



CHOOSING AN ELECTRIC VEHICLE

Electric Vehicle Training Series Script



Slide 1- Introduction

Welcome to the first presentation in the Electric Vehicle Training Series. This presentation is entitled “Choosing an Electric Vehicle.” It is designed to help inform you about what electric vehicles are available and what you need to know before selecting a new or replacement vehicle for your fleet. Other training presentations in this series cover operating an electric vehicle and planning for, installing, and operating electric vehicle infrastructure. All presentations in this training series are available through the GSA Fleet Drive-thru training page.

Slide 2 - Agenda

In this presentation we will address the Federal sustainability mandates that apply to Federal fleets, including the new Executive Order 13693, Implementing Sustainability in the Next Decade. We will also provide information on the electric vehicle offerings available to GSA customers in fiscal year 2016 and how to choose the right vehicle for your agency mission. We will then discuss the costs and benefits associated with operating an electric vehicle over a conventionally fueled gasoline vehicle. Finally, we will give you an idea of what to expect from an electric vehicle, including some of their unique features, maintenance and repair requirements, and GSA Fleet replacement criteria.

Slide 3 – Acronyms and Definitions

Before we get started, we have defined the three different types of electric vehicles and the common acronyms used to identify them:

- A “BEV,” or Battery Electric Vehicle, is an all-electric or zero emissions vehicle that is powered exclusively by a battery. Battery electric vehicles must plug into an electrical outlet for power. Common types of BEVs that you have probably heard of include Tesla models, Ford Focus Battery Electric, and the Nissan Leaf. Battery electric vehicles are synonymous with zero emission vehicles and typically have ranges between 70 and 100 miles.
- A “PHEV,” or Plug-in Hybrid Electric Vehicle, is a vehicle propelled by both an internal combustion engine and an electric motor. PHEVs combine the benefits of both an electric and gas-powered vehicle. PHEVs can operate exclusively on electric power, anywhere between 19 and 53 miles, but have the added benefit of an internal combustion engine that greatly extends the vehicle’s range. PHEVs have two fuel outlets – one that can be connected to an electrical outlet for charging and one that is fueled with conventional gasoline. The most popular

PHEV on the market in the United States today is the Chevy Volt. PHEVs do count toward federal zero emissions mandates.

- An “HEV,” or Hybrid Electric Vehicle, is a vehicle powered by the engine and fuel of a conventional vehicle with the batteries and electric motor of a battery electric vehicle. HEVs do not need to be plugged in to utilize electric power and do not have an outlet for electrical charging. Several automakers have introduced hybrid sedans and sport utility vehicles into their fleets. One of the most well-known examples of a hybrid electric vehicle is the Toyota Prius. GSA does not currently offer the Prius.

Slide 4 – Federal Mandates

There are three federal mandates that apply to Federal fleet sustainability: Executive Order 13693 entitled “Planning for Sustainability in the Next Decade,” the Energy Policy Act of 1992 and 2005, which is also referred to as EPAct, and the 2010 Guidance on Section 141 of the Energy Independence and Security Act of 2007, also referred to as EISA.

- Executive Order 13693 was signed by President Obama on March 19, 2015. It sets ambitious standards for the acquisition of zero emission vehicles in Federal fleets. By the year 2020, 20 percent of new passenger vehicle fleet acquisitions must comprise of zero emission and plug-in hybrid electric vehicles. By 2025, 50 percent of federal vehicles must meet this standard. In addition to the zero emission standards, the executive order mandates that agencies reduce fleet-wide greenhouse gas emissions by 30 percent by the year 2025, relative to 2014 baseline numbers. These reductions will be spread out over the next nine years through baselines set in the executive order. By 2017, agencies must reduce emissions by at least four percent. By 2021, emissions reductions should be at least 15 percent. In addition to emissions reductions, the executive order directs agencies to determine an optimum fleet inventory, specifically to eliminate unnecessary or non-essential vehicles from its fleet, to begin collecting asset-level data, and to implement telematics devices on all new acquisition light duty and medium duty vehicles where appropriate. Finally, the executive order directs agencies to plan for charging and refueling infrastructure for BEVs and PHEVs.
- EPAct requires 75 percent of light duty vehicles acquired in metropolitan statistical areas to be alternative fuel vehicles. Alternative fuel vehicles, or AFVs, are those that do not run on gasoline or diesel. Electric vehicles are considered AFVs along with compressed natural gas, hydrogen, and ethanol vehicles. Per the expanded definition of an AFV in the Defense Authorization Act of 2008, low greenhouse gas gasoline-powered vehicles can be considered AFVs when they are not garaged within 5 miles or 15 minutes of an alternative fuel source.
- EISA mandates that agencies acquire all light-duty vehicles as low-greenhouse gas emitting and medium duty vehicles designed to transport less than 12

passengers or less than 9 passengers rearward of the driver's seat or medium duty passenger vehicles not equipped with an open cargo area of 72 inches in interior length or more. For model year 2016, EPA sets the "low-greenhouse gas emitting" threshold at a maximum of 300 grams per mile of carbon dioxide emissions for passenger cars and a 375 grams per mile of carbon dioxide emissions for light-duty trucks.

Slide 5 – EV Features

The table on this slide breaks down the different components that distinguish the three types of electric vehicles.

- When looking at the motor/engine, HEVs, PHEVs, and BEVs all have electric motors. However, HEVs and PHEVs also have internal combustion engines.
- Fuel Source is the next category. The primary fuel source of an HEV is usually conventional gasoline or diesel, though some models can use the higher ethanol by volume fuel, such as E85. PHEVs utilize both electricity and a conventional fuel such as gasoline, diesel, or E85. BEVs are pure electric vehicles and can only be fueled by plugging into electricity.
- The battery type used in electric vehicles has changed over time. As an industry, automakers are turning to lithium ion batteries for electric vehicles. Lithium-ion batteries have been commonly used in everything from cellular phones to laptops, but more recently automotive companies have started using them in PHEVs and BEVs. Lithium-ion batteries are smaller and lighter than their nickel-metal hydride counterpart, which is the typical car battery used in most vehicles. This allows for the most energy storage in the smallest space. Additionally, lithium-ion batteries are not affected by "memory." This means that the battery does not have to be fully discharged in order to maintain a long life. The Chevy Volt and Ford Focus Electric both use lithium-ion, while HEVs have tended to use nickel-metal hydride batteries. This is because nickel-metal hydride batteries have traditionally been much cheaper than lithium-ion. However, this has started to change. As the technology has become more widely used, lithium ion battery costs have begun to fall. As a result, some automakers have begun offering lithium-ion batteries in their hybrid electric vehicle models. For example, the 2016 Ford C-MAX Hybrid comes standard with a lithium-ion battery.
- Vehicle range depends on the engine type and battery size of the specific vehicle model. However, HEVs typically get 500 miles in one tank of fuel. PHEVs can go anywhere between 19 and 53 electric miles on a single charge, depending on the model, and have a combined electric and gasoline range of 420 miles or more. BEV range varies significantly between models. The only BEV available through GSA in fiscal year 2016 is the Ford Focus Electric and has a range of approximately 76 miles.

- When planning for the zero emissions requirements in executive order 13693, only PHEVs and BEVs meet the Federal zero emissions mandate.

Slide 6 – FY 2016 EV Offerings

There are four vehicle models available in fiscal year 2016 that meet executive order 13693 zero emission requirements. All four models are sedans. The 8E Ford Focus Battery Electric Vehicle has a lease rate of 180 dollars per month and 6 cents per mile driven. In fiscal year 2016, leasing customers can take advantage of a full replacement rate offering by GSA Fleet. The full replacement rate, or FRR, stretches the incremental cost over the life of the vehicle – essentially GSA Fleet pays for the upfront added cost of the vehicle so that agencies are not burdened with high upfront vehicle costs. Customers can pay a full replacement rate for the life of the vehicle and, upon replacement, will only have to pay the base price for a new electric vehicle. The full replacement rate for the Focus BEV is 454 dollars per month and 6 cents per mile driven. For customers interested in purchasing this vehicle, the purchase price is 26,684 dollars. The incremental – or dollar amount over the base price of the low-bid vehicle in the same class – is 12,039 dollars. The 8P Chevy Volt Plug-in Hybrid Electric Vehicle has a lease rate of 180 dollars per month and 8 point 3 cents per mile driven. The incremental cost is 15,655 dollars. The full replacement rate is 441.00 dollars per month and 8 point 3 cents per mile. The purchase price of the vehicle is 30,300.00 dollars. The 8P Ford C-MAX Energi Plug-in Hybrid Electric Vehicle has the same lease rate as the Chevy Volt of 180 dollars per month and 8 point 3 cents per mile. It has an incremental cost of 14,519 dollars. The full replacement rate is also the same as the Chevy Volt at 441 dollars per month and 8 point 3 cents per mile driven. The purchase price is 29,164 dollars. The 9P Ford Fusion Energi Plug-in Hybrid Electric Vehicle has a lease rate of 181 dollars per month and 9 point 9 cents per mile driven. The incremental cost is 12,362 dollars. The full replacement rate is the highest among the electric vehicles at 474 dollars per month and approximately 10 cents per mile driven. The purchase price is 30,234 dollars.

Slide 7 – Average Range and Charging Time

The range and charging time required by each vehicle offered in fiscal year 2016 should factor into your selection process. In model year 2016 vehicles, all four models can seat five people. This is an improvement from previous Chevy Volt and Ford Focus models that could only seat four people. Both Ford PHEV models, the C-MAX Energi and the Fusion, have the same specs. Their estimated electric range is 19 miles with a total combined range of 550 miles. It will take an estimated two and a half hours to charge the battery with a level 2 charging station. The Chevy Volt has more than double the electric range of the Ford PHEV models. The Volt can get an estimated 53 miles per charge, with a combined range of 420 miles. It takes approximately four and a half hours to charge the battery with a level 2 charging station. Finally, the Ford Focus Electric, the only all-electric vehicle through GSA, gets 76 miles of electric range per charge. With no back-up fuel option, this vehicle is best for city use where the vehicle

does not travel more than 70 miles in a day. Using a level 2 charging station, the manufacturer estimates that it will take approximately 3 point 6 hours to fully charge the battery.

Slide 8 – Choosing the Right Vehicle

Choosing the right vehicle for your agency's mission is important. The electric vehicles that are available through GSA are passenger sedans that may not perform in the ways that your agency needs. Consider where your vehicles are driven and how they are driven. If your vehicles regularly travel on **mountainous, rocky terrain**, an electric sedan is probably not the right vehicle for you. In these instances, we recommend 4 by 4 pick-up trucks that can better maneuver rough terrains. Most trucks available through GSA are gasoline or flex-fuel vehicles, meaning they can use gasoline or the more sustainable E85 fuel. Alternatively, if compressed natural gas fueling and maintenance facilities are available in your area, there are compressed natural gas options for 4 by 2 and 4 by 4 light duty trucks. Compressed natural gas is a more sustainable fuel and releases less greenhouse gas emissions than conventional vehicles. If your vehicles typically travel in the **city** and do not need towing capacity, then an electric vehicle is probably for you. BEVs, PHEVs, and HEVs are best designed for city driving. Long idle times and frequent acceleration from a stop make a zero emission vehicle the most environmentally friendly option in the city. Low-greenhouse gas emitting sedans are also recommended for city driving. If your vehicles frequently travel on the **highway**, a low-greenhouse gas emitting sedan or diesel sedan is recommended. This is largely due to range. If vehicles are traveling long distances, an electric vehicle might not have the range capability that you need to complete your mission on a day-to-day basis. However, fleet managers should assess the distance that their vehicles typically travel in a day to determine whether an electric vehicle is appropriate.

Slide 9 – Choosing Electric

Each agency must take into consideration unique agency needs before deciding on an electric vehicle. We have found that electric vehicles are well suited for agencies when the average distance traveled per day is 60 miles or less, vehicles are operated primarily on paved roadways, vehicles do a lot of start-stop driving or have long idle times, vehicles do not need to carry large loads, charging infrastructure exists or the agency has funds to install charging stations, local dealerships are authorized to service and repair electric vehicles, and when vehicles need to carry five people or less.

Slide 10 – EV Attributes and Cost Considerations

Usage patterns and attributes of the vehicle are large determinants as are costs when deciding whether or not to go electric. Executive Order 13693 mandates Federal fleets to be leaders in sustainability and greenhouse gas emission reductions. This chart highlights the cost, MPG, and greenhouse gas differences between electric vehicles and their gas-powered equivalent. When comparing currently available electric vehicles to the fiscal year 2016 low-bid 8C Ford Focus, you can see MPG and greenhouse gas

improvements across the board. The 8C Focus gets 31 combined city and highway miles per gallon when run on gas and only 23 combined miles per gallon on E85. As you move across the electric vehicle spectrum, MPG continues to improve. The HEV Ford C-MAX gets a combined 40 miles per gallon, a savings of 58 gallons of fuel per year when calculated based on 8,000 miles driven per year. When run on gasoline, the PHEV C-MAX gets a slightly lower MPG at 38. However, when run on purely electric power the C-MAX gets an equivalent of 88 miles per gallon, more than double the gas miles per gallon in the Focus. When run primarily on electric power, this results in a fuel savings of up to 167 gallons per year. The BEV Focus gets an equivalent of 105 miles per gallon – more than three times better mileage than the regular gas-powered Focus and almost four times better than the E85 powered Focus. The fuel savings on the BEV Focus is greatest – up to 182 gallons per year. Greenhouse gas emissions follow the same trend. The HEV C-MAX emits 225 grams of carbon dioxide per mile compared to the Focus' 285 and 266 grams per mile on gas and E85, respectively. The PHEV C-MAX, at 129 grams of carbon dioxide per mile, emits half the amount of carbon dioxide as the regular Focus. As an all-electric vehicle, the BEV Focus emits no carbon dioxide, making it the “greenest” option for agencies. While electric vehicles are more efficient, they do come with a higher price tag. The incremental represents the added purchase cost of the alternative fuel vehicle over the base model. Leased customers pay an added surcharge for all fleet vehicles per month which accumulates in a fund that covers the incremental cost of the AFV in the first year. Once the incremental cost is paid in the first year, the average annual lease cost based on an estimated 8,000 miles driven per year, for each year thereafter is not much different than the lease costs on the conventionally fueled vehicle. . In fact, because of higher mileage rates – which in part pay for fuel – the gas-fueled 8C Focus actually costs more to lease than the HEV, PHEV, and BEV. Of course, the upfront incremental costs may outweigh these mileage cost savings over the life of the vehicle depending on the number of miles driven.

Slide 11 – Electric Vehicles Features

Electric vehicles have a new regenerative braking feature that allows energy to be recovered when drivers brake slowly. This extends the vehicle's electric range as well as the life of the vehicle's braking system. This feature is in all three levels of electric vehicles and improves the efficiency of the vehicle. Some other features to be aware of include an “EV Later” option in PHEVs. This feature allows you, the driver, to decide when to use electric charge or gas to power the vehicle. The vehicle can switch seamlessly between both fuel types when in use. For example, if you start your trip on the highway but eventually will do city driving during the day, a smart driver would utilize the vehicle's gas supply for highway driving and save the electric charge for start-stop and idle driving in the city. This will extend the vehicle's range and reduce carbon emissions. Operators should also be aware that a level one charging cord comes standard with every electric vehicle. These cords plug into a regular 120 volt wall outlet on one end and into the vehicle charging receptacle on the other end.

Slide 12 – What to Expect: EV Maintenance and Repair

Maintenance requirements for electric vehicles are slightly different from traditional internal combustion engine vehicles. First and most importantly, GSA requires that electric vehicle maintenance be handled by the original equipment manufacturer. Dealerships must be authorized to work on plug-in electric vehicles in order to complete work on the vehicle. It is recommended that fleet managers confirm that there are dealerships in close proximity that can service the electric vehicle before adding an EV to their fleet. GSA Leasing customers should adhere to the following preventative maintenance schedule. For battery electric vehicles, preventative maintenance should occur every 10,000 miles or 12 months, whichever comes first. For Plug-in Hybrid electric vehicles, preventative maintenance should occur every 15,000 miles or 24 months, whichever comes first.

Slide 13 – What to Expect: GSA Fleet Minimum Vehicle Replacement Standards

One concern around electric vehicles is their battery life because of the high cost associated with replacing the battery. Manufacturers today typically offer an eight year or 100,000 mile warranty for electric vehicle batteries. Most batteries meet or exceed the warranty lifespan and in some states, such as California and New York, the warranty period is longer. GSA Fleet has set minimum vehicle replacement standards for electric vehicles within the battery warranty period so customers should never have to pay for a replacement if the vehicle is operated and maintained properly. Replacement standards for electric vehicles are dependent on both vehicle age and miles. The minimum replacement for an electric vehicle is 60,000 miles and five years old, when it is seven years old regardless of the mileage, or when it has traveled 85,000 miles regardless of age.

Slide 14 – Resources

This concludes the first part of our Electric Vehicle Training Series. If you have questions regarding any of the content included here or about electric vehicles in general, please reach out to the GSA Fleet Alternative Fuel Vehicle Team at GSAFleetAFVTeam@gsa.gov. Some additional resources available to fleet managers are linked here. We encourage you to take the other part to this training entitled “Operating an Electric Vehicle” as well as our charging station training for important details about whether and how to obtain charging infrastructure to fuel your electric vehicle.