cash purchase that captures the federal EV tax credit. This scenario assumed that an auto dealer captured the credit and passed the full value along to the public fleet. The value of the credit depended on the vehicle type, with the two battery electric vehicles receiving $7,500 and the plug-in hybrid receiving $4,007 based on its battery capacity in kilowatt-hours [11].
- **Scenario 2: Financed Purchase.** This procurement is a debt financed purchase with no incentives. This scenario assumed that the purchase was financed with public debt (e.g., a municipal bond) and did not capture any available incentives. Research documented in *II. Evaluation of Procurement Elements* showed that funding a procurement with debt would reduce the likelihood that the credit was able to be captured.
- **Scenario 3: Lease Hybrid with Federal Incentive.** This procurement is a tax-exempt lease purchase that captures the federal EV tax credit. This scenario assumed that under a tax-exempt lease purchase, the full value of the available tax credit was captured. This scenario assumed a lease period of three years, after which the fleet purchased each vehicle for $1. Research and outreach documented in *II. Evaluation of Procurement Elements* showed that the lease purchase arrangement is the only feasible way to capture the value of tax incentives in a lease beginning in 2019, due to changes in Generally Accepted Accounting Principles.

The summary of findings in the financial and environmental performance analyses is intended to inform the multi-state Sourcing Team of potential options and offer guidance to ordering agencies. The findings include an assessment of the results from each procurement scenario for small and large fleets. A sensitivity analysis was also conducted to identify the key factors affecting the viability of EV procurements for the most attractive scenarios from a financial perspective. For the sensitivity analysis, only the most promising EV procurement structures were considered.

The sensitivity analysis evaluated the effects of gasoline and electricity prices, annual vehicle travel, duration of ownership, and the cost of carbon on the vehicle total cost of ownership for large and small fleets. In addition, the effects of term length and interest rate were evaluated for the loan and lease agreements for Scenario 2 and Scenario 3, respectively. Details on the range used for each sensitivity factor are found in Appendix A.

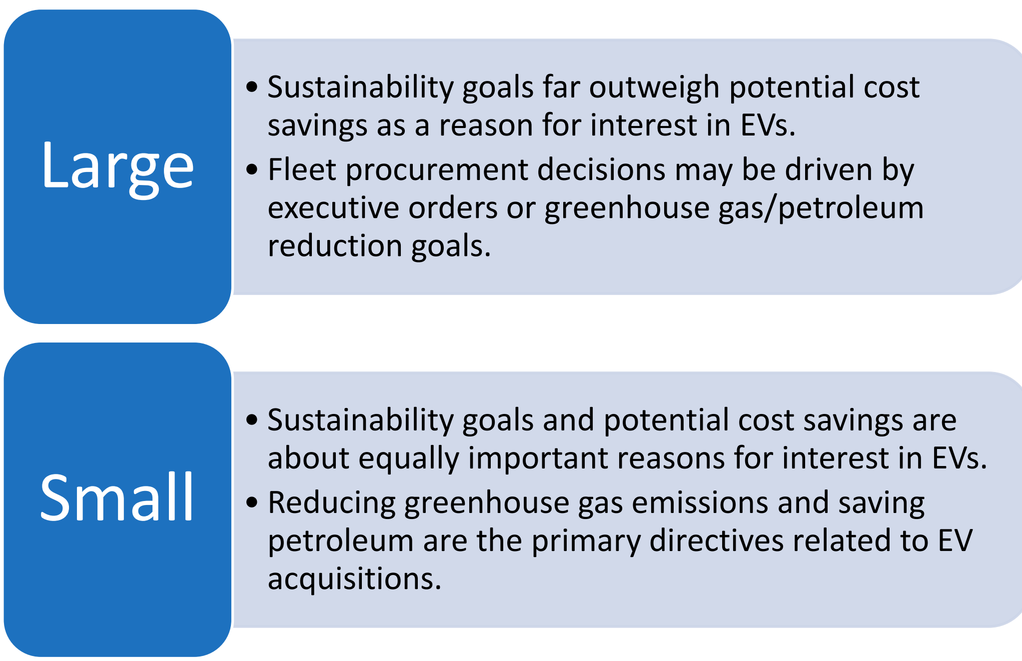
PROCUREMENT RECOMMENDATIONS

Considering the scenario and sensitivity analyses, procurement recommendations were made to inform viable strategies that can be used by ordering agencies when conducting procurements for EVs. These recommendations detail which combinations of vehicle type and procurement strategy are best suited for specific use cases. The recommendations also considered the feasibility of procuring EVs for both large and small fleets.

The recommendations were based on motivating factors specific to each fleet profile (see Figure 5). For example, the survey conducted by the EV Smart Fleets team indicated that interest in EVs by large fleets is driven by sustainability goals more so than the potential to achieve cost savings.

Recommendations considered results from both the scenario analysis and sensitivity analysis in order to identify the best-fit procurement strategies for each fleet profile. Recommendations also considered the feasibility of each procurement as outlined in Table 3. For each of the procurement recommendations, details on cost, environmental impact, and suitability with respect to fleet type and usage are provided.

FIGURE 5: VEHICLE PROCUREMENT CRITERIA FOR LARGE AND SMALL FLEETS



These criteria were derived from the online survey conducted by the EV Smart Fleets Team (see Online Fleet Survey*). For this assessment, a small fleet was any survey respondent with fewer than 100 vehicles.*

FINANCIAL ANALYSIS RESULTS

The financial analysis aimed to answer questions that are key to understanding the advantages and disadvantages of various procurement structures, specifically to highlight the value of individual procurement elements and how each can influence the cost-effectiveness of different vehicle drivetrains. An analysis of the environmental performance of the vehicles is presented later in this chapter.

Throughout this section the three scenarios are referred to as Scenarios 1, 2, and 3 where:

- Scenario 1 is a vehicle cash purchase with the federal EV tax credit,
- Scenario 2 is a vehicle loan purchase without any incentives, and
- Scenario 3 is a tax-exempt lease purchase with the federal EV tax credit.

Full results of the scenario and sensitivity analysis are found in Appendix B and Appendix D.

UNDER WHAT CONDITIONS DO EVS OFFER A COMPETITIVE TOTAL COST OF OWNERSHIP COMPARED TO GASOLINE VEHICLES?

Without incentives, EVs often have a higher upfront purchase cost than comparable gasoline vehicles. However, fleets can realize operational savings that may make the total cost of ownership of EVs competitive on a per-mile basis. This question explores the circumstances under which EVs could have a lower total cost of ownership than conventional vehicles through lower operating costs and/or the use of incentives.

FIGURE 6: INSIGHTS ON EV COST COMPETITIVENESS

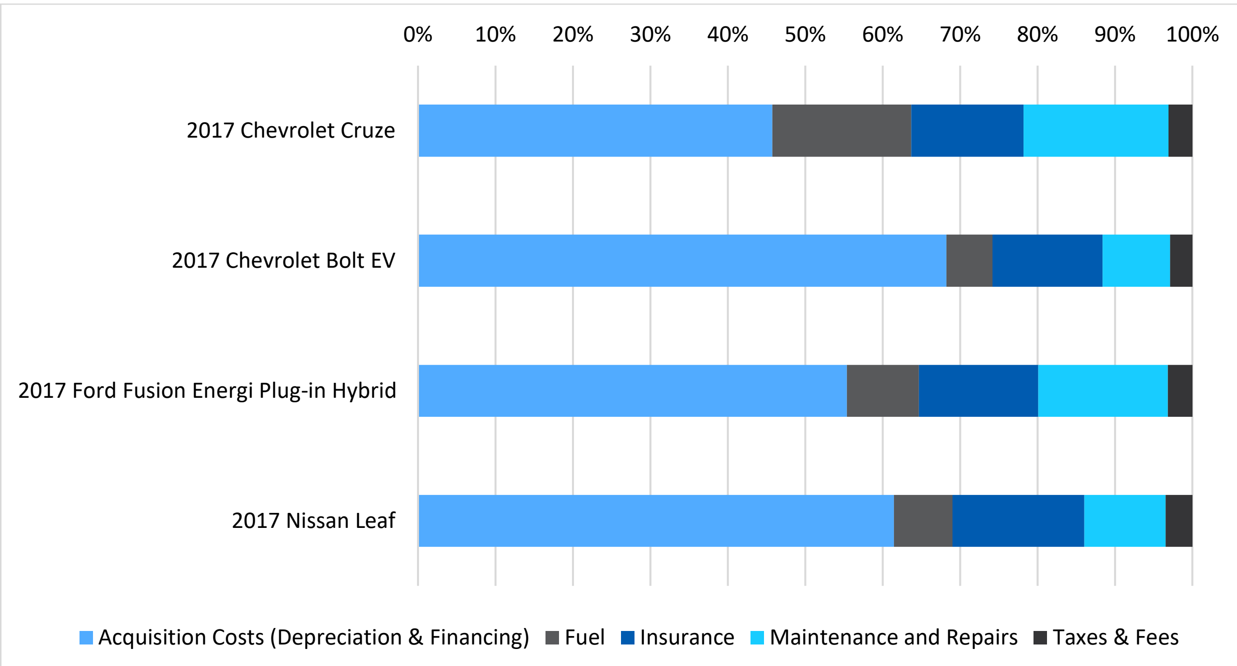
Large Fleets	Small Fleets
• The federal EV tax credit results in the EVs being lower cost than the Cruze in Scenario 1 and Scenario 3 • The Nissan Leaf is the least expensive EV in every scenario • Using dealer cost plus pricing approach can improve the cost competitiveness of EVs	• EVs are cost competitive with the Cruze in most cases • The lowest cost EV in all scenarios is the Ford Fusion Energi Plug-in Hybrid • Increasing annual miles traveled improves EV competitiveness

For both large and small fleets, opportunities exist for public fleets to acquire EVs at a cost competitive to conventional vehicles.

EVs can cost less to own than gasoline vehicles when the federal EV tax credit is captured. On average, vehicle acquisition costs (depreciation and financing) made up more than 60 percent of the total costs for battery electric vehicles. For the conventional vehicle modeled, the Chevrolet Cruze, less than half of the total cost was attributable to depreciation and financing. Because EVs have higher relative upfront costs, any actions that reduce the acquisition costs of vehicles may lower the total cost of ownership for EVs more so than gasoline vehicles (see Figure 7).

Scenarios 1 and 3 captured the federal EV tax credit, resulting in a lower total cost for the EVs compared to the Cruze for both small and large fleets. In fact, for the large fleets, in Scenario 1 (Purchase with Federal Incentive), the lowest cost vehicle analyzed in this report was the Nissan Leaf due to the federal EV tax credit, triple net pricing, and low operating costs. In this scenario, the Leaf was over 30 percent less expensive than the Cruze. Overall, the Leaf was the lowest cost vehicle to operate in every scenario, except for small fleets under Scenario 1 (see Figure 8).

Figure 7: Share of Costs for All Scenarios by Vehicle

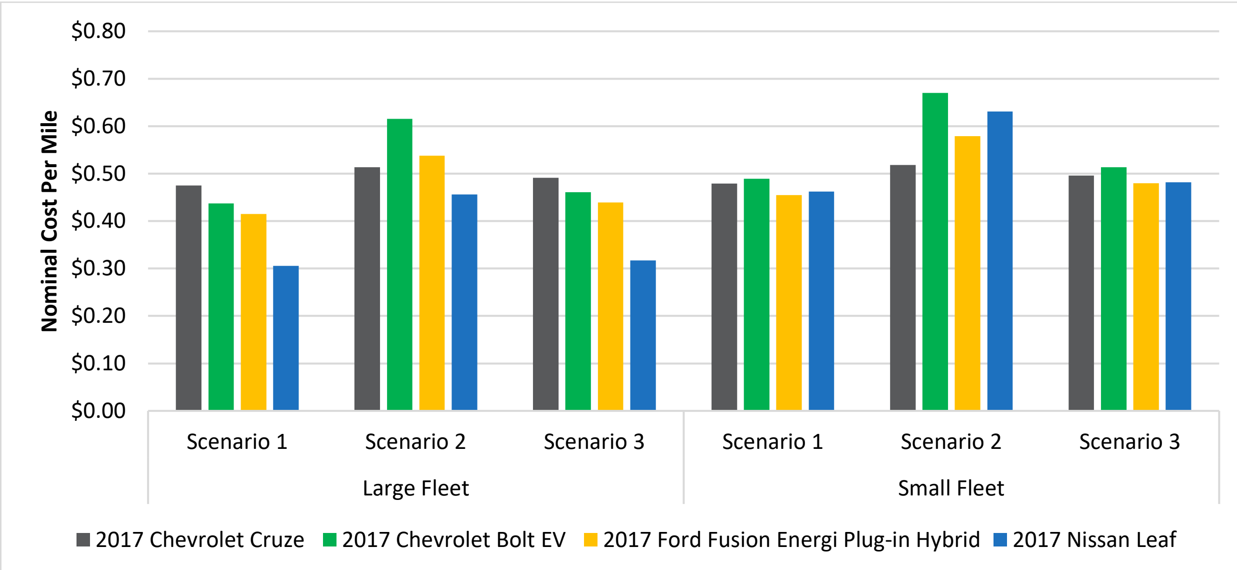


On Average, vehicle acquisition costs (depreciation and financing) make up most of the costs for EVs.

The Ford Fusion Energi and Chevrolet Bolt were cost competitive with the Cruze for small and large fleets in scenarios that captured the tax credit (Scenarios 1 and 3). For Scenarios 1 and 3, the Bolt was less expensive than the Cruze for large fleets and fewer than five percent more expensive than the Cruze for small fleets; large fleets were expected to acquire the EVs at a lower upfront cost due to dealer cost plus pricing. Like the Leaf, the Fusion cost less than the Cruze for both small and large fleets in Scenarios 1 and 3.

See Figure 8 for the nominal cost per mile for each vehicle by scenario and fleet size.

FIGURE 8: DISCOUNTED TOTAL VEHICLE COST PER MILE FOR ALL SCENARIOS



Total cost of ownership on a per mile basis for large and small fleets under three procurement scenarios.

Using the dealer cost plus pricing approach can improve the cost competitiveness of EVs. As with the federal tax credit, the pricing approach used by a fleet can lower the total cost for EVs more so than conventional vehicles. A large share of the cost advantage from the Leaf in Scenarios 1 and 3 for large fleets is due to dealer cost plus, or triple net pricing. This pricing approach, often only available for large volume purchases, resulted in a price drop of 29 percent over the MSRP less discounts approach (see Table 6).

Triple net pricing had less of an effect on the total cost for the Fusion and Bolt in Scenarios 1 and 3 because it was assumed that fleets would save less than five percent using triple net pricing rather than the MSRP less discounts approach.

TABLE 6: VEHICLE ACQUISITION COSTS BY PRICING APPROACH

Pricing Approach	2017 Chevrolet Cruze	2017 Ford Fusion Energi Plug-in Hybrid	2017 Nissan Leaf	2017 Chevrolet Bolt EV
MSRP Less Discounts	$18,549	$31,464	$29,146	$34,789
Dealer Cost Plus	$18,224	$30,946	$20,558	$33,526
% Difference	2%	2%	29%	4%

This table shows the upfront vehicle cost depending on the pricing approach. The percentage difference shown is from MSRP Less Discounts to Dealer Cost Plus. Vehicle price assumptions for triple net pricing were based on existing data from California Department of General Services.

Source: See Appendix A for details.

WHAT ARE THE KEY COST DRIVERS FOR PROCURING VEHICLES?

Many aspects of vehicle ownership for both EVs and gasoline vehicles can vary in importance depending on the procurement mechanism. This question explores four factors driving the competitiveness of EVs versus gasoline vehicles in a procurement: upfront costs and depreciation, operation costs (fuel, insurance, maintenance, and repairs), financing costs, and vehicle use. For each key factor, low and high costs were with respect to each vehicle within a procurement scenario. See Table 7 for a summary of the key cost drivers.

TABLE 7: INSIGHTS ON KEY COST DRIVERS FOR EACH VEHICLE PROCUREMENT SCENARIO

Scenario	Vehicle	Total Vehicle Cost ($/mile)	Key Factors
Large Fleet			
Purchase with Federal Incentive	Chevrolet Cruze	$0.475	High Fuel, Maintenance & Repairs
	Chevrolet Bolt EV	$0.437	Low Fuel, Maintenance & Repairs, High Depreciation
	Ford Fusion Energi Plug-in Hybrid	$0.415	Low Fuel, Depreciation
	Nissan Leaf	$0.306	Low Depreciation, Fuel, Maintenance & Repairs
Financed Purchase	Chevrolet Cruze	$0.513	Low Financing, Depreciation cost
	Chevrolet Bolt EV	$0.615	Highest Depreciation, Financing
	Ford Fusion Energi Plug-in Hybrid	$0.538	High Financing, Maintenance & Repairs, Low Depreciation
	Nissan Leaf	$0.456	Low Fuel, Depreciation, Maintenance & Repairs, Financing
Lease Hybrid with Federal Incentive	Chevrolet Cruze	$0.491	High Fuel, Maintenance & Repairs
	Chevrolet Bolt EV	$0.461	Low Fuel, Maintenance & Repairs, High Depreciation
	Ford Fusion Energi Plug-in Hybrid	$0.439	Low Fuel, Depreciation

Scenario	Vehicle	Total Vehicle Cost ($/mile)	Key Factors
	Nissan Leaf	$0.317	Low Financing and Depreciation
Small Fleet			
Purchase with Federal Incentive	Chevrolet Cruze	$0.479	High Fuel, Maintenance & Repairs
	Chevrolet Bolt EV	$0.489	High Depreciation
	Ford Fusion Energi Plug-in Hybrid	$0.455	Low Fuel, Depreciation
	Nissan Leaf	$0.462	Low Fuel, High Depreciation
Financed Purchase	Chevrolet Cruze	$0.519	Low Depreciation
	Chevrolet Bolt EV	$0.670	High Depreciation
	Ford Fusion Energi Plug-in Hybrid	$0.579	Low Depreciation
	Nissan Leaf	$0.631	High Depreciation
Lease Hybrid with Federal Incentive	Chevrolet Cruze	$0.496	High Fuel, Maintenance & Repairs
	Chevrolet Bolt EV	$0.514	High Depreciation
	Ford Fusion Energi Plug-in Hybrid	$0.480	Low Fuel, Maintenance & Repairs, and Depreciation
	Nissan Leaf	$0.482	High Depreciation

The nominal values for Total Vehicle Cost ($/mile) are shaded with a color gradient across all scenarios to convey the cost difference among the procurements scenarios and vehicles. For each key factor, low and high costs were with respect to each vehicle within a procurement scenario. The gradient goes from deep green (least expensive) to deep red (most expensive).

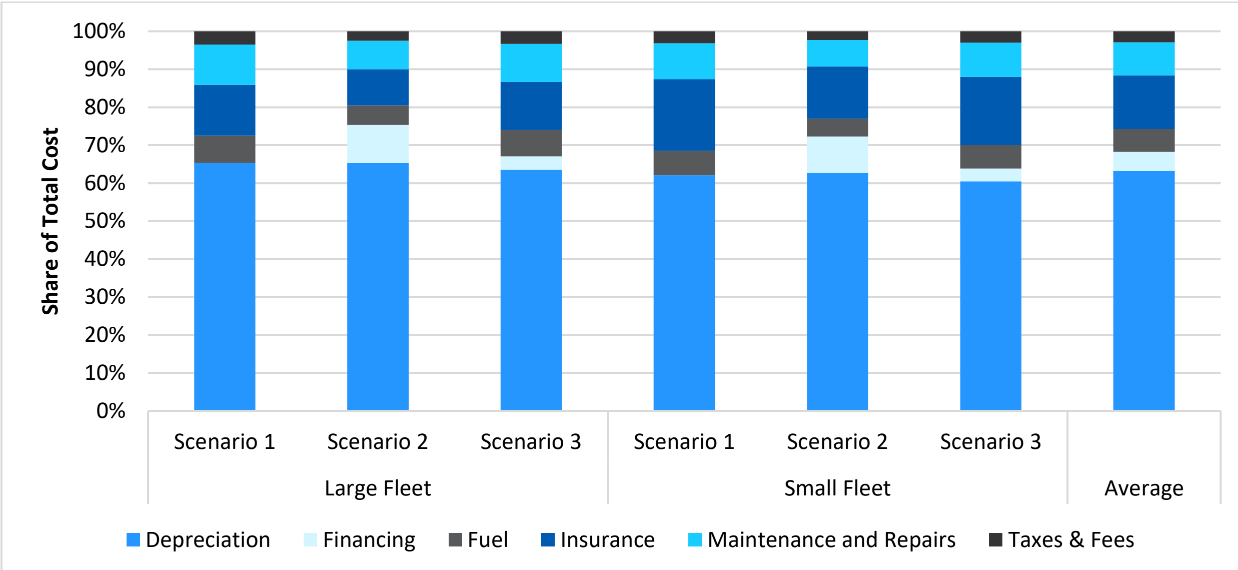
UPFRONT COSTS AND DEPRECIATION

For all procurements, depreciation is the greatest single cost component and EVs have higher depreciation costs compared to gasoline vehicles. On average, depreciation accounted for over 60 percent of the Bolt's total costs for small and large fleets, with the only difference being higher insurance costs for small fleets. The very high share of depreciation costs was consistent across procurement structures, see Figure 9.[12]

For comparison, depreciation for the Cruze made up 45 percent of the total cost for the large fleet and 40 percent for the small fleet. For the Cruze, fuel, maintenance, and repair costs made up about twice the share of the total costs compared to the battery electric vehicles. The only case where the depreciation costs of the Fusion Energi Plug-in Hybrid were lower than the Cruze was the large fleet Scenario 1 (Purchase with Federal Incentive) because the federal tax credit reduced upfront capital costs in year one.

[12] Depreciation was modeled in the Fleet Procurement Analysis Tool. The tool's user guide contains a detailed description of the methodology used to calculate depreciation and the vehicle's residual value.

FIGURE 9: DISTRIBUTION OF COST FACTORS FOR ALL SCENARIOS FOR THE CHEVROLET BOLT



While all costs fluctuate across the scenarios in this analysis, depreciation is the key cost driver for EVs.

Financing can reduce the cost competitiveness of battery electric vehicles when the federal EV tax credit is not captured. EVs have a lot of onboard technology that make them more efficient and environmentally-friendly, and currently more expensive than conventional vehicles. As a result, financing the vehicle purchase can have a negative effect on the total cost of ownership, when compared to conventional vehicles, even if those vehicles cost more to use.

The total cost for both the Leaf and Bolt is more than 35 percent higher going from Scenarios 1 to 2 for large and small fleets, due to higher depreciation costs from the loss of the tax credit; the Fusion total cost increased by 27 and 30 percent for small and large fleets, respectively. The cost difference for the Fusion was slightly less relative to the battery electric vehicles, due to a lower initial incentive. Scenario 2 (Financed Purchase) was also the only instance where both the Bolt and Fusion were more expensive than the Cruze, as the increase in cost by switching from a cash purchase to a loan for the Cruze was only 8 percent between Scenarios 1 and 2.

All things equal, higher vehicle acquisition costs make financing a less attractive option than outright purchase for vehicle procurements. Thus, fleets unable to implement triple net pricing and who wish to finance a vehicle purchase may be deterred procuring EVs; the Cruze was the least cost option when financing with debt in Scenario 2 (Financed Purchase) for small fleets. Additionally, despite maintenance and repair costs that were 75 percent higher than the other EVs, the Fusion cost 16 percent less than the Bolt and 8 percent less than the Leaf in Scenario 2. The cost of the Fusion was less affected by the increased costs incurred in Scenario 2, because the plug-in hybrid qualifies for a lower tax credit than a battery electric vehicle. See Appendix B for the complete results of the financial analysis.

OPERATIONAL COSTS INCLUDING FUEL, INSURANCE, MAINTENANCE, AND REPAIRS

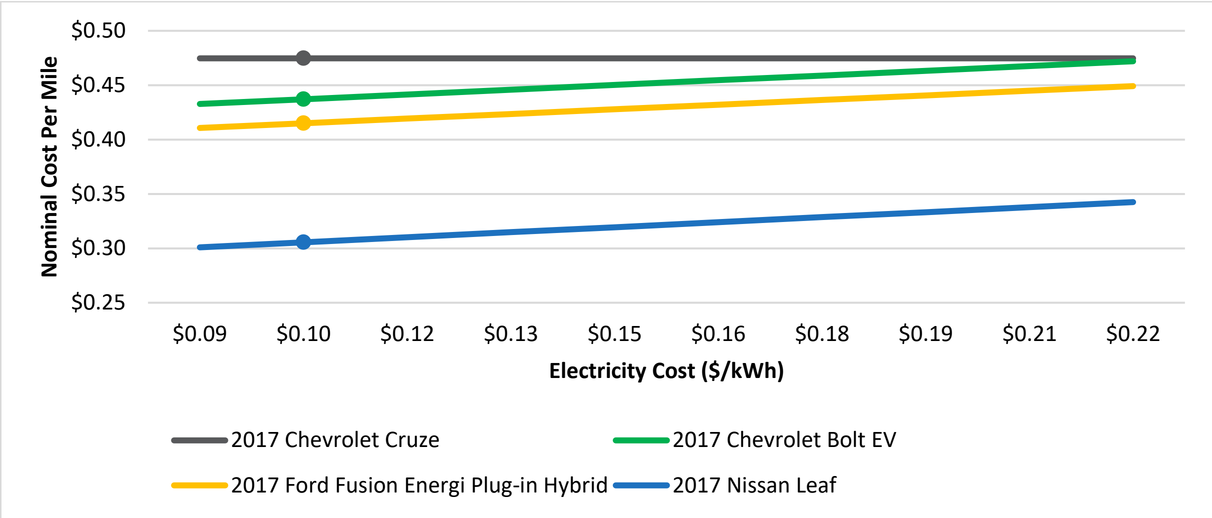
Gasoline powered vehicles have higher operational costs than EVs. Even with gasoline prices below $2.50 per gallon, EVs can offer significant operational cost savings compared to conventional vehicles due to their very high fuel economy and the low cost of electricity. For battery electric vehicles, fuel cost was only $0.03 per mile traveled compared to $0.09 for the Cruze, on average for all scenarios, and maintenance was about half as expensive. The plug-in hybrid Fusion had higher maintenance costs than the battery electric vehicles, and fuel costs about 40 percent lower than gasoline vehicles (see Appendix B for the financial analysis results).

Rising gasoline prices have a greater effect on improving EV cost competitiveness than falling electricity prices. The effect of fuel prices on total cost of ownership is determined by vehicle fuel economy, the percentage of miles driven in the city versus on the highway, and for the plug-in hybrid, the percentage of miles driven on gasoline. The fueling cost for an EV is lower due to the markedly higher fuel economy of these vehicles compared to gasoline vehicles on an energy-equivalent basis. To illustrate, when electricity prices and gasoline prices both double from $0.09 to $0.18 kilowatt-hours and $2 to $4 per gallon, respectively, the total cost of ownership for the Bolt increased by only 7 percent whereas the cost of the Cruze increased by 16 percent (see Figure 10 and Figure 11).

For small fleets, costs were higher and more closely distributed than the large fleet for each scenario, due to higher upfront and insurance costs. The close distribution of the total costs for each vehicle for small fleets offers evidence that the lowest cost vehicle could be dependent on slight changes in market factors, like gasoline prices.

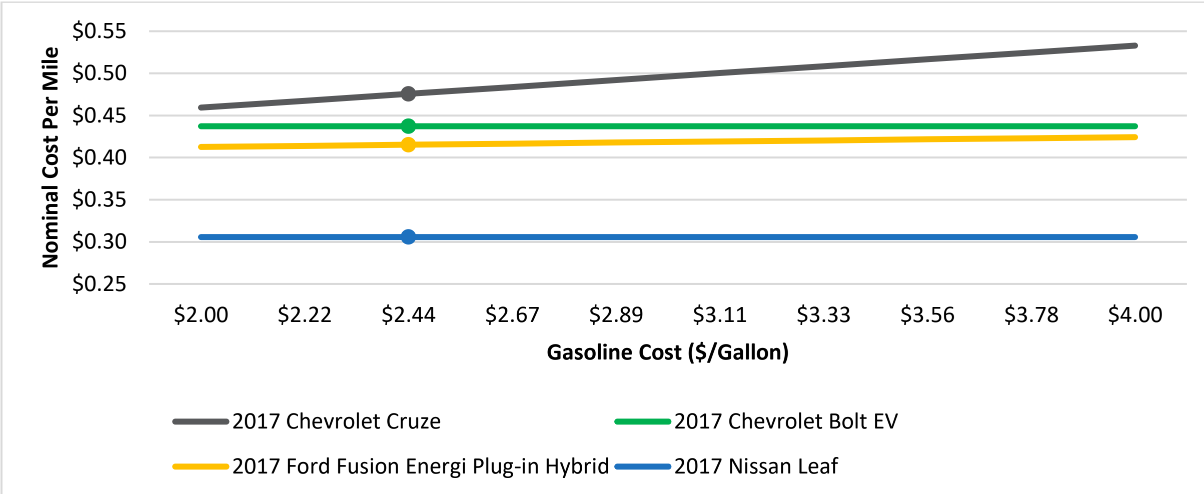
EVs can be cost competitive with gasoline-powered vehicles even in areas of the United States where electricity is very expensive. The very high fuel economy for EVs helps to keep fuel cost as a share of total cost low compared to gasoline vehicles even in the most expensive electricity market. In Scenario 1 (Purchase with Federal Incentive) for the large fleet, even with expensive electricity costs, at $0.22 per kilowatt-hour, and low gas prices, $2.42 per gallon, battery electric vehicles can still be competitive with gasoline vehicles (see Figure 10)

FIGURE 10: THE EFFECT OF VARIOUS ELECTRICITY COSTS ON TOTAL COST OF OWNERSHIP (LARGE FLEET SCENARIO 1)



The figure shows the effect of increased electricity prices on the cost of ownership of electric vehicles. The cost of the Cruze is provided in the figure as a reference. Even when electricity prices are considerably high, EVs can still be competitive with gasoline vehicles. The approximate default electricity price, denoted by dots in the figure, was $0.1048 per kilowatt-hour.

FIGURE 11: GASOLINE COST ($/GALLON) (LARGE FLEET SCENARIO 1)



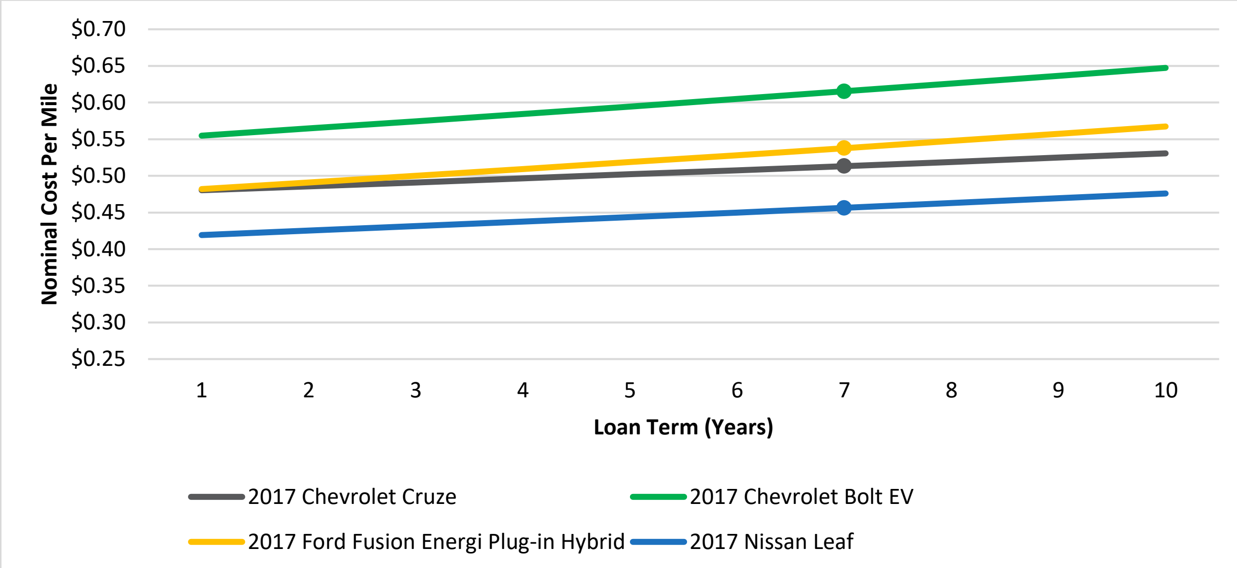
The figure shows the effect of increased gas prices on the cost of ownership of the Cruze and the Fusion Energi Plug-in Hybrid. The costs of the Bolt and Leaf are provided in the figure as a reference. EVs become more competitive relative to gasoline vehicles as gas prices increase. The approximate default gasoline price, denoted by dots in the figure, was $2.42 per gallon.

The cost of owning a plug-in hybrid is not as sensitive to changes in gasoline prices as a conventional gasoline powered vehicle. Because plug-in hybrids can travel a large share of miles on electricity, the total cost of ownership is less dependent on the price of gasoline than a conventional vehicle. The nominal cost per mile increased by only 3 percent when gasoline prices rose from $2 to $4 per gallon. For these vehicles, the sensitivity of the total cost of ownership to gasoline prices increases with the percentage of miles driven on gasoline.

FINANCING COSTS

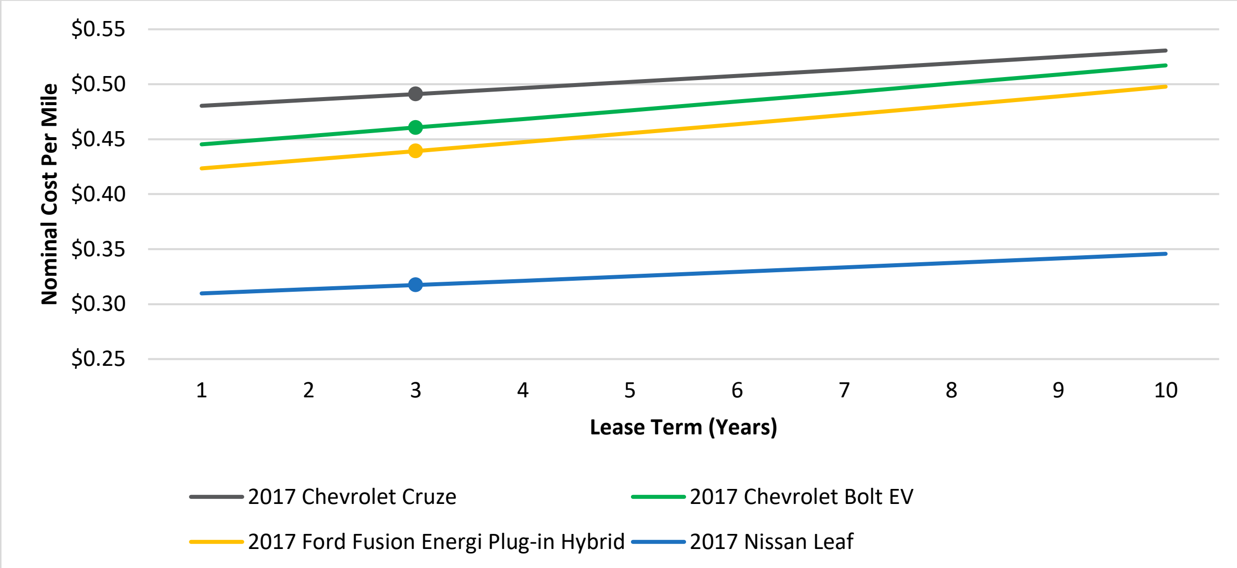
A longer financing term increases the procurement cost for all vehicles, but affects EVs more than gasoline vehicles. Because EVs cost more upfront than conventional vehicles, financing vehicle purchases can disproportionately affect the total cost for these vehicles. The highest cost vehicle for each procurement is Scenario 2 (Financed Purchase) due to the cost of financing vehicles over a seven-year period and the lack of an EV incentive. The financing added costs for all vehicles, and the lack of incentives for EVs, which are otherwise captured in Scenarios 1 and 3, drove up total costs even further for EVs. In Scenario 2, the loan term was seven years (the life of vehicle ownership), resulting in a far greater cost of financing than Scenario 3 (Lease Hybrid with Federal Incentive), which had a lease term of only three years (see Figure 12 and Figure 13). For the Bolt in Scenario 2, financing was 10 percent of total costs on average, whereas in Scenario 3 that cost was reduced to just 3.5 percent. As a share of the total cost of ownership, financing costs for each of the vehicles was about the same for both fleet types.

FIGURE 12: LOAN TERM IN YEARS FOR A LARGE FLEET (SCENARIO 2)



As loan term increases so does the cost of ownership; vehicles with higher upfront costs are more adversely affected. The Cruze and Fusion diverge because of higher upfront costs for the Fusion. The default loan term, denoted by dots in the figure, was seven years.

FIGURE 13: LEASE TERM IN YEARS FOR A LARGE FLEET (SCENARIO 3)



As lease term increases so does the cost of ownership; vehicles with higher upfront costs are more adversely affected. The Cruze, Bolt, and Fusion, converge as the lease term increases because the upfront costs take up an increasing share of the total cost, and the operational savings from the EVs have a smaller effect on the total cost. The default lease term, denoted by dots in the figure, was three years.

The effect of the financing term on the total cost of ownership is nearly the same for leases and loans. The total cost of the Leaf, which had a significantly higher capital cost for small versus large fleets, rose 14 percent with a change in the loan term for Scenario 2 from one to 10 years. The financing cost increased by 12 and 13 percent for large and small fleets, respectively, for the same change in term for the lease in Scenario 3 (Lease Hybrid with Federal Incentive). This relationship is similar for all vehicles in small and large fleets.

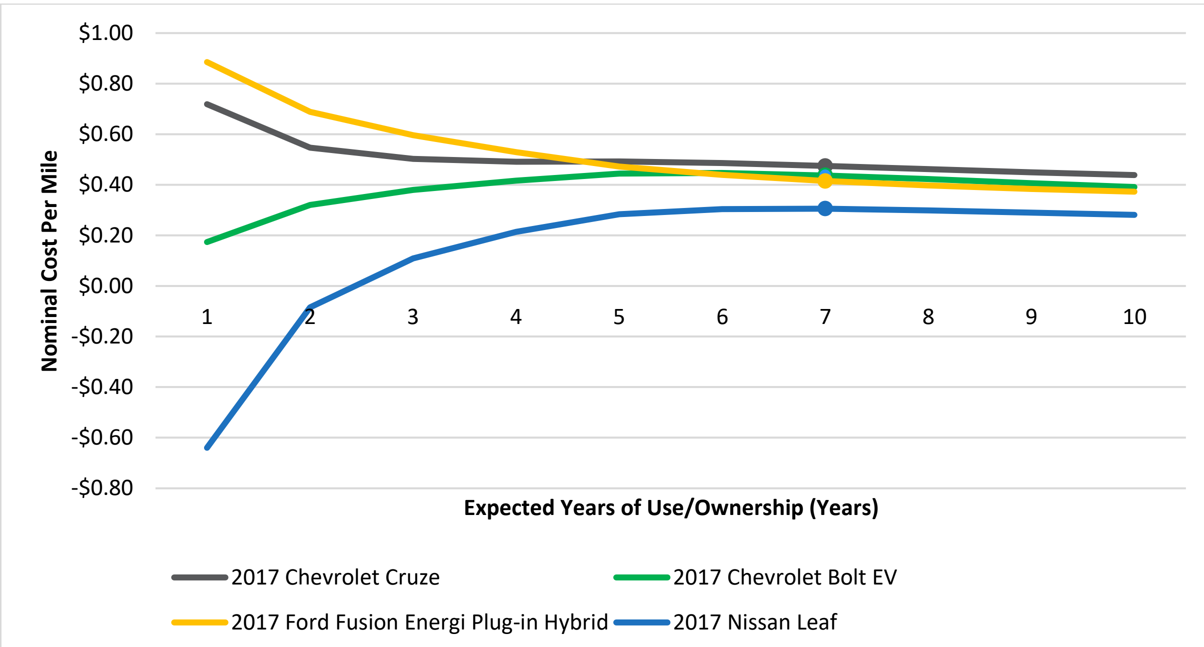
VEHICLE USE

The total cost of ownership converges for all vehicles as the years of use increase and operating costs make up a larger share of total costs. When used for more than five years, the total cost for all vehicles began to change at a similar rate with or without the federal EV tax credit as operating costs made up an increasing share of total costs. For vehicles used for less than five years, acquisition costs, including the availability of federal EV tax credit, played a significant role in the total of ownership. For Scenario 1 (Purchase with Federal Incentive), the Leaf had a negative cost of ownership for vehicles held less than two years, since the tax credit more than canceled out the vehicle's expected depreciation. The Bolt's total cost rose quickly for years of use less than three, while the Fusion and Cruze costs decreased (see Figure 14). Under Scenario 2 (Financed Purchase), without the tax credit, the years of use had a similar effect on total cost for the Bolt, Cruze, and Fusion. The Leaf, however, still had a slight increase in total cost for years of use less than five due to assumptions about the vehicle depreciation and residual value (see Figure 15).

Under Scenario 1 for large fleets, the range for the nominal cost per mile of the most and least expensive vehicles decreased from over 230 percent for one year of use to 57 percent with 10 years of use. The

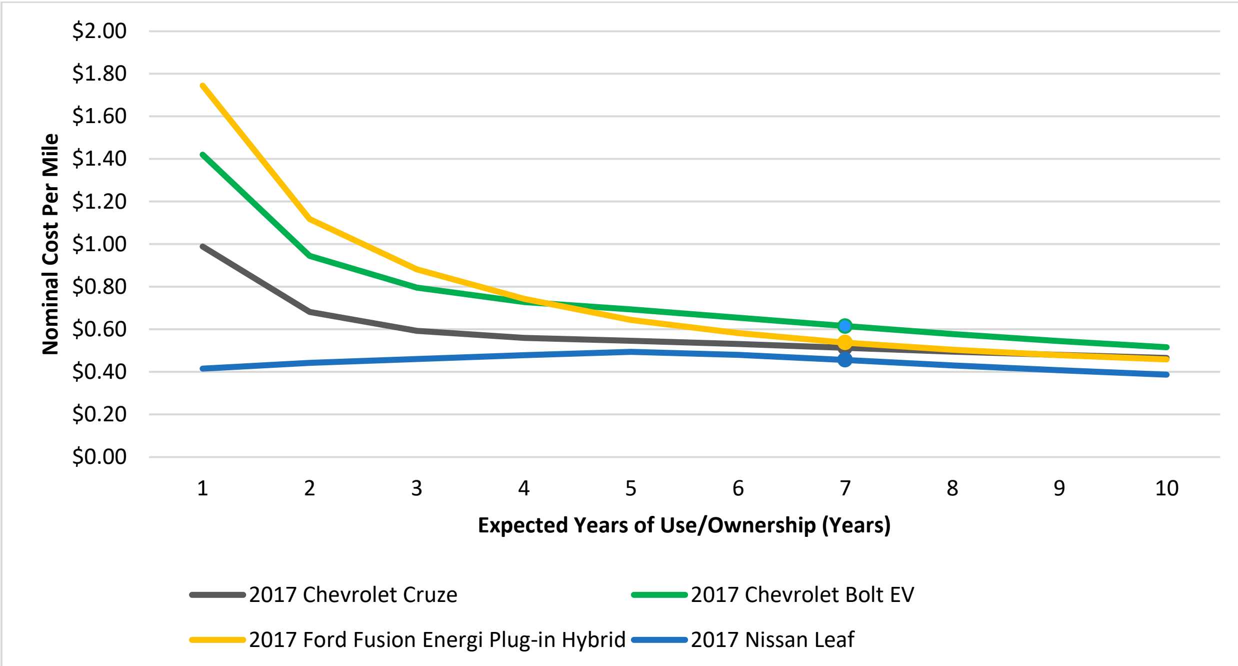
Energi Plug-in Hybrid started out at as the most expensive vehicle with a cost of $0.89 per mile in year one, but total cost decreased significantly after more than one year of use; with 10 years of use, it was the second lowest cost vehicle. The Fusion reached cost parity with the conventional vehicle at five years of ownership due to its lower operating costs (see Figure 14). Without the federal EV tax credit, Scenario 2 for large fleets had a more pronounced convergence, with the difference between the most and least expensive vehicle falling from 324 percent to 33 percent (see Figure 15).

FIGURE 14: EXPECTED YEARS OF USE FOR A LARGE FLEET (SCENARIO 1)



This figure shows the convergence in the total cost of ownership as the years of use increases. Due to the federal EV tax credit, it is possible for Nissan Leaf to have a negative cost if the vehicle is sold within the first two years. The default years of use, denoted by dots in the figure, was seven years.

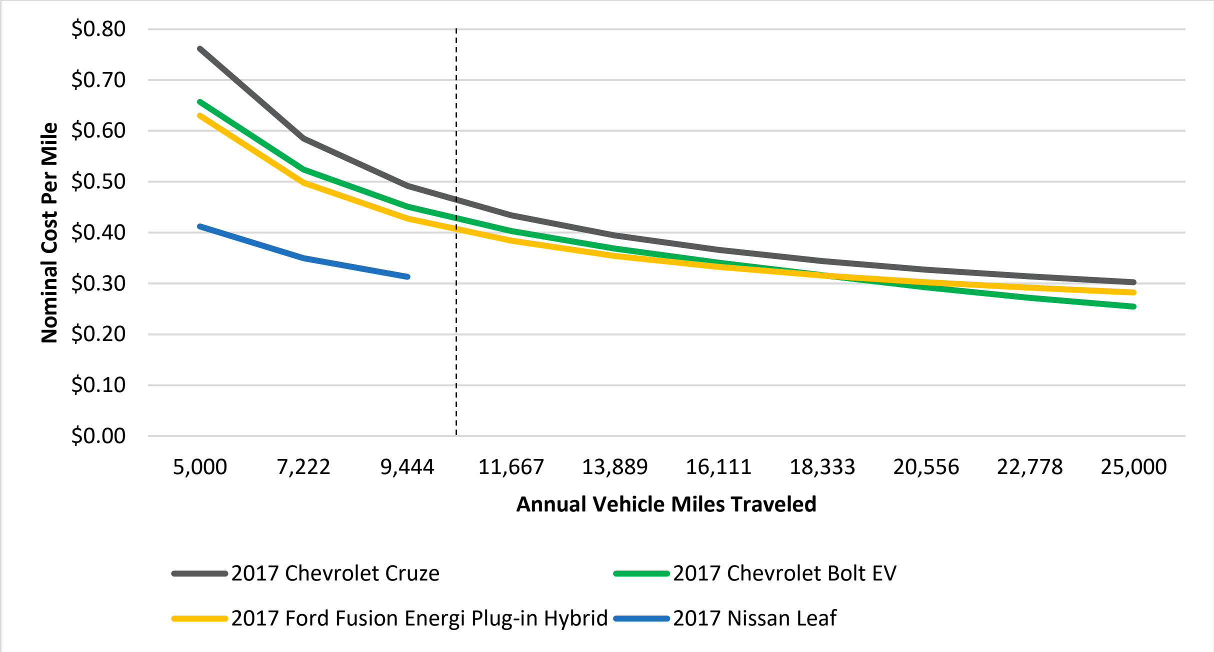
Figure 15: Expected Years of Use for a Large Fleet (Scenario 2)



This figure shows the convergence in the total cost of ownership as the years of use increases. While the other vehicles decreased with more years of use, the Nissan Leaf increased until year five due to assumptions about vehicle depreciation and residual value. The default years of use, denoted by dots in the figure, was seven years.

The cost effectiveness of a long-range battery electric vehicle improves relative to a conventional vehicle as annual miles traveled increases. As miles traveled increases, the cost per mile for maintenance and fuel should stay the same, but depreciation, insurance, and taxes and fees will decrease because they are mostly per-vehicle fixed costs. This effect advantages EVs on a total cost basis, because they generally have higher acquisition costs, which make up a large share of the total cost of ownership. In Scenario 1 for the large fleet, as shown in Figure 16, although the per-mile cost reduced more for the Cruze nominally between 5,000 and 25,000 miles, as a percentage difference, the Bolt's cost fell more than the Cruze at 25,000 miles (19 percent lower cost) than at 5,000 miles (16 percent lower cost). This relationship is consistent for all procurements of the Cruze and Bolt for both profiles. As a result, the argument for procuring the Bolt improves when comparing it to the Cruze as annual miles traveled increases. The Fusion, conversely, becomes more expensive relative to the Cruze as more miles are driven, due to higher relative costs of depreciation. As stated in *Methodology for Selecting Elements to Include in the* , it is impractical to assume a BEV-100 such as the Nissan Leaf would travel more than 10,000 miles annually.

FIGURE 16: ANNUAL VEHICLE MILES TRAVELED FOR LARGE FLEETS (SCENARIO 1)



This figure shows the relative improvement in the total cost of ownership as annual VMT increases for the Bolt versus the Cruze. The Nissan Leaf is modelled to consider the reasonable limitation of 10,000 annual VMT for a vehicle with less than 100 miles of range. The default annual VMT, denoted by a dotted line in the figure, was 10,000 miles.

ENVIRONMENTAL PERFORMANCE ANALYSIS RESULTS

The environmental performance analysis was focused on answering questions that are key to understanding the potential environmental advantages of EVs versus gasoline-powered vehicles. Specifically, the analysis considered the mobile source emissions from EVs and gasoline vehicles, and how a price on carbon would affect the total cost of ownership for each.

The Fleet Procurement Calculator estimates lifecycle, or well-to-wheel, emissions from a fleet procurement on a per-mile basis. While EVs when powered by batteries run emission free, emissions attributed to the vehicle exist upstream through electricity generation and distribution. The tool includes emissions from regional electrical grids and the U.S. average, as defined by the U.S. Environmental Protection Agency eGRID, and utilizes a methodology to estimate electricity feedstock emissions developed by the Union of Concerned Scientists. The eGRID emissions data used in this report is from 2014. Importantly, power plant emissions have been steadily decreasing in recent years and the environmental performance of EVs will likely improve over time.

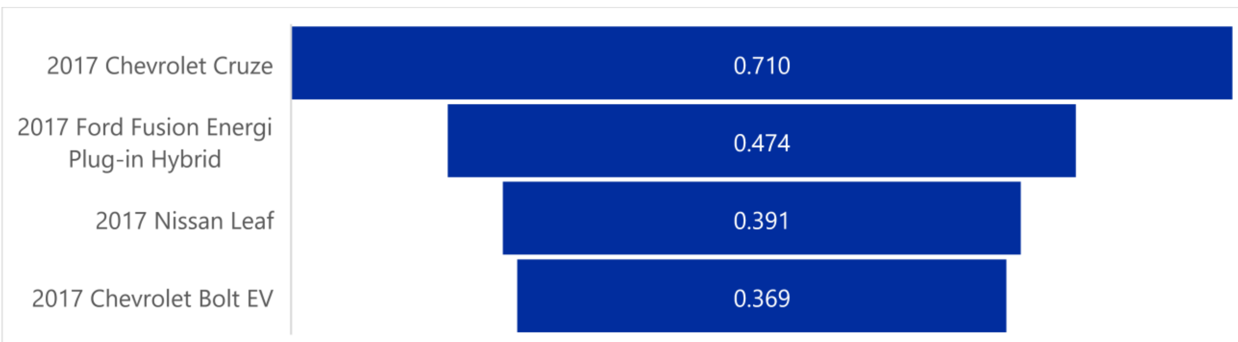
Since the emissions are presented on a per-mile basis, the results are constant for each vehicle across all the scenarios and are unaffected by total miles driven. The tool estimates carbon dioxide (CO_2) emissions and emissions of five criteria pollutants: particulate matter 10 and 2.5 micrometers in diameter (PM_{10} & $PM_{2.5}$), volatile organic compounds (VOCs), nitrogen oxides (NO_x), and sulfur oxides (SO_x).

CAN FLEETS REDUCE MOBILE SOURCE EMISSIONS BY SWITCHING TO EVS?

A switch to EVs can significantly reduce greenhouse gas and some criteria pollutants. All modeled EVs have significantly fewer CO_2 emissions than the Chevrolet Cruze on average, with the Cruze having over 90 percent higher CO_2 emissions than the Chevrolet Bolt (see Figure 17). The Cruze emits significantly higher VOCs compared to EVs, and nearly double the NO_x emissions of the next highest emitter, the Ford Fusion Energi Plug-In Hybrid (see Figure 18). Though the plug-in hybrid is a higher emitter than a battery electric vehicle, on average, procurements of the Fusion still result in significant emission reductions for most pollutants compared to gasoline vehicles.

On the other hand, when accounting for upstream emissions, EVs emit more SO_x emissions and about the same PM_{10} and $PM_{2.5}$ emissions. Emissions inputs are based on the generation mix of the electrical grid serving a particular service territory and do not account for the actual impacts of power plant emissions on local air quality, which depend on geographic and meteorological conditions; EVs emit no local emissions when powered by batteries.

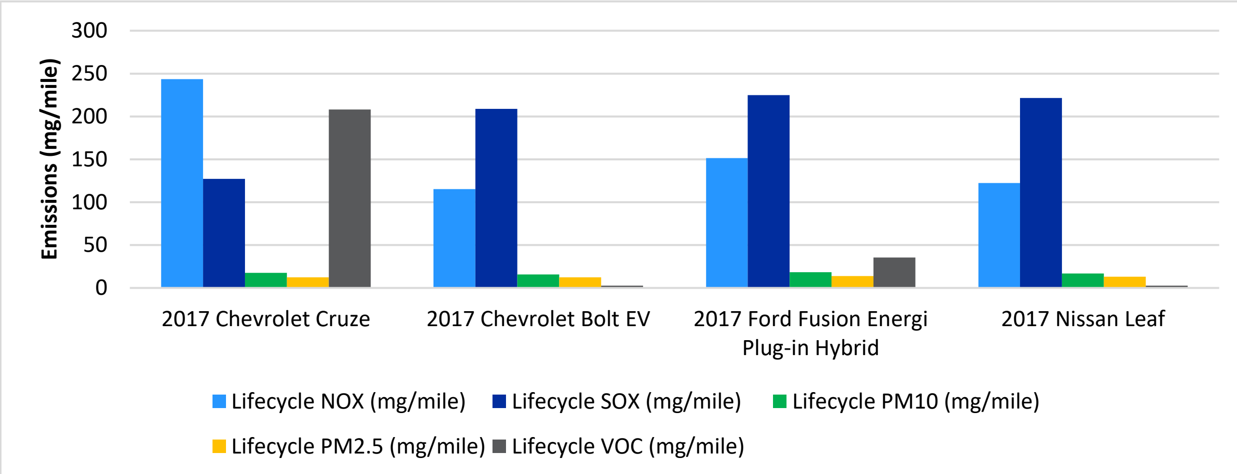
FIGURE 17: U.S. AVERAGE LIFECYCLE CARBON DIOXIDE EMISSIONS



The figure shows lifecycle carbon emissions in pounds of CO_2e per mile for all vehicles modelled in the financial analysis. For the grid region modelled, EVs have lower carbon emissions than gasoline powered vehicles. The upstream carbon emissions shown for EVs are based on charging vehicles using the U.S. average grid generation mix.

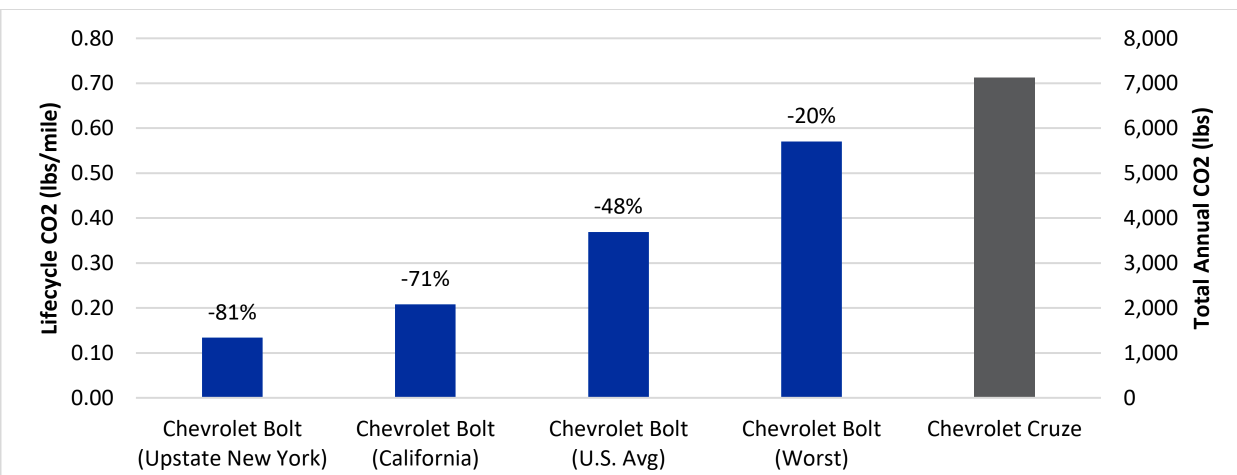
The feedstocks used to power the electrical grid vary significantly by region and have a large effect on the volume of greenhouse gas and criteria pollutants from EVs. Electric vehicles that charge on low-emitting grids, such as those in upstate New York or California, have considerably lower carbon footprints than vehicles charging in the Midwest region of the United States. For any grid in the country, however, EVs emit fewer CO_2 emissions. In fact, a Bolt EV that charges in upstate New York could emit up to 80 percent fewer emissions than a Cruze (see Figure 19).

FIGURE 18: U.S. AVERAGE ENVIRONMENTAL PERFORMANCE FOR CRITERIA POLLUTANTS



Criteria pollutant emissions for EVs are noticeably lower for volatile organic compounds and nitrogen oxides, but higher for sulfur oxides. All emissions shown are on a lifecycle, or well-to-wheels basis. The upstream emissions for EVs were calculated based on the U.S. average grid generation mix.

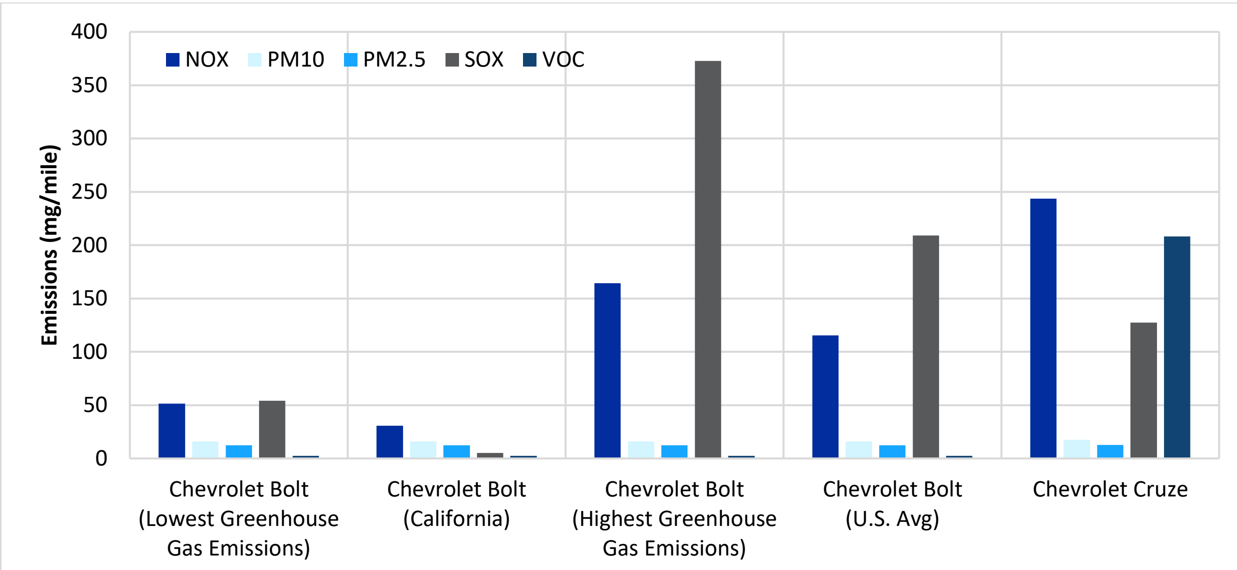
FIGURE 19: LIFECYCLE CO_2 EMISSIONS FOR CHEVROLET BOLT AND CRUZE



Carbon intensity and total annual emissions, assuming 10,000 miles traveled. The percent decline in emissions from the Cruze is shown in the figure. Even when charged on the grid with the highest carbon intensity, the Bolt emits 20 percent fewer CO_2 emissions.

EVs powered by low-carbon electrical grids have better criteria pollutant performance than conventional vehicles. Criteria pollutants and greenhouse gas emissions both result from the combustion of fossil fuels, and EVs operating in regions with grids that are less dependent on these fuel sources have superior environmental performance compared to conventional vehicles for both types of pollutants. Figure 20 shows the lifecycle criteria emissions for the Chevrolet Bolt powered by four electrical grids and the Chevrolet Cruze.

FIGURE 20: LIFECYCLE CRITERIA EMISSIONS FOR THE CHEVROLET BOLT AND CRUZE



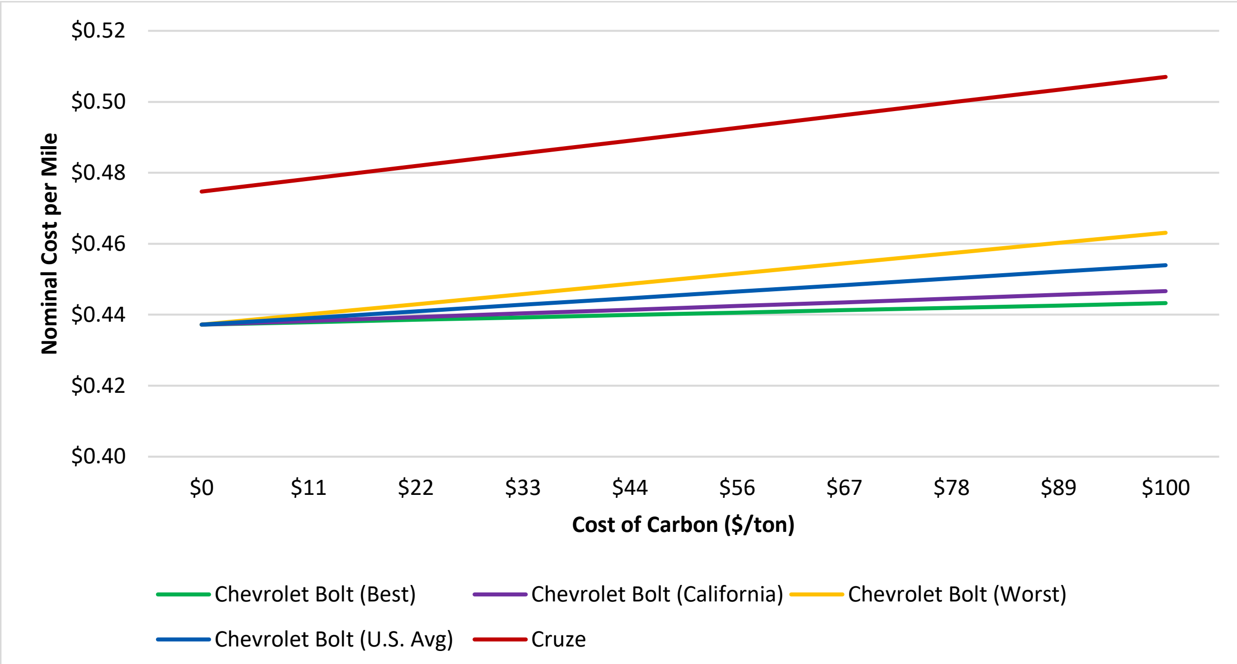
Emissions intensity for criteria pollutants. Best is denoted by the grid with lowest carbon intensity (upstate New York). The U.S. average is also with respect to carbon intensity.

COULD A CARBON PRICE IMPROVE THE TOTAL COST OF OWNERSHIP FOR EVS VERSUS GASOLINE VEHICLES?

The baseline assumption for the financial analysis was to set the cost of carbon at zero, as most states did not have a price on greenhouse gas emissions from transportation at the time of this report. Several U.S. federal agencies, led by the U.S. Environmental Protection Agency (EPA), have performed robust evaluations of the social cost of carbon, which considers economic and human health impacts from increased greenhouse gas emissions. For 2015, the social cost of carbon was projected to be $36 per metric ton of CO_2 [27]. Adding this carbon cost to a procurement results in higher costs for gasoline vehicles than EVs in general, with the difference being dependent on the EV grid carbon intensity.

A price on carbon increases the cost competitiveness of an EV compared to a conventional vehicle, even when it charges on an electrical grid with the highest carbon intensity. Figure 21 shows the effect of adding a cost of carbon, from $0 to $100, on the nominal vehicle cost per mile of the Cruze and a Bolt charging on four electrical grids: the U.S. average grid, California's grid, and the grids with the lowest and highest carbon intensities. In each case, the addition of a carbon price increased the cost of ownership, but the cost for the Cruze increased at a noticeably higher rate compared to Bolts that recharged on lower carbon grids. For every $1 increase in the carbon price, the nominal cost per mile for the Cruze increased by $0.0032, which is more than 90 percent greater than a Bolt charging with the average U.S. grid mix. When charging on the grid with the lowest carbon intensity, the Cruze increased at a rate 433 percent greater than the Bolt. Even when the Bolt charged on a grid with the highest carbon intensity, the Cruze increased at a rate 25 percent greater than the Bolt.

FIGURE 21: CARBON PRICE EFFECTS ON LARGE FLEET SCENARIO 1 USING VARIOUS ELECTRICAL GRIDS



The figure shows how the total cost of ownership for the Cruze and the Bolt increase as the result of imposing a carbon price. The Bolt is modelled using the grid with the lowest and highest carbon intensity, along with the U.S. average grid mix and California's grid. Even when charging on the grid with the highest carbon intensity, the cost of the Bolt increases at a rate slightly lower than the Cruze.

A price on carbon will not have a large effect on the total cost of an EV or a conventional vehicle. A carbon price can offer the most value for EVs when charging on grids that have a low carbon intensity. Adding a cost of carbon has only a marginal effect on the total procurement costs, however. A carbon price increase from $0 to $100 per ton raises the Chevrolet Cruze total cost by less than 10 percent. (For reference, the social cost of carbon is $36 per ton.) Further improvements in gasoline vehicle fuel economy will continue to reduce the impact of a price on carbon on light-duty vehicle total cost. The Cruze costs significantly more per mile in this example scenario due to the federal EV tax credit, however. In procurements where the cost of the vehicles is more competitive, adding a price on carbon could help make the financial case for EVs versus gasoline vehicles.

IV. CONCLUSIONS AND GUIDANCE ON PROCUREMENT STRATEGIES

A multi-state solicitation to establish an EV agreement can increase the likelihood of favorable terms for acquiring EVs for both small and large public fleets. The research and analysis conducted for the EV Smart Fleets initiative highlight important considerations to improve the likelihood that the resulting multi-state EV agreement achieves the project goals, which include:

- Accelerate electric vehicle adoption by public fleets
- Lower the purchase price of electric vehicles for public fleets by at least 15 percent below MSRP through volume purchases and creative financing and ownership tools
- Increase access to a wider range of electric models

This section presents a summary of findings and guidance on procurement strategies to achieve these goals with a multi-state agreement. The findings and guidance were based on factors specific to large and small fleets that drive procurement decisions. These factors were identified through surveys, research, and stakeholder outreach.

Both small and large fleets cited the importance of achieving sustainability goals and cost savings as key drivers of their interest in EVs. Large fleets said sustainability goals outweighed cost savings while small fleets weighed the two factors equally. Large fleets also said executive orders were a key driver and both fleet types said reducing greenhouse gases and saving petroleum were important.

For each finding described below, specific guidance related to a solicitation effort to establish a multi-state agreement is provided.

FINDING: PUBLIC FLEETS CAN CAPTURE THE FEDERAL EV TAX CREDIT AND MAKE EVS LESS EXPENSIVE THAN GASOLINE VEHICLES

Capturing the federal EV tax credit in a procurement can result in EVs costing less to own than gasoline vehicles by as much as 30 percent. Vehicle acquisition costs (depreciation and financing) for battery electric vehicles make up a much larger share of the total cost of ownership than for conventional vehicles. The federal tax credit can lower these costs for EVs by up to $7,500 and have a noticeably positive effect on the total cost of ownership for EVs.

Several public fleets have demonstrated the ability to capture this incentive in procurements, and research confirmed that capturing the credit is possible for vehicle leases or purchases. A solicitation effort to establish a multi-state EV agreement that encourages the capturing of this credit for either leases or purchases could attract participation from auto dealers or dealer networks with large tax appetites. These groups could also support drop-shipping vehicles to public agencies across the country and increase vehicle model availability to agencies in jurisdictions with limited availability.

FINDING: AN AGGREGATED VOLUME PURCHASE CAN ENCOURAGE FAVORABLE PRICING APPROACHES AND INCREASE VEHICLE MODEL AVAILABILITY

Large fleets often use the *triple net*, or *dealer cost plus pricing* approach, which greatly improves the cost competitiveness of EVs. While pricing for vehicles can vary by fleet size, location, vehicle type, and more, large fleets could procure vehicles at 25 percent below the MSRP through dealer cost plus pricing. Small fleets can often only attain minor discounts from auto dealers, making EVs more challenging to purchase. As with capturing the federal tax credit, the fleet's pricing approach can lower the total cost of an EV more than a conventional vehicle. A multi-state agreement can help small fleets attain more competitive vehicle pricing through scale and leveraging the purchasing power of large fleets.

In addition to improved vehicle pricing, a solicitation effort to establish a multi-state EV agreement that encourages the participation of large fleets can increase vehicle model availability in some cases. At the time of this report, model availability is limited in many states, making it difficult for fleets of all sizes to acquire suitable EVs. With the participation of large fleets in states like California, that have a large vehicle selection, a volume purchase could provide more choices for fleets in other states through drop shipping. Automaker restrictions, however, could still limit vehicle availability.

FINDING: INCREASING THE ANNUAL MILEAGE OF VEHICLES CAN IMPROVE EV COMPETITIVENESS

EVs have significantly lower fuel and maintenance costs than conventional vehicles and increasing vehicle annual vehicle miles traveled (VMT) can make EVs more cost competitive over conventional vehicles. Fuel costs for battery electric vehicles can be one-third of the cost for a conventional vehicle when gasoline prices are below $2.50 per gallon and electricity is the U.S. average price; maintenance can be half as expensive. For plug-in hybrid electric vehicles, fuel costs can run about 40 percent less than fuel costs for gasoline vehicles, while maintenance can cost about the same.

The cost per mile for maintenance and fuel should stay the same as annual mileage increases, but depreciation, insurance, and taxes and fees should decrease because they are mostly per-vehicle fixed costs. As a result, increasing annual mileage favors EVs, particularly battery electric vehicles, over conventional vehicles.

Greater awareness about the suitability of EVs in fleets and their potential to achieve total cost savings for high use applications could encourage greater participation from large and small fleets.

FINDING: EVS CAN PLAY A LEADING ROLE IN ACHIEVING THE ENVIRONMENTAL GOALS OF PUBLIC AGENCIES

EVs operating in any region of the United States have superior environmental performance compared to conventional vehicles. In regions with low-carbon electrical grids, a switch to EVs can reduce carbon dioxide emissions by up to 80 percent and significantly reduce some criteria pollutants. EVs operating in these regions are less dependent on fossil fuels and can help public agencies achieve environmental goals cost effectively.

A multi-state EV agreement could attract greater participation from small and large fleets with sustainability objectives, particularly in regions with low-carbon electrical grids. Fleet participation in the multi-state EV agreement is an important “lead by example” initiative and can help achieve climate and air quality goals.

The findings in this report highlight possible opportunities for establishment of a multi-state EV agreement that may help lower the cost of EV ownership for fleets of all sizes. An EV can have a lower total cost of ownership than a comparable conventional vehicle in many cases, even in a period of low gasoline prices. EVs can also greatly reduce air pollution from public fleets, including both greenhouse gas emissions and criteria pollutants. The EV Smart Fleets Team’s goal is to implement a multi-state EV agreement that improves the value proposition of EVs for public agencies through the capture of public incentives like the federal EV tax credit, improved vehicle pricing, and a greater selection of vehicle models.

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Appendix A: Analysis Assumptions

Table 8: Market Inputs for all Procurement Scenarios

Input	Value	Source
ZIP Code	00000	Special ZIP code to use U.S. average emissions.
Gasoline Cost ($/Gallon)	$2.417	The average U.S. Regular Gasoline Price for April 2017 [28].
Electricity Cost ($/kWh)	$0.1048	The average U.S. Commercial Electricity Price for February 2017 [29].
Inflation Rate (Excluding Fuel) (%/Year)	2%	The default inflation rate is based on the Federal Reserve's medium-term target as of 2015. See https://www.federalreserve.gov/faqs/economy_14400.htm.
Include Cost of Carbon?	No	Assume a carbon price is not considered by default.
Cost of Carbon ($/ton)	Null	Assume a carbon price is not considered by default.

TABLE 9: ASSUMPTIONS FOR FLEET PROFILE ANALYSIS INPUTS

Category	Fleet Profile	Input	Source
Vehicle Inputs	Large	Cost to Insure ($/Year)	Based on State of California agency annual rate of $550 per vehicle in FY 2014/2015 paid into the state’s insurance pool.
	Small	Cost to Insure ($/Year)	The default is based on the average for five years of ownership from Edmunds True Cost to Own for Springfield, IL (62701) [30].
	Small, Large	Annual Vehicle Mileage limit (VMT/Year) for BEVs with 100-mile range.	The mileage assumption for long-range battery electric vehicles was based on an analysis done by Idaho National Laboratory, as part of the EV Project [26].
	Small, Large	Recurring Taxes and Fees ($/Year)	Based on feedback on recurring annual fees from New Hampshire Department of Administrative Services.
Vehicle Procurement Inputs	Large	Number of Vehicles to Procure (#)	Based on average projected fleet EV procurements of focus states. Assumes from California average procurement rate from 2014-2016 that EVs are 0.3% of fleet total.
	Small	Number of Vehicles to Procure (#)	Based on procurement by City of New Bedford, MA of 10 Nissan Leafs in 2015 [6].
	Small	MSRP ($/Vehicle)	The Default MSRP either from the manufacturer's website or fueleconomy.gov.
	Large	Dealer Triple Net Price ($/Vehicle)	Based on contract pricing from the California Department of General Services. The triple-net price for each vehicle is equal to the contract price less dealer markup.
	Large	Dealer Markup ($/Vehicle)	Based on data from Alameda County and the assumption that pricing for conventional gasoline vehicles is more competitive than it is for EVs.
	Small	Value of Negotiated Discounts off MSRP ($/Vehicle)	In Massachusetts state LDV contract VEH98 detailed in the Master Blanket Purchase Order, Milford Nissan listed the 2017 Leaf at MSRP $35,065 per vehicle

Category	Fleet Profile	Input	Source
			and listed bid prices at $33,300 (about 5 percent lower than the MSRP) and $24,300 when incorporating available government discounts [22].

This table summarizes the inputs customized for the analysis. Any other assumption used is the default from the tool.

TABLE 10: SCENARIO 1, PURCHASE WITH FEDERAL INCENTIVE

User Input	**Large Fleet Profile**				**Small Fleet Profile**			
	ICE	***PHEV***	***BEV-100***	***BEV-200***	***ICE***	***PHEV***	***BEV-100***	***BEV-200***
Vehicle Inputs								
Type of Vehicle	Chevy Cruze (2017)	Ford Fusion Energi (2017)	Nissan Leaf (2017)	Chevrolet Bolt (2017)	Chevy Cruze (2017)	Ford Fusion Energi (2017)	Nissan Leaf (2017)	Chevrolet Bolt (2017)
Fuel Economy Gas City (MPG)	30	43			30	43		
Fuel Economy Gas Highway (MPG)	40	41			40	41		
Fuel Economy Electric City (MPGe)		104	124	128		104	124	128
Fuel Economy Electric Highway (MPGe)		91	101	110		91	101	110
Expected Years of Use/Ownership (Years)	7	7	7	7	7	7	7	7
Annual Vehicle Mileage (VMT/Year)	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000
% of Annual Miles on Gasoline	100%	100%	100%	100%	100%	100%	100%	100%

User Input	Large Fleet Profile				Small Fleet Profile			
	ICE	*PHEV*	*BEV-100*	*BEV-200*	*ICE*	*PHEV*	*BEV-100*	*BEV-200*
% of Annual Miles City Driving	55%	55%	55%	55%	55%	55%	55%	55%
Cost to Insure ($/Year)	$550	$550	$550	$550	$805	$855	$869	$869
Maintenance and Repair Cost - Years 1 - 5 ($/Mile)	$0.0800	$0.0700	$0.0400	$0.0400	$0.0800	$0.0700	$0.0400	$0.0400
Maintenance and Repair Cost - Years 5+ ($/Mile)	$0.1040	$0.0910	$0.0520	$0.0520	$0.1040	$0.0910	$0.0520	$0.0520
Recurring Taxes and Fees ($/Year)	$10	$10	$10	$10	$10	$10	$10	$10
Vehicle Procurement Inputs								
Discount Rate for NPV Calculations (%)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Number of Vehicles to Procure (#)	19	19	19	19	10	10	10	10
Pricing Approach (select one)	Dealer Cost Plus	Dealer Cost Plus	Dealer Cost Plus	Dealer Cost Plus	MSRP Less Discounts	MSRP Less Discounts	MSRP Less Discounts	MSRP Less Discounts
MSRP ($/Vehicle)					$19,525	$33,120	$30,680	$36,620
Value of Negotiated Discounts off MSRP ($/Vehicle)					$976.25	$1,656.00	$1,534.00	$1,831.00
Dealer Triple Net Price ($/Vehicle)	$18,024	$30,646	$20,258	$33,226				
Dealer Markup ($/Vehicle)	$200	$300	$300	$300				
Value of Federal Tax Incentives ($/Vehicle)		$4,007	$7,500	$7,500		$4,007	$7,500	$7,500
Value of State Tax Incentives ($/Vehicle)								
State Tax Incentive Cap ($)								

User Input	Large Fleet Profile				Small Fleet Profile			
	ICE	***PHEV***	***BEV-100***	***BEV-200***	***ICE***	***PHEV***	***BEV-100***	***BEV-200***
Value of Non-Tax Incentives ($/Vehicle)								
Initial Tax, Title, and Registration Cost ($/Vehicle)	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000
Initial Fee as Percent of Vehicle Base Price (%)	0%	0%	0%	0%	0%	0%	0%	0%
Ownership Structure	Purchase (Cash)	Purchase (Cash)	Purchase (Cash)	Purchase (Cash)	Purchase (Cash)	Purchase (Cash)	Purchase (Cash)	Purchase (Cash)
Tax Credits Can Be Monetized? (Y/N)		Yes	Yes	Yes		Yes	Yes	Yes
Down Payment ($/Vehicle)								

TABLE 11: SCENARIO 2, FINANCED PURCHASE

User Input	Large Fleet Profile				Small Fleet Profile			
	ICE	***PHEV***	***BEV-100***	***BEV-200***	***ICE***	***PHEV***	***BEV-100***	***BEV-200***
Vehicle Inputs								
Type of Vehicle	Chevy Cruze (2017)	Ford Fusion Energi (2017)	Nissan Leaf (2017)	Chevrolet Bolt (2017)	Chevy Cruze (2017)	Ford Fusion Energi (2017)	Nissan Leaf (2017)	Chevrolet Bolt (2017)
Fuel Economy Gas City (MPG)	30	43			30	43		
Fuel Economy Gas Highway (MPG)	40	41			40	41		
Fuel Economy Electric City (MPGe)		104	124	128		104	124	128
Fuel Economy Electric Highway (MPGe)		91	101	110		91	101	110
Expected Years of Use/Ownership (Years)	7	7	7	7	7	7	7	7
Annual Vehicle Mileage (VMT/Year)	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000
% of Annual Miles on Gasoline	100%	100%	100%	100%	100%	100%	100%	100%
% of Annual Miles City Driving	55%	55%	55%	55%	55%	55%	55%	55%
Cost to Insure ($/Year)	$550	$550	$550	$550	$805	$855	$869	$869
Maintenance and Repair Cost - Years 1 - 5 ($/Mile)	$0.0800	$0.0700	$0.0400	$0.0400	$0.0800	$0.0700	$0.0400	$0.0400
Maintenance and Repair Cost - Years 5+ ($/Mile)	$0.1040	$0.0910	$0.0520	$0.0520	$0.1040	$0.0910	$0.0520	$0.0520
Recurring Taxes and Fees ($/Year)	$10	$10	$10	$10	$10	$10	$10	$10

User Input	Large Fleet Profile				Small Fleet Profile			
	ICE	***PHEV***	***BEV-100***	***BEV-200***	***ICE***	***PHEV***	***BEV-100***	***BEV-200***
Vehicle Procurement Inputs								
Discount Rate for NPV Calculations (%)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Number of Vehicles to Procure (#)	19	19	19	19	10	10	10	10
Pricing Approach (select one)	Dealer Cost Plus	Dealer Cost Plus	Dealer Cost Plus	Dealer Cost Plus	MSRP Less Discounts	MSRP Less Discounts	MSRP Less Discounts	MSRP Less Discounts
MSRP ($/Vehicle)					$19,525	$33,120	$30,680	$36,620
Value of Negotiated Discounts off MSRP ($/Vehicle)					$976.25	$1,656.00	$1,534.00	$1,831.00
Dealer Triple Net Price ($/Vehicle)	$18,024	$30,646	$20,258	$33,226				
Dealer Markup ($/Vehicle)	$200	$300	$300	$300				
Value of Federal Tax Incentives ($/Vehicle)								
Value of State Tax Incentives ($/Vehicle)								
State Tax Incentive Cap ($)								
Value of Non-Tax Incentives ($/Vehicle)								
Initial Tax, Title, and Registration Cost ($/Vehicle)	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000
Initial Fee as Percent of Vehicle Base Price (%)	0%	0%	0%	0%	0%	0%	0%	0%
Ownership Structure	Purchase (Loan)	Purchase (Loan)	Purchase (Loan)	Purchase (Loan)	Purchase (Loan)	Purchase (Loan)	Purchase (Loan)	Purchase (Loan)
Tax Credits Can Be Monetized? (Y/N)		No	No	No		No	No	No
Down Payment ($/Vehicle)								

User Input	Large Fleet Profile				Small Fleet Profile			
	ICE	***PHEV***	***BEV-100***	***BEV-200***	***ICE***	***PHEV***	***BEV-100***	***BEV-200***
Loan Term (Years)	7	7	7	7	7	7	7	7
Interest Rate (APR - %)	4%	4%	4%	4%	4%	4%	4%	4%

TABLE 12: SCENARIO 3, LEASE HYBRID WITH FEDERAL INCENTIVE

User Input	Large Fleet Profile				Small Fleet Profile			
	ICE	***PHEV***	***BEV-100***	***BEV-200***	***ICE***	***PHEV***	***BEV-100***	***BEV-200***
Vehicle Inputs								
Type of Vehicle	Chevy Cruze (2017)	Ford Fusion Energi (2017)	Nissan Leaf (2017)	Chevrolet Bolt (2017)	Chevy Cruze (2017)	Ford Fusion Energi (2017)	Nissan Leaf (2017)	Chevrolet Bolt (2017)
Fuel Economy Gas City (MPG)	30	43			30	43		
Fuel Economy Gas Highway (MPG)	40	41			40	41		
Fuel Economy Electric City (MPGe)		104	124	128		104	124	128
Fuel Economy Electric Highway (MPGe)		91	101	110		91	101	110
Expected Years of Use/Ownership (Years)	7	7	7	7	7	7	7	7
Annual Vehicle Mileage (VMT/Year)	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000

User Input	Large Fleet Profile				Small Fleet Profile			
	ICE	***PHEV***	***BEV-100***	***BEV-200***	***ICE***	***PHEV***	***BEV-100***	***BEV-200***
% of Annual Miles on Gasoline	100%	100%	100%	100%	100%	100%	100%	100%
% of Annual Miles City Driving	55%	55%	55%	55%	55%	55%	55%	55%
Cost to Insure ($/Year)	$550	$550	$550	$550	$805	$855	$869	$869
Maintenance and Repair Cost - Years 1 - 5 ($/Mile)	$0.0800	$0.0700	$0.0400	$0.0400	$0.0800	$0.0700	$0.0400	$0.0400
Maintenance and Repair Cost - Years 5+ ($/Mile)	$0.1040	$0.0910	$0.0520	$0.0520	$0.1040	$0.0910	$0.0520	$0.0520
Recurring Taxes and Fees ($/Year)	$10	$10	$10	$10	$10	$10	$10	$10
Vehicle Procurement Inputs								
Discount Rate for NPV Calculations (%)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Number of Vehicles to Procure (#)	19	19	19	19	10	10	10	10
Pricing Approach (select one)	Dealer Cost Plus	Dealer Cost Plus	Dealer Cost Plus	Dealer Cost Plus	MSRP Less Discounts	MSRP Less Discounts	MSRP Less Discounts	MSRP Less Discounts
MSRP ($/Vehicle)					$19,525	$33,120	$30,680	$36,620
Value of Negotiated Discounts off MSRP ($/Vehicle)					$976.25	$1,656.00	$1,534.00	$1,831.00
Dealer Triple Net Price ($/Vehicle)	$18,024	$30,646	$20,258	$33,226				
Dealer Markup ($/Vehicle)	$200	$300	$300	$300				
Value of Federal Tax Incentives ($/Vehicle)		$4,007	$7,500	$7,500		$4,007	$7,500	$7,500
Value of State Tax Incentives ($/Vehicle)								
State Tax Incentive Cap ($)								

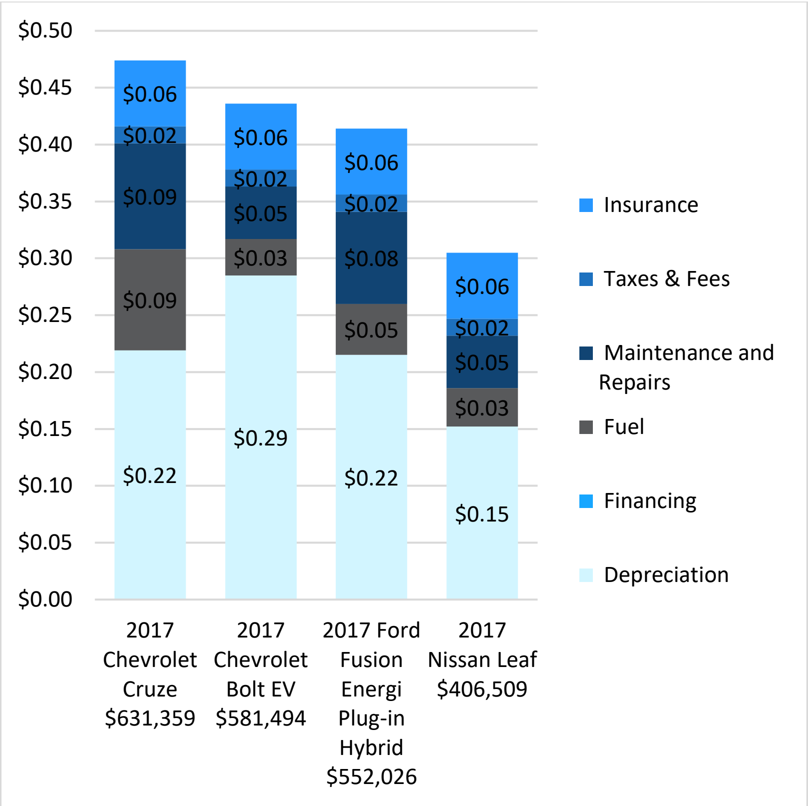
User Input	Large Fleet Profile				Small Fleet Profile			
	ICE	***PHEV***	***BEV-100***	***BEV-200***	***ICE***	***PHEV***	***BEV-100***	***BEV-200***
Value of Non-Tax Incentives ($/Vehicle)								
Initial Tax, Title, and Registration Cost ($/Vehicle)	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000
Initial Fee as Percent of Vehicle Base Price (%)	0%	0%	0%	0%	0%	0%	0%	0%
Ownership Structure	Tax-Exempt Lease Purchase (Cash)	Tax-Exempt Lease Purchase (Cash)	Tax-Exempt Lease Purchase (Cash)	Tax-Exempt Lease Purchase (Cash)	Tax-Exempt Lease Purchase (Cash)	Tax-Exempt Lease Purchase (Cash)	Tax-Exempt Lease Purchase (Cash)	Tax-Exempt Lease Purchase (Cash)
Tax Credits Can Be Monetized? (Y/N)		Yes	Yes	Yes		Yes	Yes	Yes
Down Payment ($/Vehicle)								
Lease Term (Years)	3	3	3	3	3	3	3	3
Interest Rate (APR - %)	4%	4%	4%	4%	4%	4%	4%	4%
Acquisition Fee ($/Vehicle)								
Disposition Charge ($/Vehicle)								
Negotiated Residual Value ($/Vehicle)	$1	$1	$1	$1	$1	$1	$1	$1
Mileage Included (Closed-End Only)								
Excess Mileage Cost ($/Mile)								

TABLE 13: SENSITIVITY ANALYSIS SETTINGS

Input Field	Min Value	Max Value	Source
Electricity Cost ($/kWh)	$0.09	$0.22	Highest and lowest average commercial electricity prices from February 2017 according to EIA [29].
Cost of Carbon ($/Ton)	$0.00	$100.00	Atlas Public Policy assumption.
Gasoline Cost ($/Gallon)	$2.00	$4.00	Atlas Public Policy assumption.
Baseline/Comparison Expected Years of Use/Ownership (Years)	1	10	Atlas Public Policy assumption.
Baseline/Comparison Annual Vehicle Mileage (VMT/Year)	5,000	25,000	Atlas Public Policy assumption.
Baseline/Comparison Loan Term (Years)	1	10	Atlas Public Policy assumption.
Baseline/Comparison Loan Interest Rate (APR - %)	1%	5%	Range for interest rate based on market rate for auto loan as of June 2017 [31].
Baseline/Comparison Lease Term (Years)	1	10	Atlas Public Policy assumption.
Baseline/Comparison Lease Interest Rate (APR - %)	1%	5%	Range for interest rate based on market rate for auto loan as of June 2017 [31].

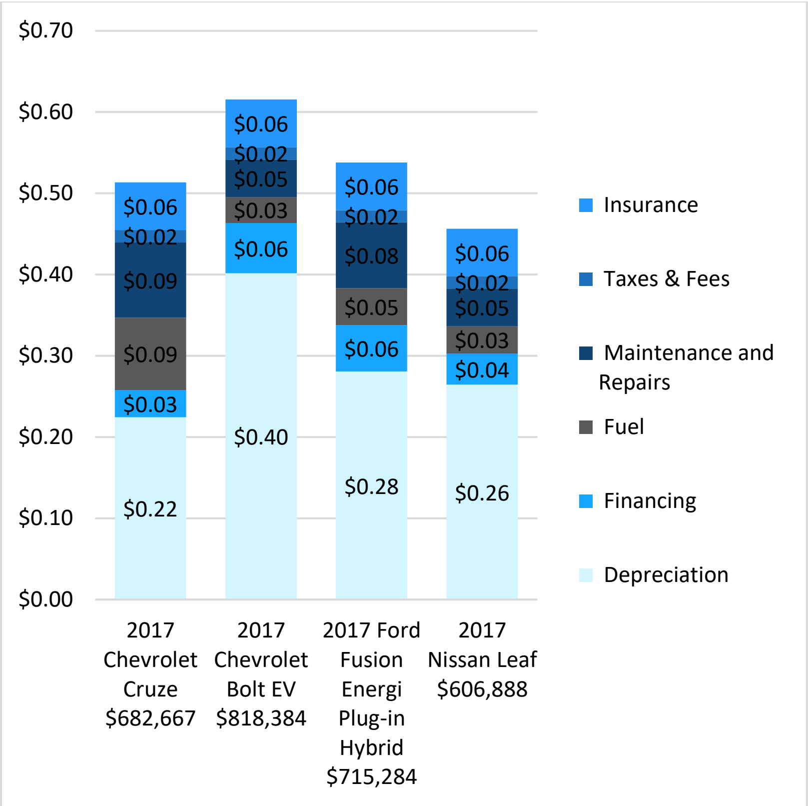
Appendix B: Financial Analysis Results

FIGURE 22: PURCHASE WITH FEDERAL INCENTIVE (SCENARIO 1)



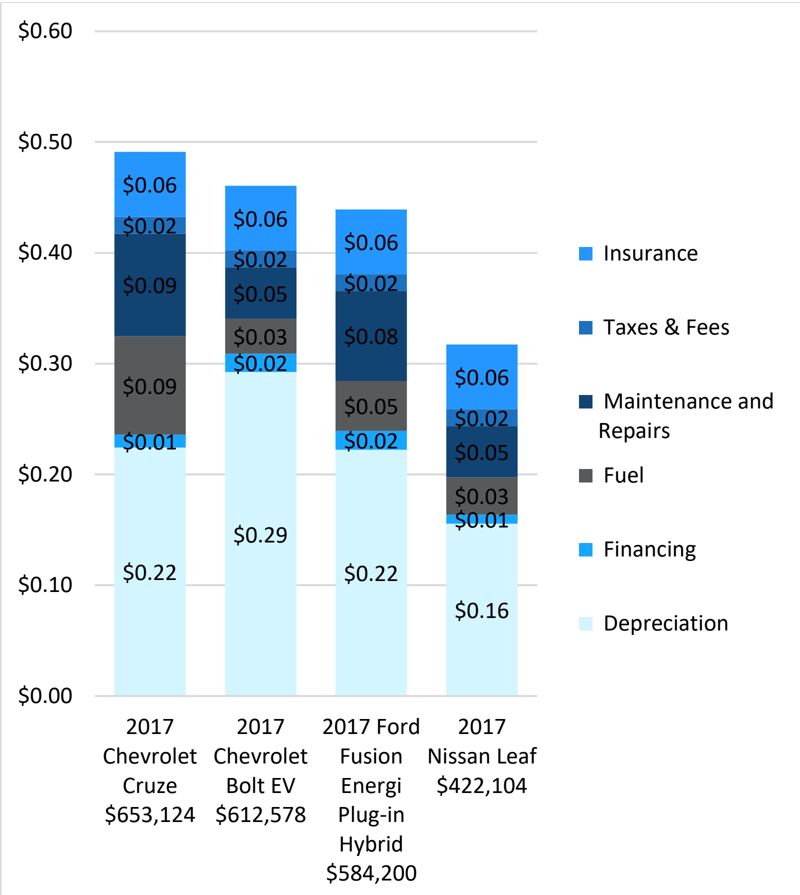
This figure shows the nominal costs per mile by category for each vehicle in Large Fleet Scenario 1. The discounted total cost of ownership is shown below the vehicle name.

FIGURE 23: LARGE FLEET FINANCED PURCHASE (SCENARIO 2)



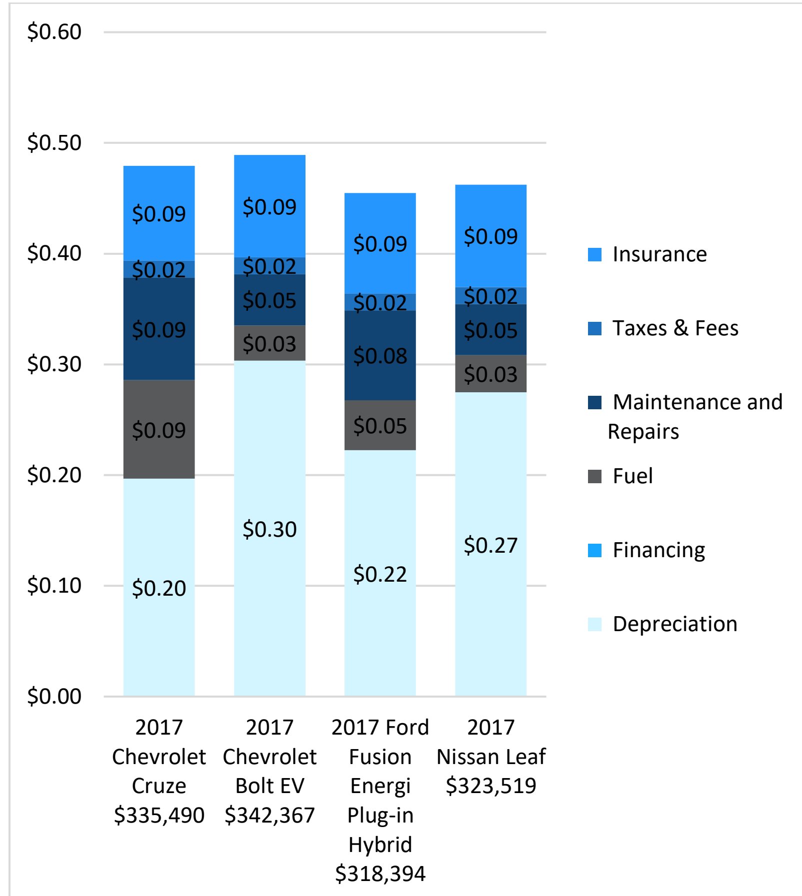
This figure shows the nominal costs per mile by category for each vehicle in Large Fleet Scenario 2. The discounted total cost of ownership is shown below the vehicle name.

FIGURE 24: LARGE FLEET LEASE HYBRID WITH FEDERAL INCENTIVE (SCENARIO 3)



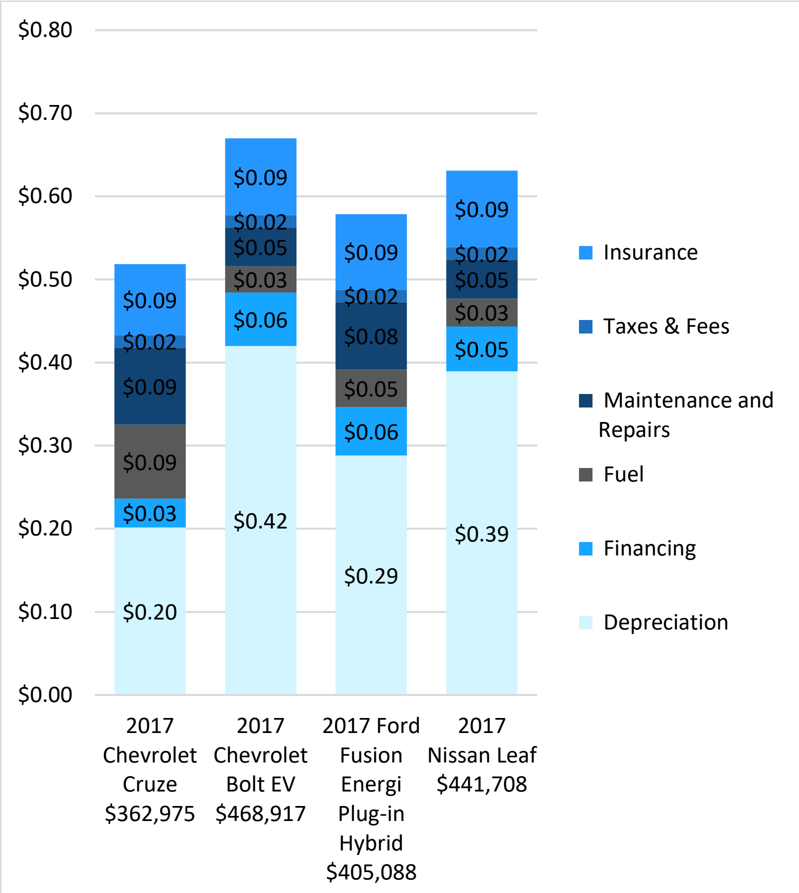
This figure shows the nominal costs per mile by category for each vehicle in Large Fleet Scenario 3. The discounted total cost of ownership is shown below the vehicle name.

FIGURE 25: FIGURE SMALL FLEET PURCHASE WITH INCENTIVE (SCENARIO 1)



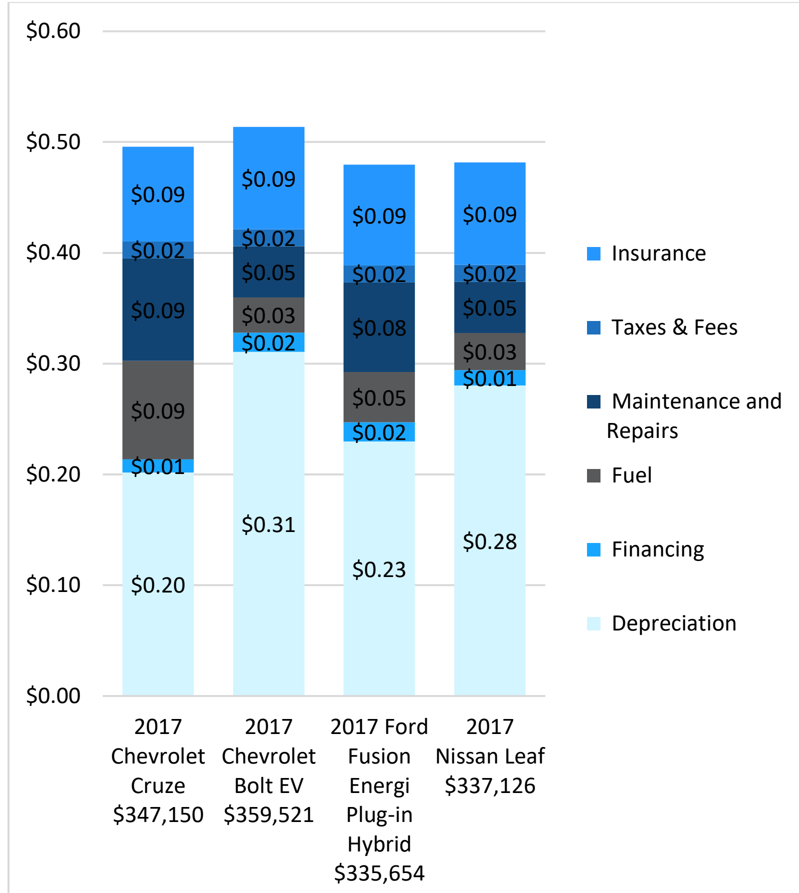
This figure shows the nominal costs per mile by category for each vehicle in Small Fleet Scenario 1. The discounted total cost of ownership is shown below the vehicle name.

FIGURE 26: SMALL FLEET FINANCED PURCHASE (SCENARIO 2)



This figure shows the nominal costs per mile by category for each vehicle in Small Fleet Scenario 2. The discounted total cost of ownership is shown below the vehicle name.

FIGURE 27: SMALL FLEET LEASE HYBRID WITH FEDERAL INCENTIVE (SCENARIO 3)



This figure shows the nominal costs per mile by category for each vehicle in Small Fleet Scenario 3. The discounted total cost of ownership is shown below the vehicle name.

TABLE 14: ENVIRONMENTAL MODEL RESULTS (ALL SCENARIOS)

Vehicle Type	2017 Chevrolet Cruze	2017 Chevrolet Bolt EV	2017 Ford Fusion Energi Plug-in Hybrid	2017 Nissan Leaf
CO2 emissions (lbs/mile)	0.712	0.369	0.474	0.391
NOX (mg/mile)	243.481	115.394	151.586	122.316
SOX (mg/mile)	127.375	208.992	224.909	221.529
M10 (mg/mile)	17.479	15.838	18.282	16.788
PM2.5 (mg/mile)	12.562	12.287	14.025	13.024
VOC (mg/mile)	208.129	2.588	35.475	2.744

All emissions are lifecycle, or well-to-wheel.

Appendix D: Sensitivity Analysis Tables

LARGE FLEET

TABLE 15: EXPECTED YEARS OF USE (LARGE FLEET SCENARIO 1)

Years of Use	2017 Chevrolet Cruze	2017 Chevrolet Bolt EV	2017 Ford Fusion Energi Plug-in Hybrid	2017 Nissan Leaf
1	$0.719	$0.174	$0.885	-$0.640
2	$0.547	$0.321	$0.689	-$0.085
3	$0.503	$0.380	$0.596	$0.110
4	$0.492	$0.417	$0.529	$0.215
5	$0.493	$0.445	$0.473	$0.283
6	$0.486	$0.447	$0.439	$0.304
7	$0.475	$0.437	$0.415	$0.306
8	$0.462	$0.423	$0.397	$0.299
9	$0.450	$0.407	$0.384	$0.291
10	$0.439	$0.391	$0.373	$0.282

TABLE 16: EXPECTED YEARS OF USE (LARGE FLEET SCENARIO 2)

Years of Use	2017 Chevrolet Cruze	2017 Chevrolet Bolt EV	2017 Ford Fusion Energi Plug-in Hybrid	2017 Nissan Leaf
1	$0.989	$1.420	$1.745	$0.415
2	$0.682	$0.944	$1.118	$0.442
3	$0.593	$0.795	$0.882	$0.461

4	$0.559	$0.728	$0.744	$0.478
5	$0.547	$0.694	$0.644	$0.494
6	$0.531	$0.655	$0.582	$0.480
7	$0.513	$0.615	$0.538	$0.456
8	$0.496	$0.579	$0.505	$0.431
9	$0.480	$0.545	$0.479	$0.408
10	$0.466	$0.516	$0.459	$0.387

Table 17: Expected Years of Use (Large Fleet Scenario 3)

Years of Use	2017 Chevrolet Cruze	2017 Chevrolet Bolt EV	2017 Ford Fusion Energi Plug-in Hybrid	2017 Nissan Leaf
1	$0.833	$0.337	$1.055	-$0.558
2	$0.604	$0.403	$0.773	-$0.044
3	$0.541	$0.434	$0.652	$0.137
4	$0.520	$0.457	$0.571	$0.235
5	$0.516	$0.477	$0.506	$0.300
6	$0.505	$0.474	$0.467	$0.318
7	$0.491	$0.461	$0.439	$0.317
8	$0.476	$0.443	$0.418	$0.310
9	$0.462	$0.425	$0.402	$0.300
10	$0.450	$0.408	$0.390	$0.290

Table 18: Annual VMT (Large Fleet Scenario 1)

Annual VMT	2017 Chevrolet Cruze	2017 Chevrolet Bolt EV	2017 Ford Fusion Energi Plug-in Hybrid	2017 Nissan Leaf
5,000	$0.762	$0.657	$0.630	$0.412
7,222	$0.585	$0.524	$0.498	$0.350
9,444	$0.492	$0.451	$0.428	$0.313
11,667	$0.434	$0.403	$0.384	$0.286
13,889	$0.394	$0.369	$0.354	
16,111	$0.366	$0.341	$0.332	
18,333	$0.344	$0.316	$0.316	
20,556	$0.327	$0.293	$0.302	
22,778	$0.314	$0.272	$0.291	
25,000	$0.302	$0.254	$0.282	

Table 19: Annual VMT (Large Fleet Scenario 2)

Annual VMT	2017 Chevrolet Cruze	2017 Chevrolet Bolt EV	2017 Ford Fusion Energi Plug-in Hybrid	2017 Nissan Leaf
5,000	$0.839	$1.013	$0.876	$0.713
7,222	$0.639	$0.770	$0.668	$0.558
9,444	$0.532	$0.639	$0.558	$0.473
11,667	$0.467	$0.556	$0.489	$0.415
13,889	$0.422	$0.497	$0.443	
16,111	$0.390	$0.451	$0.409	
18,333	$0.365	$0.414	$0.383	
20,556	$0.346	$0.379	$0.362	

22,778	$0.330	$0.350	$0.345	
25,000	$0.318	$0.326	$0.331	

Table 20: Annual VMT (Large Fleet Scenario 3)

Annual VMT	2017 Chevrolet Cruze	2017 Chevrolet Bolt EV	2017 Ford Fusion Energi Plug-in Hybrid	2017 Nissan Leaf
5,000	$0.719	$0.174	$0.885	-$0.640
7,222	$0.547	$0.321	$0.689	-$0.085
9,444	$0.503	$0.380	$0.596	$0.110
11,667	$0.492	$0.417	$0.529	$0.215
13,889	$0.493	$0.445	$0.473	$0.283
16,111	$0.486	$0.447	$0.439	$0.304
18,333	$0.475	$0.437	$0.415	$0.306
20,556	$0.462	$0.423	$0.397	$0.299
22,778	$0.450	$0.407	$0.384	$0.291
25,000	$0.439	$0.391	$0.373	$0.282

Table 21: Electricity Price ($/kWh) (Large Fleet Scenario 1)

$/kWh	2017 Chevrolet Cruze	2017 Chevrolet Bolt EV	2017 Ford Fusion Energi Plug-in Hybrid	2017 Nissan Leaf
$0.09	$0.475	$0.433	$0.411	$0.301
$0.10	$0.475	$0.437	$0.415	$0.306
$0.12	$0.475	$0.441	$0.419	$0.310

$0.13	$0.475	$0.446	$0.423	$0.315
$0.15	$0.475	$0.450	$0.428	$0.319
$0.16	$0.475	$0.455	$0.432	$0.324
$0.18	$0.475	$0.459	$0.436	$0.329
$0.19	$0.475	$0.463	$0.441	$0.333
$0.21	$0.475	$0.468	$0.445	$0.338
$0.22	$0.475	$0.472	$0.449	$0.343

TABLE 22: ELECTRICITY PRICE ($/KWH) (LARGE FLEET SCENARIO 2)

$/kWh	2017 Chevrolet Cruze	2017 Chevrolet Bolt EV	2017 Ford Fusion Energi Plug-in Hybrid	2017 Nissan Leaf
$0.09	$0.513	$0.611	$0.533	$0.452
$0.10	$0.513	$0.615	$0.538	$0.456
$0.12	$0.513	$0.620	$0.542	$0.461
$0.13	$0.513	$0.624	$0.546	$0.465
$0.15	$0.513	$0.628	$0.551	$0.470
$0.16	$0.513	$0.633	$0.555	$0.475
$0.18	$0.513	$0.637	$0.559	$0.479
$0.19	$0.513	$0.641	$0.563	$0.484
$0.21	$0.513	$0.646	$0.568	$0.489
$0.22	$0.513	$0.650	$0.572	$0.493

Table 23: Electricity Price ($/kWh) (Large Fleet Scenario 3)

$/kWh	2017 Chevrolet Cruze	2017 Chevrolet Bolt EV	2017 Ford Fusion Energi Plug-in Hybrid	2017 Nissan Leaf
$0.09	$0.491	$0.456	$0.435	$0.313
$0.10	$0.491	$0.460	$0.439	$0.317
$0.12	$0.491	$0.465	$0.443	$0.322
$0.13	$0.491	$0.469	$0.448	$0.327
$0.15	$0.491	$0.474	$0.452	$0.331
$0.16	$0.491	$0.478	$0.456	$0.336
$0.18	$0.491	$0.482	$0.461	$0.340
$0.19	$0.491	$0.487	$0.465	$0.345
$0.21	$0.491	$0.491	$0.469	$0.350
$0.22	$0.491	$0.495	$0.473	$0.354

Table 24: Gasoline Price ($/gallon) (Large Fleet Scenario 1)

$/gallon	2017 Chevrolet Cruze	2017 Chevrolet Bolt EV	2017 Ford Fusion Energi Plug-in Hybrid	2017 Nissan Leaf
$2.00	$0.459	$0.437	$0.413	$0.306
$2.22	$0.468	$0.437	$0.414	$0.306
$2.44	$0.476	$0.437	$0.415	$0.306
$2.67	$0.484	$0.437	$0.417	$0.306
$2.89	$0.492	$0.437	$0.418	$0.306
$3.11	$0.500	$0.437	$0.419	$0.306
$3.33	$0.508	$0.437	$0.420	$0.306
$3.56	$0.517	$0.437	$0.422	$0.306

$3.78	$0.525	$0.437	$0.423	$0.306
$4.00	$0.533	$0.437	$0.424	$0.306

Table 25: Gasoline Price ($/gallon) (Large Fleet Scenario 2)

$/gallon	2017 Chevrolet Cruze	2017 Chevrolet Bolt EV	2017 Ford Fusion Energi Plug-in Hybrid	2017 Nissan Leaf
$2.00	$0.498	$0.615	$0.535	$0.456
$2.22	$0.506	$0.615	$0.537	$0.456
$2.44	$0.514	$0.615	$0.538	$0.456
$2.67	$0.522	$0.615	$0.539	$0.456
$2.89	$0.531	$0.615	$0.541	$0.456
$3.11	$0.539	$0.615	$0.542	$0.456
$3.33	$0.547	$0.615	$0.543	$0.456
$3.56	$0.555	$0.615	$0.544	$0.456
$3.78	$0.563	$0.615	$0.546	$0.456
$4.00	$0.572	$0.615	$0.547	$0.456

Table 26: Gasoline Price ($/gallon) (Large Fleet Scenario 3)

$/gallon	2017 Chevrolet Cruze	2017 Chevrolet Bolt EV	2017 Ford Fusion Energi Plug-in Hybrid	2017 Nissan Leaf
$2.00	$0.476	$0.461	$0.437	$0.317
$2.22	$0.484	$0.461	$0.438	$0.317
$2.44	$0.492	$0.461	$0.439	$0.317
$2.67	$0.500	$0.461	$0.441	$0.317

$2.89	$0.508	$0.461	$0.442	$0.317
$3.11	$0.517	$0.461	$0.443	$0.317
$3.33	$0.525	$0.461	$0.445	$0.317
$3.56	$0.533	$0.461	$0.446	$0.317
$3.78	$0.541	$0.461	$0.447	$0.317
$4.00	$0.549	$0.461	$0.448	$0.317

Table 27: Loan Term (Large Fleet Scenario 2)

Term	2017 Chevrolet Cruze	2017 Chevrolet Bolt EV	2017 Ford Fusion Energi Plug-in Hybrid	2017 Nissan Leaf
1	$0.480	$0.555	$0.482	$0.419
2	$0.486	$0.565	$0.491	$0.425
3	$0.491	$0.574	$0.500	$0.431
4	$0.497	$0.584	$0.509	$0.437
5	$0.502	$0.595	$0.519	$0.444
6	$0.508	$0.605	$0.528	$0.450
7	$0.513	$0.615	$0.538	$0.456
8	$0.519	$0.626	$0.548	$0.463
9	$0.525	$0.637	$0.557	$0.469
10	$0.531	$0.647	$0.567	$0.476

Table 28: Lease Term (Large Fleet Scenario 3)

Term	2017 Chevrolet Cruze	2017 Chevrolet Bolt EV	2017 Ford Fusion Energi Plug-in Hybrid	2017 Nissan Leaf
1	$0.480	$0.445	$0.423	$0.310
2	$0.486	$0.453	$0.431	$0.314
3	$0.491	$0.461	$0.439	$0.317
4	$0.497	$0.468	$0.447	$0.321
5	$0.502	$0.476	$0.455	$0.325
6	$0.508	$0.484	$0.464	$0.329
7	$0.513	$0.492	$0.472	$0.333
8	$0.519	$0.500	$0.481	$0.337
9	$0.525	$0.509	$0.489	$0.342
10	$0.531	$0.517	$0.498	$0.346

SMALL FLEET

Table 29: Expected Years of Use (Small Fleet Scenario 1)

Years of Use	2017 Chevrolet Cruze	2017 Chevrolet Bolt EV	2017 Ford Fusion Energi Plug-in Hybrid	2017 Nissan Leaf
1	$0.546	$0.332	$0.968	$0.251
2	$0.473	$0.416	$0.745	$0.377
3	$0.463	$0.454	$0.644	$0.429
4	$0.468	$0.481	$0.573	$0.462
5	$0.480	$0.503	$0.515	$0.488
6	$0.483	$0.501	$0.480	$0.481

7	$0.479	$0.489	$0.455	$0.462
8	$0.473	$0.473	$0.437	$0.441
9	$0.466	$0.455	$0.422	$0.421
10	$0.458	$0.439	$0.412	$0.402

TABLE 30: EXPECTED YEARS OF USE (SMALL FLEET SCENARIO 2)

Years of Use	2017 Chevrolet Cruze	2017 Chevrolet Bolt EV	2017 Ford Fusion Energi Plug-in Hybrid	2017 Nissan Leaf
1	$0.821	$1.597	$1.835	$1.433
2	$0.611	$1.049	$1.179	$0.968
3	$0.554	$0.876	$0.933	$0.822
4	$0.537	$0.797	$0.790	$0.758
5	$0.535	$0.756	$0.688	$0.725
6	$0.529	$0.712	$0.624	$0.678
7	$0.519	$0.670	$0.579	$0.631
8	$0.507	$0.631	$0.545	$0.589
9	$0.496	$0.596	$0.519	$0.552
10	$0.486	$0.565	$0.498	$0.521

TABLE 31: EXPECTED YEARS OF USE (SMALL FLEET SCENARIO 3)

Years of Use	2017 Chevrolet Cruze	2017 Chevrolet Bolt EV	2017 Ford Fusion Energi Plug-in Hybrid	2017 Nissan Leaf

1	$0.663	$0.503	$1.140	$0.387
2	$0.532	$0.502	$0.832	$0.445
3	$0.502	$0.511	$0.702	$0.474
4	$0.498	$0.524	$0.617	$0.496
5	$0.503	$0.537	$0.549	$0.515
6	$0.502	$0.530	$0.508	$0.504
7	$0.496	$0.514	$0.480	$0.482
8	$0.488	$0.494	$0.458	$0.458
9	$0.479	$0.475	$0.442	$0.436
10	$0.470	$0.456	$0.429	$0.416

TABLE 32: ANNUAL VMT (SMALL FLEET SCENARIO 1)

Annual VMT	2017 Chevrolet Cruze	2017 Chevrolet Bolt EV	2017 Ford Fusion Energi Plug-in Hybrid	2017 Nissan Leaf
5,000	$0.770	$0.761	$0.710	$0.725
7,222	$0.591	$0.596	$0.553	$0.567
9,444	$0.496	$0.506	$0.470	$0.479
11,667	$0.438	$0.448	$0.418	
13,889	$0.398	$0.406	$0.383	
16,111	$0.369	$0.373	$0.357	
18,333	$0.347	$0.345	$0.337	
20,556	$0.330	$0.318	$0.322	
22,778	$0.316	$0.294	$0.309	
25,000	$0.305	$0.275	$0.298	

TABLE 33: ANNUAL VMT (SMALL FLEET SCENARIO 2)

Annual VMT	2017 Chevrolet Cruze	2017 Chevrolet Bolt EV	2017 Ford Fusion Energi Plug-in Hybrid	2017 Nissan Leaf
5,000	$0.839	$1.013	$0.957	$1.063
7,222	$0.639	$0.770	$0.725	$0.800
9,444	$0.532	$0.639	$0.601	$0.658
11,667	$0.467	$0.556	$0.524	
13,889	$0.422	$0.497	$0.472	
16,111	$0.390	$0.451	$0.434	
18,333	$0.365	$0.414	$0.405	
20,556	$0.346	$0.379	$0.382	
22,778	$0.330	$0.350	$0.363	
25,000	$0.318	$0.326	$0.348	

TABLE 34: ANNUAL VMT (SMALL FLEET SCENARIO 3)

Annual VMT	2017 Chevrolet Cruze	2017 Chevrolet Bolt EV	2017 Ford Fusion Energi Plug-in Hybrid	2017 Nissan Leaf
5,000	$0.803	$0.810	$0.759	$0.764
7,222	$0.614	$0.629	$0.587	$0.593
9,444	$0.514	$0.532	$0.496	$0.499
11,667	$0.452	$0.469	$0.439	
13,889	$0.410	$0.424	$0.401	
16,111	$0.379	$0.388	$0.372	

18,333	$0.356	$0.358	$0.351	
20,556	$0.338	$0.330	$0.334	
22,778	$0.323	$0.305	$0.320	
25,000	$0.311	$0.285	$0.308	

TABLE 35: ELECTRICITY PRICE ($/KWH) (SMALL FLEET SCENARIO 1)

$/kWh	2017 Chevrolet Cruze	2017 Chevrolet Bolt EV	2017 Ford Fusion Energi Plug-in Hybrid	2017 Nissan Leaf
$0.09	$0.479	$0.485	$0.450	$0.457
$0.10	$0.479	$0.489	$0.455	$0.462
$0.11	$0.479	$0.493	$0.459	$0.467
$0.13	$0.479	$0.498	$0.463	$0.471
$0.14	$0.479	$0.502	$0.468	$0.476
$0.16	$0.479	$0.506	$0.472	$0.481
$0.17	$0.479	$0.511	$0.476	$0.485
$0.19	$0.479	$0.515	$0.480	$0.490
$0.20	$0.479	$0.520	$0.485	$0.494
$0.22	$0.479	$0.524	$0.489	$0.499

TABLE 36: ELECTRICITY PRICE ($/KWH) (SMALL FLEET SCENARIO 2)

$/kWh	2017 Chevrolet Cruze	2017 Chevrolet Bolt EV	2017 Ford Fusion Energi Plug-in Hybrid	2017 Nissan Leaf
$0.09	$0.519	$0.665	$0.574	$0.626
$0.10	$0.519	$0.670	$0.579	$0.631

$0.11	$0.519	$0.674	$0.583	$0.636
$0.13	$0.519	$0.678	$0.587	$0.640
$0.14	$0.519	$0.683	$0.591	$0.645
$0.16	$0.519	$0.687	$0.596	$0.649
$0.17	$0.519	$0.692	$0.600	$0.654
$0.19	$0.519	$0.696	$0.604	$0.659
$0.20	$0.519	$0.700	$0.609	$0.663
$0.22	$0.519	$0.705	$0.613	$0.668

TABLE 37: ELECTRICITY PRICE ($/KWH) (SMALL FLEET SCENARIO 3)

$/kWh	2017 Chevrolet Cruze	2017 Chevrolet Bolt EV	2017 Ford Fusion Energi Plug-in Hybrid	2017 Nissan Leaf
$0.09	$0.496	$0.509	$0.475	$0.477
$0.10	$0.496	$0.513	$0.479	$0.481
$0.11	$0.496	$0.518	$0.484	$0.486
$0.13	$0.496	$0.522	$0.488	$0.491
$0.14	$0.496	$0.527	$0.492	$0.495
$0.16	$0.496	$0.531	$0.496	$0.500
$0.17	$0.496	$0.535	$0.501	$0.505
$0.19	$0.496	$0.540	$0.505	$0.509
$0.20	$0.496	$0.544	$0.509	$0.514
$0.22	$0.496	$0.548	$0.514	$0.518

TABLE 38: GASOLINE PRICE ($/GALLON) (SMALL FLEET SCENARIO 1)

$/Gallon	2017 Chevrolet Cruze	2017 Chevrolet Bolt EV	2017 Ford Fusion Energi Plug-in Hybrid	2017 Nissan Leaf
$2.00	$0.464	$0.489	$0.452	$0.462
$2.22	$0.472	$0.489	$0.454	$0.462
$2.44	$0.480	$0.489	$0.455	$0.462
$2.67	$0.488	$0.489	$0.456	$0.462
$2.89	$0.497	$0.489	$0.458	$0.462
$3.11	$0.505	$0.489	$0.459	$0.462
$3.33	$0.513	$0.489	$0.460	$0.462
$3.56	$0.521	$0.489	$0.461	$0.462
$3.78	$0.529	$0.489	$0.463	$0.462
$4.00	$0.537	$0.489	$0.464	$0.462

TABLE 39: GASOLINE PRICE ($/GALLON) (SMALL FLEET SCENARIO 2)

$/Gallon	2017 Chevrolet Cruze	2017 Chevrolet Bolt EV	2017 Ford Fusion Energi Plug-in Hybrid	2017 Nissan Leaf
$2.00	$0.503	$0.670	$0.576	$0.631
$2.22	$0.511	$0.670	$0.578	$0.631
$2.44	$0.520	$0.670	$0.579	$0.631
$2.67	$0.528	$0.670	$0.580	$0.631
$2.89	$0.536	$0.670	$0.581	$0.631
$3.11	$0.544	$0.670	$0.583	$0.631
$3.33	$0.552	$0.670	$0.584	$0.631

$3.56	$0.560	$0.670	$0.585	$0.631
$3.78	$0.569	$0.670	$0.587	$0.631
$4.00	$0.577	$0.670	$0.588	$0.631

TABLE 40: GASOLINE PRICE ($/GALLON) (SMALL FLEET SCENARIO 3)

$/Gallon	2017 Chevrolet Cruze	2017 Chevrolet Bolt EV	2017 Ford Fusion Energi Plug-in Hybrid	2017 Nissan Leaf
$2.00	$0.481	$0.514	$0.477	$0.482
$2.22	$0.489	$0.514	$0.478	$0.482
$2.44	$0.497	$0.514	$0.480	$0.482
$2.67	$0.505	$0.514	$0.481	$0.482
$2.89	$0.513	$0.514	$0.482	$0.482
$3.11	$0.521	$0.514	$0.484	$0.482
$3.33	$0.530	$0.514	$0.485	$0.482
$3.56	$0.538	$0.514	$0.486	$0.482
$3.78	$0.546	$0.514	$0.487	$0.482
$4.00	$0.554	$0.514	$0.489	$0.482

TABLE 41: LOAN TERM (SMALL FLEET SCENARIO 2)

Term	2017 Chevrolet Cruze	2017 Chevrolet Bolt EV	2017 Ford Fusion Energi Plug-in Hybrid	2017 Nissan Leaf
1	$0.485	$0.607	$0.522	$0.578
2	$0.490	$0.617	$0.531	$0.587

3	$0.496	$0.627	$0.540	$0.595
4	$0.501	$0.638	$0.550	$0.604
5	$0.507	$0.648	$0.559	$0.613
6	$0.513	$0.659	$0.569	$0.622
7	$0.519	$0.670	$0.579	$0.631
8	$0.524	$0.681	$0.589	$0.640
9	$0.530	$0.692	$0.599	$0.649
10	$0.536	$0.703	$0.609	$0.659

TABLE 42: LEASE TERM (SMALL FLEET SCENARIO 3)

Term	2017 Chevrolet Cruze	2017 Chevrolet Bolt EV	2017 Ford Fusion Energi Plug-in Hybrid	2017 Nissan Leaf
1	$0.485	$0.498	$0.463	$0.469
2	$0.490	$0.506	$0.471	$0.475
3	$0.496	$0.514	$0.480	$0.482
4	$0.501	$0.522	$0.488	$0.488
5	$0.507	$0.530	$0.496	$0.495
6	$0.513	$0.538	$0.504	$0.501
7	$0.519	$0.547	$0.513	$0.508
8	$0.524	$0.555	$0.522	$0.515
9	$0.530	$0.564	$0.530	$0.522
10	$0.536	$0.573	$0.539	$0.529

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