ATLAS PUBLIC POLICY

# Methods and Assumptions for Federal Fleet Analysis

A companion to the report, *Federal Fleet Electrification Assessment* by Atlas Public Policy

This document summarizes key methods and all assumptions followed by Atlas Public Policy for an assessment of the electrification potential of the federal fleet.

## Determination of Fleet Makeup

When choosing what vehicles to analyze, we were limited by primarily by the data available in the General Service Administrations (GSA)'s 2019 Federal Fleet Report. The dataset provides a breakdown of each agency's fleet by the following categories:

| | | |
|---|---|---|
| Passenger Vehicles | • LSEVs (low speed electric vehicles)<br>• Sub-compact sedans<br>• Compact sedans<br>• Midsize sedans<br>• Large sedans | • Limousines<br>• Light SUVs<br>• Medium SUVs<br>• Light passenger vans<br>• Medium passenger vans |
| Trucks and Other Vehicles | • Light Duty 4x2<br>• Light Duty 4x4<br>• Medium Duty | • Heavy Duty<br>• Ambulances<br>• Buses |

The Federal Fleet Report also provides the number of each of the above vehicles used for Law Enforcement purposes in each agency.

Based on conversations with agency fleet managers, we determined it was too difficult to assess the types of medium- and heavy-duty vehicles aside from shuttle and school buses.

While agency-specific vehicle counts for each of the above vehicle types are unavailable, we determined the percentage makeup of buses for both the overall federal fleet and specifically for the three military departments.

In addition, we reviewed the 2019 Office of Inspector General (OIG) report on the U.S. Postal Service (USPS) fleet to determine the makeup of the USPS delivery fleet. These vehicles were:

- Long Life Vehicles
- Ram Promaster Vans

- Minivans
- Mixed Delivery and Collection Vehicles
- Ram Tradesman Pickups
- Other

These categories of vehicles were then mapped to the Federal Fleet Report vehicle types based on the description of the vehicle and a comparison of the number of vehicles of each type reported in the USPS OIG report and the number of each vehicle type listed in the Federal Fleet Report.

To provide a further breakdown of light trucks and buses, we analyzed the makeup of the state agency, school bus, and transit agency fleets in Washington state and used that data as a proxy for the federal fleet. Based on that data, we further broke down the categories of vehicles as follows:

| | | |
|---|---|---|
| Light Duty 4x2 | • Pickup<br>• Work/Utility Truck | • Flatbed |
| Light Duty 4x2 | • Pickup<br>• Work/Utility Truck | • Flatbed |
| School Buses | • Type C Buses<br>• Type D Buses | |
| Shuttle Buses | • 12-16 Passenger Shuttles<br>• 16-20 Passenger Shuttles | • 20-24 Passenger Shuttles<br>• 24+ Passenger Shuttles |

To determine the makeup of each agency's fleet, we first divided figures listed in the Federal Fleet Report by the detailed breakdown for buses based on conversations with agency fleet managers. Next, we further divided those figures by the detailed breakdown obtained from the analysis of public vehicles in Washington state to arrive at the final fleet makeup reported in the analysis results.

# Mapping Vehicle Type to Make and Model

A primary challenge of this analysis was being able to use the various sources of information published by the General Services Administration (GSA). GSA categorizes vehicles in a way that is not consistent with other major bodies like the Federal Highway Administration and it is also not consistent across GSA datasets.

Our main sources of data for this analysis were:

- Fiscal Year 2019 Federal Fleet Report
- The 2020 Vehicle Availability Listing
- FY2020 CONUS Rate Bulletin

- FY2020 AFV (Alternative Fuel Vehicle) Guide

The Federal Fleet Report contains counts of vehicles by vehicle type for each agency. The vehicle availability listing contains the makes and models available to purchase from the GSA by federal Standard Item Number (SIN) along with an item description. The CONUS Rate Bulletin provides the leasing rate for all vehicles by vehicle type, equipment code, and SIN. The FY 2020 AFV Guide provides the low-bid cost of vehicles for each SIN for which an AFV is available.

To analyze federal fleet vehicles using the Dashboard for Rapid Vehicle Electrification (DRVE) Tool, we chose a representative vehicle for each vehicle type listed in the Federal Fleet Report and determined the price the federal government would pay for that vehicle. First, we mapped the vehicle types from the Federal Fleet Report to the vehicle types listed in the CONUS Rate Bulletin. Because the CONUS Rate Bulletin also contains SINs for each vehicle type, we chose a vehicle make and model for the representative vehicles from the list in the Vehicle Availability Listing and then mapped them to the pricing data by SIN listed in the AFV guide.

The listing of vehicle types in the CONUS Rate Bulletin and Federal Fleet Report are not precisely aligned. The Federal Fleet Report provides a more granular breakdown of vehicles than the Rate Bulletin. For instance, SUVs are listed under the Light Truck vehicle type in the Rate Bulletin but as passenger vehicles in the Federal Fleet Report. To account for this, we assigned vehicle types by equipment code to map the CONUS Rate Bulletin vehicle types to the Federal Fleet Report vehicle types.

## Gasoline and Diesel Vehicles

According to our research for this project, the federal government primarily buys vehicles from the Detroit Three automakers, so we gave preference to Ford, General Motors, and Stellantis. The exception to this choice was for the midsize sedan where we chose the Nissan Maxima instead of the Dodge Charger. There were no offerings from the Detroit Three for the subcompact class, so chose the Subaru Impreza.

The vehicle make and model for large sedans and limousines is the same as midsize sedans because the GSA no longer offers large sedans or limousines. We assumed that these vehicles would be replaced with their closest equivalent, which we deemed to be a midsize sedan.

There are no law-enforcement specific models on offer from the GSA for these vehicle types and we assumed that they would be replaced with the same model as a non law-enforcement vehicle. Because the Federal Fleet Report does not provide data on mileage or age for law enforcement vehicles specifically, analysis for law enforcement compact vehicles and non-law enforcement compact vehicles in each agency would be the exact same. Therefore, we do not separate law enforcement compacts from other compacts in this analysis.

For Buses, we chose vehicle make and models based on vehicles where we have complete data.

For USPS, we relied on the USPS OIG report to choose vehicle makes and models that represent the makeup of the delivery fleet. The Long Life Vehicle is not available for commercial sale and had to be manually entered into DRVE. Based on information that USPS is buying off-the-shelf models of Promaster vans from RAM and moving the steering column to the right hand side of the vehicle, we assumed that the fuel economy of these replacements is equivalent to a Ford Transit cargo van.

### Electric Vehicles

Where applicable, we assigned a vehicle make and model that was already on offer from the GSA as the EV alternative. The exception to this is the shuttle bus where the federal government has an electric vehicle from Turtle Top buses on offer, but it was considerably more expensive than the equivalent vehicle from GreenPower Motor Company for which data was already in the DRVE tool.

We focused vehicle choices on the Detroit Three when choosing vehicle makes and models for EV alternatives. We did not include any vehicles that do not meet the requirements laid out in the American Jobs Plan from the Biden Administration. Otherwise, we aimed to choose the least expensive model that would meet the requirements of the vehicle type. This was done to be consistent with the methodology for choosing the price of gasoline or diesel vehicles, which uses the low-bid cost for each item number. Note, pricing for the Bolt EV and Mustang Mach-E come from the 2021 AFV guide, not the 2020. The Mach-E was not available in the 2020 AFV guide and General Motors dropped the price of the Bolt significantly from 2020 to 2021.

For buses, we gave preference American-made models that were the lowest price.

## Vehicle Mileage

The analysis included two mileage scenarios, Standard Mileage and High Mileage. The Standard mileage is the mileage listed for each vehicle type for each agency in the Federal Fleet Report. This represents the average annual mileage for all vehicles of a given type in each agency.

For the high mileage scenario, we created a synthetic subset of high mileage vehicles based on information about the distribution of vehicle mileage of state agency vehicles in Washington state for which we have more complete data. This carries the implicit assumption that vehicle mileage distributions in federal fleets are similar to those in Washington state fleets.

We calculate mileage values one standard deviation above the mean annual mileage for federal fleet vehicles by applying the coefficient of variation calculated from Washington state fleet vehicles to mean mileage values for federal fleet vehicles. This returns our mileage value for the high milage subset of vehicles.

Washington state vehicle fleet mileage is approximately normally distributed. To construct the subset of high-mileage vehicles, we exploit the properties of normal distributions to estimate the

number of federal fleet vehicles above one standard deviation from the mean vehicle mileage. In a normally distributed population, approximately 15.9 percent of the population will be more than one standard deviation above the mean. Therefore, the high mileage subset is 15.9 percent of the federal fleet inventory.

# Vehicle Useful Life

We relied on replacement standards for each vehicle type published by the GSA and average vehicle ages reported in the 2019 Federal Fleet Report to determine vehicle useful life. In cases where the average age of vehicles reported in the Federal Fleet Report was greater than the replacement standard set for by the GSA, we used the figure from the report. Additionally, the GSA has different replacement standards for gas-powered and hybrid or electric vehicles. To make an apples-to-apples comparison between gasoline and diesel vehicles and EVs, we modeled the total cost of ownership of gasoline and diesel vehicles using the replacement standard for EVs.

# Fuel Price

We calculated the average electricity price across all federal buildings reported by the Energy Information Administration in 2019 to determine electricity prices for charging fleet EVs. Similarly, we based gasoline and diesel prices on reported averages paid by federal agencies in the 2019 Federal Fleet Report. All non-electric vehicles use either gasoline or diesel and biodiesel, renewable diesel, and E-85 were excluded due to low volumes.

# Fuel Economy

Fuel economy for both internal combustion and electric light-duty vehicles comes from data published by U.S. Environmental Protection Agency's fueleconomy.gov. For vehicles not yet rated on fueleconomy.gov, we used alternative estimates of fuel economy. For the Rivian R1S, Ford F150 Lightning, and Lordstown Endurance, we estimated fuel economy using reported range and battery size and comparisons with similar models. For the Chevrolet Bolt EUV, we used the same fuel economy of the standard Bolt due to their similar sizes and capabilities. Finally, we used simulated fuel economy data from the Autonomie modeling tool for the Ford eTransit van.

Fuel economy for both internal combustion and electric buses are based on data published by the Altoona Bus Testing Center.

# City/Highway Mileage

For passenger vehicles and light trucks, we assume 55 percent city driving and 45 percent highway based on the EPA standard for light-duty vehicles. For all other vehicles, we base city/highway mileage splits on the vehicle use case and appropriate EPA Greenhouse Gas Emission Model (GEM) drive cycle weighting.

# Vehicle Price

With few exceptions, vehicle pricing for internal combustion and battery electric vehicles is based on the data for the low-bid cost of each vehicle type published in the 2020 AFV guide.

In cases where no low-bid pricing data was available, we calculated the average percentage discount off MSRP for vehicles which do have low-bid pricing available and applied that percentage discount to the MSRP for vehicles which do not have low-bid pricing.

In cases where we have pricing data for the base model of an EV, but not for models with particular body types, such as an eTransit with a passenger van body, we assumed that the pricing differential between the equivalent gasoline or diesel base model and the model with the body type in question was the same for the EV.

# Maintenance Costs

Maintenance costs for passenger vehicles and light trucks were taken from a Consumer Reports study. We assumed that the maintenance figures from Consumer Reports for the 0-50,000 miles would apply for the first five years of ownership based on average mileage reported for light-duty vehicles of less than 10,000 miles per year. We also assumed that the maintenance figures reported for vehicles that have traveled between 50,000 and 100,000 miles would apply for vehicles after five years of ownership.

Maintenance costs for buses were based on fleet studies published by the National Renewable Energy Laboratory.

# Charging Scenarios

Costs for Level 2 charging are based on an analysis of the total installed cost of Level 2 ports at federal buildings. The figure does not provide a breakdown between equipment and installation cost. The annual maintenance costs are assumed to be $50.

Costs for DC fast charging (DCFC) are based on the equipment costs listed in the award schedule for EV charging equipment published by the GSA. Installation costs are based on a report on charging installation costs from a 2019 ICCT study. The costs used for installation of 50 kilowatt DCFC at sites of between six and 50 charging stations. There was no publicly available data on installation costs for 24 kilowatt DCFC, so we assumed the price would be the same as 50 kilowatt DCFC given similar construction requirements.

# DRVE Tool Inputs

The *Present Day Assumption* was used as a baseline to inform the inputs used for the 2025 and 2030 analysis.

| Tool Input | Present Day Assumption | 2025 Assumption | 2030 Assumption |
|---|---|---|---|
| Market | U.S. | Same | Same |
| Zip Code | 00000 – U.S. Average used to determine grid emissions | U.S. Average - Use GREET forecasts for electrical grid emissions. | U.S. Average - Use GREET forecasts for electrical grid emissions. |
| Gasoline Price ($/Gallon) | Average price by agency calculated from the federal fleet open dataset | 7% increase in cost based on EIA projection | 27% increase in costs based on EIA projection |
| Diesel Price ($/Gallon) | Average Price by agency calculated from the federal fleet open dataset | 21% increase in cost based on EIA projection | 39% increase in cost based on EIA projection |
| Electricity Cost ($/kWh) | Average kWh price for federal buildings of $0.088; National Average kWh price for USPS fleet analysis $0.10; assume no public charging | 3% increase in cost based on EIA projection | 7% increase in cost based on EIA projection |
| Public Charging Price ($/kWh) | Assume None | Same | Same |

| | | | |
|---|---|---|---|
| On-Route Charging Price ($/kWh) | Assume None | Same | Same |
| Inflation Rate (Excluding Fuel) (%/Year) | 2% - Federal Reserve Medium-term target | Same | Same |
| Cost of Downtime from Public Charging ($/Hour) | N/A | Same | Same |
| Include Cost of Carbon? | Yes | Same | Same |
| Cost of Carbon ($/Ton) | $51 per ton from social cost of carbon schedule produced by the Biden Whitehouse | $56 per ton | $62 per ton |
| Vehicle Drivetrain Type | Varies | Same | Same |
| Vehicle Class | Varies | Same | Same |
| Vehicle Year | 2020 | Same | Same |
| Vehicle Make | **Light duty:**<br>For each vehicle type listed in the federal fleet open dataset, choose one available vehicle make/model listed by GSA as the representative vehicle for that type. When choosing models, preference given to Ford, GM, and Fiat-Chrysler in that order based on information received on the most common vehicle makes purchased by the federal government. Base models chosen were paired with an equivalent EV.<br>**Buses:**<br>The federal government divides buses into medium-duty shuttles and school buses. Based on proxy fleet data, vehicles defined as:<br>• 12-16 passenger shuttles<br>• 16-20 passenger shuttles<br>• 20-24 passenger shuttles<br>• 24+ passenger shuttles<br>• Type C school buses | | |
| Vehicle Model | | | |

| | | | |
|---|---|---|---|
| | • Type D school buses<br><br>Assumed type A buses are equivalent to 16-20 passenger shuttle buses. For all vehicles vehicle types were mapped to vehicles on offer from GSA, a representative model was chosen for each type, and the representative model was paired with an equivalent EV. | | |
| Fuel Economy Gasoline/Diesel/ Gas City (MPG) | **Light duty:** Fuel economy for representative models is taken from fueleconomy.gov.<br>**Buses:** Fuel economy data was taken from testing data performed by the Altoona bus testing center. | | |
| Fuel Economy Gasoline/Diesel/ Gas Highway (MPG) | | | |
| Fuel Economy Electric City (MPGe) | **Light duty:** Fuel economy for representative models is taken from fueleconomy.gov. For the F150<br>**Buses:** Fuel economy data was taken from testing data performed by the Altoona bus testing center | | |
| Fuel Economy Electric Hwy (MPGe) | | | |
| Expected Years of Use/Ownership (Years) | For each vehicle type, the greater of the standard GSA replacement schedule or average age of vehicles reported in the federal fleet open dataset was chosen. | | |
| Annual Vehicle Mileage (VMT/Year) | Average annual mileage per vehicle data is available in the federal fleet open dataset. Calculated percentage difference from the mean for one standard deviation and apply that percentage to the average mileage reported in the Federal Fleet Report. | | |
| % of Annual Miles on Gasoline/Diesel | N/A – only used for PHEVs which are not included in the analysis | Same | Same |
| % of Annual Miles City Driving | EPA drive cycle testing figures are used for light-, medium-, and heavy-duty vehicles | Same | Same |

| | | | |
|---|---|---|---|
| Cost to Insure ($/Year) | None | Same | Same |
| Use Drivetrain Default Maintenance and Repair Costs? | No | Same | Same |
| Maintenance and Repair Cost - Years 1 - 5 ($/Mile) | **Light duty:** Assume average lifetime maintenance costs for light-duty vehicles from Consumer Reports study **Buses:** NREL fleet studies for MD/HD maintenance costs | Same | Same |
| Maintenance and Repair Cost - Years 5+ ($/Mile) | | | |
| Recurring Taxes and Fees ($/Year) | None | Same | Same |
| Discount Rate for NPV Calculations (%) | 3% - OMB recommended figure for cost-benefit analysis of federal programs | Same | Same |
| Number of Vehicles to Procure (#) | 1 – analysis done on a vehicle-by-vehicle basis | Same | Same |
| Pricing Approach (select one) | MSRP less discounts | Same | Same |
| MSRP ($/Vehicle) | The GSA publishes base cost for a subset of vehicles and those will be used where applicable. Use the | Projected cost variations from U.S. Department of Energy Vehicle Technologies Office analysis | Same |

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|---|---|---|---|
| | base cost for each vehicle published by the GSA.<br>Where no base cost data is available; calculate the average discount off MSRP for vehicles where base cost data is available and apply that percentage to MSRP data from fueleconomy.gov or manually collected from research. | | |
| Value of Negotiated Discounts off MSRP ($/Vehicle) | None, discounts will be included in MSRP | Same | Same |
| Value of Federal Tax Incentives ($/Vehicle) | $0 | Same | Same |
| Value of State Tax Incentives ($/Vehicle) | $0 | Same | Same |
| State Tax Incentive Cap ($) | $0 | Same | Same |
| Value of Non-tax Incentives ($/Vehicle) | $0 | Same | Same |
| Initial Tax, Title, and Registration Cost ($/Vehicle) | $0 | Same | Same |
| Initial Fee as Percent of | $0 | Same | Same |

| | | | |
|---|---|---|---|
| Vehicle Base Price (%) | | | |
| Ownership Structure | Cash Purchase | Same | Same |
| Tax Credits Can Be Monetized? (Y/N) | N/A | Same | Same |
| Down Payment ($/Vehicle) | N/A | Same | Same |
| Lease Term (Years) | N/A | Same | Same |
| Lease Interest Rate (APR - %) | N/A | Same | Same |
| Money Factor (#) | N/A | Same | Same |
| Acquisition Fee ($/Vehicle) | N/A | Same | Same |
| Disposition Charge ($/Vehicle) | N/A | Same | Same |
| Negotiated Residual Value ($/Vehicle) | N/A | Same | Same |
| Mileage Included (Closed-End Only) | N/A | Same | Same |
| Excess Mileage Cost ($/Mile) | N/A | Same | Same |
| % Depot/Home Charging | N/A | Same | Same |
| % Public Charging | N/A | Same | Same |
| % On-Route Charging | N/A | Same | Same |

| | | | |
|---|---|---|---|
| Charging Level | N/A | Same | Same |
| Maximum Power for Public Charging Only (kW) | N/A | Same | Same |
| Procurement Includes EV Charging? | Yes | Same | Same |
| Number of EV Charging Stations Needed (#) | **Figures are provided as vehicle to charging port ratio**<br>**Light duty:**<br>Level 2 Charging:<br>• 1:1 vehicle-to-charger ratio<br>• 2:1 vehicle-to-charger ratio<br>• 3:1 vehicle-to-charger ratio<br>**Buses:**<br>Level 2 Charging:<br>• 1:1 vehicle-to-charger ratio<br>DCFC Charging:<br>• 1:1 24 kW charger<br>• 2:1 24 kW charger | | |
| Charging Equipment Cost ($/Station) | L2: $7,362 total installed cost reported by NREL at federal sites. DCFC: 24kW: $12,863 from GSA | 16% cost reduction in equipment cost based on 3% annual reduction in equipment costs based on ICCT research | 34% cost reduction in equipment cost based on 3% annual reduction in equipment costs based on ICCT research |
| Construction & Equipment Installation Cost ($/Station) | L2: $7,362 total installed cost total installed cost reported by NREL at federal sites. DCFC: 24kW: $17,692 from installed cost analysis | 16% cost reduction in equipment cost based on 3% annual reduction in equipment costs based on ICCT research | 34% cost reduction in equipment cost based on 3% annual reduction in equipment costs based on ICCT research |

| | |
|---|---|
| Electric Utility Upgrades and Grid Interconnection Cost ($/Site) | N/A |
| Maintenance Cost ($/Station/Year) | 3% of equipment cost |
| Ownership Structure | Cash Purchase |