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Electric Vehicle Preparedness

Implementation Approach for Electric Vehicles at Naval Air Station Whidbey Island: Task 4

Stephen Schey
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June 2015

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Implementation Approach for Adoption of Electric Vehicles at Naval Air Station Whidbey Island: Task 4

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ABSTRACT

Battelle Energy Alliance, LLC, managing and operating contractor for the U.S. Department of Energy's Idaho National Laboratory, is the lead laboratory for U.S. Department of Energy Advanced Vehicle Testing. Battelle Energy Alliance, LLC contracted with Intertek Testing Services, North America (Intertek) to conduct several U.S. Department of Defense base studies to identify potential U.S. Department of Defense transportation systems that are strong candidates for introduction or expansion of plug-in electric vehicles (PEVs). This study is focused on the Naval Air Station Whidbey Island (NASWI) located in Washington State.

Task 1 consisted of a survey of the non-tactical fleet of vehicles at NASWI to begin the review of vehicle mission assignments and types of vehicles in service. In Task 2, daily operational characteristics of vehicles were identified to select vehicles for further monitoring and attachment of data loggers. Task 3 recorded vehicle movements in order to characterize the vehicles' missions. The results of the data analysis and observations were provided. Individual observations of the selected vehicles provided the basis for recommendations related to PEV adoption, i.e., whether a battery electric vehicle (BEV) or plug-in hybrid electric vehicle (PHEV) (collectively PEVs) can fulfill the mission requirements. It also provided the basis for recommendations related to placement of PEV charging infrastructure.

This report focuses on an implementation plan for the near-term adoption of PEVs into the NASWI fleet.

Intertek acknowledges the support of Idaho National Laboratory, Naval Facilities Engineering Command (NAVFAC) Northwest, and Naval Air Station Whidbey Island fleet managers and personnel for participation in this study.

Intertek is pleased to provide this report and is encouraged by enthusiasm and support from NAVFAC personnel.

EXECUTIVE SUMMARY

Federal agencies are mandated[a] to purchase alternative-fuel vehicles, increase consumption of alternative fuels, and reduce petroleum consumption. Available plug-in electric vehicles (PEVs) provide an attractive option in the selection of alternative fuel vehicles. PEVs, which consist of both battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs), have significant advantages over internal combustion engine (ICE) vehicles in terms of energy efficiency, reduced petroleum consumption, reduced production of greenhouse gas (GHG) emissions, and they provide performance benefits with quieter, smoother operation. This study is intended to evaluate the extent to which Naval Air Station Whidbey Island (NASWI) could convert part or all of their fleet of vehicles from petroleum-fueled vehicles to PEVs.

More fuel-efficient ICE vehicles, including hybrid electric vehicles, exist that may provide improvements for the current fleet; however, this study's focus is on replacing ICE vehicles with suitable PEVs.

BEVs provide the greatest benefit when it comes to fuel and emissions savings because all the motive power is provided by the energy stored in the on-board battery pack. These vehicles use no petroleum and emit no pollutants at their point of use. PHEVs provide similar savings when their battery provides all or the majority of the motive power (depending on the PHEV design) but they also have the ability to extend their operating range with an onboard ICE. Since a PHEV can meet all transportation range needs, the adoption of a PHEV will be dependent upon its ability to meet other transportation needs such as cargo or passenger capability. Operation of PHEVs in the charge depleting mode where all or the majority of the motive power is provided by the battery can be increased with opportunity charging at available charging stations. It should be noted, however, that not all PHEVs have a mode in which the battery provides all of the motive power at all speeds. Previous work on this study focused on the non-tactical fleet of vehicles at NASWI, to identify a subset of 60 vehicles for data logging in an effort to identify vehicles that may be replaced with PEVs with emphasis on BEVs that provide maximum benefit. This report provides an approach for the near-term adoption of PEVs at NASWI.

NASWI is located on Whidbey Island on the Puget Sound in Washington State. Vehicles travel extensively to other nearby naval bases as well as locations in the greater Seattle area. NASWI identified 324 vehicles in its fleet of which 175 were identified to be a part of the analysis project. NASWI, NAVFAC, and Intertek selected 60 vehicles as representative of this fleet for participation in the detailed monitored study. The results of the data logging and analysis for these 60 vehicles and the extrapolation to the entire fleet were previously reported in the Task 3 report.

That Task 3 report observed that a mix of BEVs and PHEVs are capable of performing most of the required missions using BEVs for the short trips and PHEVs for the longer trips. It also observed that the replacement of vehicles in

[a] Energy Policy act of 1992, Energy Policy Act of 2005, Executive Order 13423, Energy Independence and Security Act of 2007.

the current fleet could result in significant reductions in the emission of GHGs and in petroleum use, as well as reductions in fleet operating costs. The other Task 3 report identified potential PEV charging locations should PEV replacement occur.

This report presents a replacement approach for the adoption of PEVs at NASWI. This approach provides a gradual introduction of PEVs into the NASWI operation and into the balance of the non-tactical fleet. The gradual approach provides a transitional period to allow greater experience in the operation, maintenance, and support for PEVs in their daily missions. The vehicles introduced by this approach provide for **51% of the fleet as PEVs** by 2030 assuming the size of the fleet remains as it was in 2015. The projected PEV adoption rate for sedans, non-sedans, and total fleet is presented in **Error! Reference source not found.**.

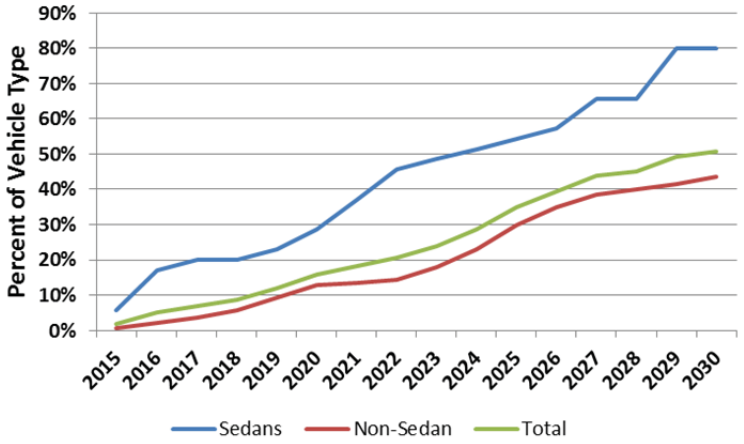

Figure ES- 1. Projected PEV adoption rate at NASWI.

NASWI will decide whether to adopt PEVs as provided by the General Services Administration (GSA) only, which now consists only of sedan type vehicles, or to justify the adoption of non-GSA-listed vehicles. While the greater emphasis and initial adoption is for GSA-listed vehicles, both approaches are presented in this report.

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ACRONYMS

AC	Alternating current
BEA	Battelle Energy Alliance, LLC
BEV	battery electric vehicle
CD	Charge depleting
CS	Charge sustaining
DC	Direct current
EPA	U.S. Environmental Protection Agency
EVSE	electric vehicle supply equipment
GHG	greenhouse gas emissions
GSA	General Services Administration
ICE	internal combustion engine
INL	Idaho National Laboratory
Intertek	Intertek Testing Services, North America
LSV	Low-speed vehicle
NASWI	Naval Air Station Whidbey Island
OEM	original equipment manufacturer
PEV	plug-in electric vehicle (includes BEVs and PHEVs, but not hybrid electric vehicles)
PHEV	plug-in hybrid electric vehicle
SOC	state of charge
SUV	sports utility vehicle

Implementation Approach for Plug-in Electric Vehicles at Naval Air Station Whidbey Island: Task 4

1. INTRODUCTION

The U.S. Department of Energy and the U.S. Department of Defense signed a memorandum of understanding on July 22, 2010 for strengthening the coordination of efforts to enhance national energy security and to demonstrate federal government leadership in transitioning the U.S. to a low-carbon economy. The memorandum of understanding included efforts in the areas of energy efficiency, fossil fuels, alternative fuels, efficient transportation technologies and fueling infrastructure, grid security, smart grid, and energy storage.

In support of the memorandum of understanding, the Idaho National Laboratory (INL), with funding provided by the U.S. Department of Energy's Vehicle Technologies Office and Federal Energy Management Program, directed Intertek Testing Services, North America (Intertek) to conduct several U.S. Department of Defense base studies to identify potential transportation systems that are strong candidates for introduction or expansion of plug-in electric vehicles (PEVs). Intertek previously has conducted similar fleet, city, state, and countrywide studies using their Micro-Climate assessment process, which consists of the following four main tasks:

- Task 1: Conduct a non-tactical fleet and infrastructure assessment
- Task 2: Select vehicles for mission and fleet characterizations
- Task 3: Perform detailed assessment of selected vehicles and charging infrastructure needs
- Task 4: Prepare adoption approach for PEV and charging infrastructure

Assessment of the potential for replacing Naval Air Station Whidbey Island (NASWI) fleet vehicles with PEVs starts with an assessment of the fleet vehicles' missions and vehicle characteristics. This assessment was conducted through correspondence with fleet managers and records analysis. The Task 1 report, titled, *Assessment of Data and Survey Results for Naval Air Station Whidbey Island*, dated January 2015, provided a summary and fleet assessment.

PEVs generally are classified into two vehicle types: battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs). A BEV contains an onboard battery that provides all motive power. PHEVs also have an onboard battery that provides some motive power but there is also another motive power source (such as a gasoline engine). PHEVs have, in general, two modes: (1) Charge-depleting (CD) mode in which the battery provides all or most (depending on the PHEV design) of the motive power and the battery is being depleted, and (2) Charge-sustaining (CS) mode in which the non-battery power source provides the majority of the motive power while being supplemented by the battery power while the battery state of charge (SOC) is maintained within a designed range. A BEV can be considered to operate solely in a CD mode. Collectively, BEVs and PHEVs are PEVs.

The Task 1 report documented the identification of fleet vehicles that appeared to be good candidates for replacement by PEVs. The Task 2 report, titled, *Identification of Naval Air Station Whidbey Island Vehicles for Installation of Data Loggers*, dated March 2015, identified the 60 vehicles within the candidate groups for further monitoring and analysis through addition of vehicle data loggers. The data loggers were installed and data collected on the selected vehicles. The Task 3 report, titled, *Utilization Assessment of Target Electrification Vehicles at Naval Air Station Whidbey Island*, dated May 2015, provided a summary and details of the data collection for the monitored vehicles and extrapolated that to the entire non-tactical fleet of vehicles at NASWI. The other Task 3 report, titled, *Assessment of Charging Infrastructure for Plug-in Electric Vehicles at Naval Air Station Whidbey Island*, dated May 2015,

provided the related charging infrastructure assessment. This report provides an implementation approach for adoption of PEVs at NASWI in the next few years.

2. NON-TACTICAL VEHICLES

2.1 Fleet Vehicle Survey

NAVFAC Northwest and NASWI reported 175 vehicles in its non-tactical fleet, not counting specialty vehicles, low-speed vehicles (LSVs), and heavy-duty trucks. The Task 1 report identified the 25 tenant commands (Commands) and Naval Air Station departments and divisions (Departments) to which the vehicles are assigned. Table 1 provides a summary of the vehicle types by class and group. Note that the inventory list does not always allow specific differentiation between cargo or passenger vans since the same body frame may be used for each. Consequently, some assumptions are made on type.

Table 1. NASWI non-tactical fleet summary.

	Sedan - Compact	Sedan - Midsize	Sedan- Large	Minivan	SUV	Van Cargo	Van Pass	Pickup	Total
Commands	2	4	1	7	2	31	5	17	69
Departments	4	15	9	4	11	24	14	25	106
Total	6	19	10	11	13	55	19	42	175

Figure 1 shows vehicle type distribution for all vehicles for comparison.

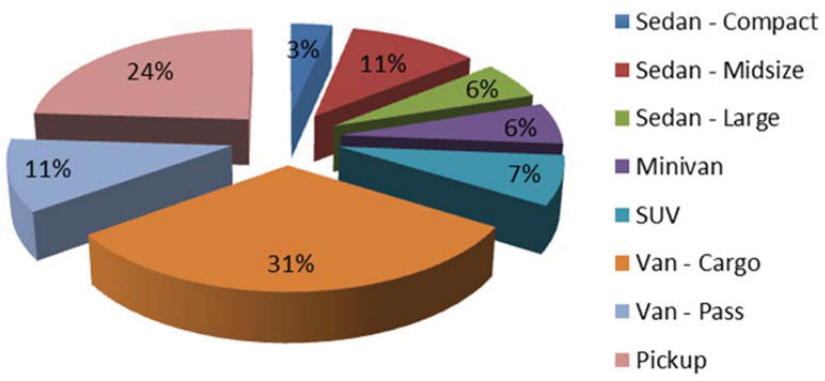

Figure 1. Vehicle type distribution for all non-tactical vehicles.

NASWI identified 60 vehicles for further study, as described in the Task 2 report. Table 2 categorizes the monitored vehicles. This distribution is approximately representative of the entire non-tactical fleet.

Table 2. NASWI monitored vehicles by group.

	Sedan - Compact	Sedan - Midsize	Sedan- Large	Minivan	SUV	Van Cargo	Van Pass	Pickup	Total
Commands	-	4	-	6	1	1	1	5	18
Departments	2	8	3	3	3	1	9	13	42
Total	2	12	3	9	4	2	10	18	60

The fleet vehicles are used for a variety of purposes by several different divisions on base. Section 2.2 provides detail on these purposes, or missions. The category of mission can be helpful in the identification of PEVs as potential replacements.

The initial survey also identified the fuel used by the fleet vehicles. In particular, cars and light trucks are powered predominantly by gasoline. These vehicle types make up the majority of the fleet and are the most likely candidates for replacement by electric vehicles because auto manufacturers have focused on providing electric vehicles of this size to date. Diesel-powered vehicles also make up a sizeable fraction of the fleet; diesel is the predominant fuel used in larger vehicles. In particular, medium trucks are likely candidates for replacement by EVs because manufacturers plan to provide more vehicles of this size in the coming years. Figure 2 illustrates the fuel types in use at NASWI.

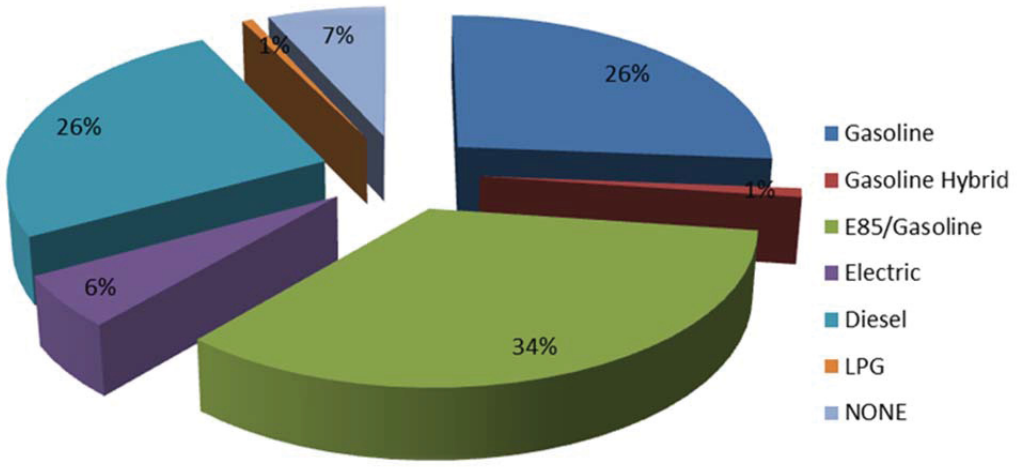

Figure 2. Fuel-type distribution for all vehicles.

The "None" fuel type is identified for the non-powered vehicles and the "Electric" fuel type are all LSVs. The two LPG-powered vehicles are forklifts.

2.2 Vehicle Missions

The vehicle mission is an important characteristic in the fleet study. Intertek has established the following seven mission/vehicle categories for analysis. The categories are listed below and examples are depicted in Figure 3.

1. **Pool vehicles**: A pool vehicle is any automobile (other than the LSVs identified below) manufactured primarily for use in passenger transportation, with not more than 10 passengers.
2. **Enforcement vehicles**: Vehicles specifically approved in an agency's appropriation act for use in apprehension, surveillance, police, or other law enforcement work. This category also includes site security vehicles, parking enforcement, and general use, but the vehicles are capable of requirements to support enforcement activities.
3. **Support vehicles**: Vehicles assigned to a specific work function or group to support the mission of that group. Vehicles are generally passenger vehicles or light-duty pickup trucks and may contain after-market modifications to support the mission.

2. **Transport vehicles**: Light-, medium-, or heavy-duty trucks used to transport an operator and tools or equipment of a non-specific design or nature. The vehicle's possible uses include repair, maintenance, and delivery.
3. **Specialty vehicles**: Vehicles designed to accommodate a specific purpose or mission (such as ambulances, mobile cranes, and handicap controls).
4. **Shuttles/buses**: Vehicles designed to carry more than 12 passengers and further outlined in 49 CFR 532.2.
5. **LSV:** Vehicles that are legally limited to roads with posted speed limits up to 35 or 45 mph (depending on state law) and that have a limited load-carrying capability.

Figure 3. Vehicle missions.

Vehicle mission assignments can be useful in identifying the type of potential replacement PEV as shown in Section 3.

2.3 General Services Administration Vehicle Replacement Requirements

Table 3 presents the replacement requirements for fleet vehicles. Note that both the age and mileage requirements need to be met in order for the vehicle to qualify for replacement, except where noted as "or".

Table 3. GSA vehicle replacement requirements.

GSA Vehicle Replacement Requirements[2]			
	Fuel Type	Years	Miles
Passenger vehicles	Gasoline or alternative fuel vehicle	3 4 5 Any age	36,000 24,000 Any mileage 75,000

[2] http://www.gsa.gov/graphics/fas/VehicleReplacementStandardsJune2011Redux.pdf [accessed March 12, 2015].

GSA Vehicle Replacement Requirements[2]			
	Fuel Type	Years	Miles
	Hybrid	5	Any mileage
	Low-speed BEV	6	Any mileage
Light trucks 4 x 2	Non-diesel	7 or	65,000
	Diesel	8 or	150,000
	Hybrid	7	Any mileage
Light trucks 4 x 4	Non-diesel	7 or	60,000
	Diesel	8 or	150,000
	Hybrid	7	Any mileage
Medium trucks	Non-diesel	10 or	100,000
	Diesel	10 or	150,000
Heavy Trucks	Non-diesel	12 or	100,000
	Diesel	12 or	250,000

2.4 Plug-In Electric Vehicle Availability

The adoption of PHEVs and BEVs is a primary goal of the GSA and supports many directives in this area. As GSA increases its certification of PHEVs and BEVs, agencies can plan for vehicle replacement through GSA for passenger vehicles and trucks. GSA provides a summary of light- and medium-duty passenger vehicles available for lease or purchase through the GSA portal[3], although not all BEVs and PHEVs currently on the market are 'certified' to be GSA replacements. Vehicles not on the GSA list of 'certified' vehicles require an agency to self-certify a functional need or alternative measures for exemptions. Tables 4 and 5 summarize the vehicles that may be suitable replacements and are certified replacements through GSA. Note that the "CD/CS" column provides the U.S. Environmental Protection Agency (EPA) fuel economy values for CD and CS modes of the PHEVs, while the city and highway fuel economy values are provided for BEVs. The fuel economy of the PHEV CD mode and BEVs is provided in units of miles-per-gallon-of-gasoline-equivalent (MPGe). This metric allows the electricity consumption to be compared with fuel consumption during CS mode (or against conventional vehicles). The Nissan Leaf and Mitsubishi i-MiEV are not included in the alternative fuel guide for 2014, but they have appeared in previous guides. For NASWI, the replacement is dependent on vehicle configuration characteristics and its ability to meet the vehicle's mission.

Original equipment manufacturers (OEM) provide information related to a vehicle's range in CD mode and EPA provides test results. However, actual results may vary depending upon several factors other than travel that may also deplete a vehicle's battery. Such factors include changes in the battery's capacity over time, area topography, weather conditions (e.g. cabin cooling/heating), payload, etc. This report will identify a BEV's "safe range" as 70 miles as this is typically less than the advertised range of most BEV OEMs and a PHEV's safe range in CD mode as 40 miles.

Tables 4 through 9 provide summaries of PHEVs and BEVs either currently available or near commercialization in both passenger cars and pickup trucks, but do not appear on the GSA 'certified' vehicle list. These vehicles may qualify for use by the agency through demonstrating a functional need.

[3] http://www.gsa.gov/portal/content/104211 [accessed August 1, 2014]

Table 4. GSA-certified PHEVs for 2014.

Make/Model	GSA Class	Type	CD/CS	GSA Incremental Price
Chevrolet Volt	Sedan, Subcompact	PHEV	98 MPGe/37 mpg	$17,087.18
Ford C-MAX Energi	Sedan, Subcompact	PHEV	88 MPGe/38 mpg	$14,899.52
Ford Fusion Energi	Sedan, Compact	PHEV	88 MPGe/38 mpg	$19,289.99

Table 5. GSA-certified BEVs for 2014.

Make/Model	GSA Class	Type	City/Highway	GSA Incremental Price
Ford Focus Electric	Sedan, Subcompact	BEV	110/99 MPGe	$16,573.09

Note that EPA differs from GSA in vehicle class designation. EPA identifies the Volt as a compact, the C-MAX Energi as a midsize, the Fusion Energi as a midsize, and the Focus as a compact.[4]

Table 6. OEM PHEV cars and availability.

Make	EPA Class	Model	Model Year/Estimated Year for Commercialization
Chevrolet	Compact	Volt	2011
Ford	Midsize	C-MAX Energi	2013
Ford	Midsize	Fusion Energi	2013
Toyota	Midsize	Prius PHEV	2012
Honda	Midsize	Accord PHEV	2014
BMW	Subcompact	i3 REx	2014
BMW	Subcompact	i8	2014
Audi	Compact	A3 eTron PHEV	2015 (estimate)
Volvo	SUV	V60 Plug-in	2016 (estimate)

Table 7. OEM BEV cars and availability.

Make	EPA Class	Model	Model Year/Estimated Year for Commercialization
Nissan	Midsize	Leaf	2011
Ford	Compact	Focus Electric	2012
Tesla	Large	Model S	2012
Fiat	Mini	500e	2013
Honda	Small Station Wagon	Fit EV	2013
BMW	Subcompact	i3	2014
Chevrolet	Subcompact	Spark EV	2014
smart	Two Seater	ED	2014
Kia	Small Station Wagon	Soul EV	2014

[4] http://www.fueleconomy.gov/feg/Find.do?action=sbs&id=34130 [accessed August 1, 2014]

Make	EPA Class	Model	Model Year/Estimated Year for Commercialization
Volkswagen	Compact	Golf e-Golf	2015
Mercedes-Benz	Midsize	B-Class ED	2015 (estimate)
Volvo	Compact	C30 Electric	2016 (estimate)

Table 8. OEM PHEV trucks, vans, and availability.

Make	EPA Class	Model	Model Year/Estimated Year for Commercialization
Via	Standard Pickup Truck	VTRUX VR300	2013
Via	Special Purpose Vehicle	VTRUX Cargo Van	2013
Via	Vans, Cargo Type	VTRUX Pass Van	2013
Mitsubishi	Small SUV	Outlander PHEV	2015 (estimate)
Land Rover	Standard SUV	C30 Electric	2016 (estimate)

Table 9. OEM BEV trucks, vans, and availability.

Make	EPA Class	Model	Model Year/Estimated Year for Commercialization
Toyota	SUV	RAV4 EV	2013 (California only-nationwide release date unknown)
Tesla	Standard SUV	Model X	2015 (estimate)
Land Rover	Standard SUV	C30 Electric	2016 (estimate)

As further indication of the expanding market for PEVs, companies are offering after-market vehicle upgrades involving the addition of plug-in capabilities to OEM vehicles. For example, Echo Automotive headquartered in Scottsdale, Arizona offers a "…low-cost, bolt-on, plug-in hybrid system that can quickly be installed on new or existing fleet vehicles to increase fuel efficiency and decrease operating costs – all without affecting the OEM power train or requiring costly infrastructure."[5] EVAOS conducts upgrades of Ford F-series pickup trucks to PHEV models and has delivered vehicles to the US Air Force[6]. Options such as these conversions might be of benefit for vehicles in the NASWI fleet but for which no replacement PEV is currently available.

2.5 Plug-In Electric Vehicle Charging

Refueling electric vehicles presents some challenges and some opportunities not encountered when refueling petroleum-fueled vehicles. Recharging the battery of a PHEV follows the same methodology as that for BEVs. The Task 3 infrastructure report provides detailed information on recharging PEVs.

[5] http://www.echoautomotive.com/index.php?option=com_content&view=article&id=8 [accessed July 14, 2014]

[6] http://www.evaos.com [accessed November 20, 2014]

Most PEV manufacturers supply an AC Level 1 cordset with the vehicle, which provides sufficient capabilities for some drivers, but more typically provides an emergency backup capability because of the long recharge times. AC recharging capabilities found in the public arena more typically are AC Level 2.

Because the battery of a BEV is typically much larger than that of a PHEV, recharge times are longer. BEVs that see daily mileage near the limits of the advertised range do better when recharged using AC Level 2 EVSE or DC fast charging, because AC Level 1 recharge times are usually extensive. PHEVs, on the other hand, generally can use AC Level 1 EVSE for overnight charging to ensure a fully charged battery at the start of daily use. AC Level 2 EVSE units provide greater range in the shortest amount of time when intermediate or opportunity charging. DC fast charging provides the fastest recharge capability for those vehicles equipped with DC fast charge inlets; however, there are currently no PHEVs with DC fast charging capability available and no announced plans for one to be introduced. It is important to note that the Task 3 reports show that the PEVs studied do not need to rely on DC fast charging to complete their missions.

3. VEHICLE MISSION REPLACEMENT GUIDANCE

3.1 Background and Methods

Section 2.2 identified the mission categories for analysis. The Task 3 report provided specific information for the monitored fleet based upon vehicle mission. When suitable PEV types are available to replace the ICE vehicles in the current fleet, the specific mission of the vehicle to be replaced can be a guide in determining whether a BEV or PHEV should be selected. As previously noted, the greater fuel cost savings and GHG reductions occur with BEVs than PHEVs, which suggests a greater emphasis on BEVs. For NASWI, the missions monitored included pool, support, and enforcement.

Aside from specific mission functions, the distance a PEV can travel in CD mode between charge opportunities is the most important factor in considering vehicle replacement. The two most significant considerations in vehicle analysis then include the vehicle daily travel and vehicle outings.

3.2 Pool Mission Guidance

Nine of the vehicles monitored at NASWI were assigned a pool mission. These vehicles included compact and mid-size sedans, an SUV, minivans, pickup trucks, passenger vans, and cargo vans. The overall summary for these vehicles is shown in Table 10. These vehicles traveled 9,525 miles, logged 247 hours, and idled for 21 hours.

Table 10. NASWI pool vehicle travel summary.

Pool Vehicles Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	80.8/396.6	92.5/1008.4	16.8/162.1	9,525
Travel Time (Minutes)	125.4/486.0	143.7/1202.0	26.2/237.0	14,802
Idle Time (Minutes)	10.6/NA	12.2/NA	2.2/NA	1,255

Figure 4 shows the daily travel and outing travel for the group of pool vehicles.

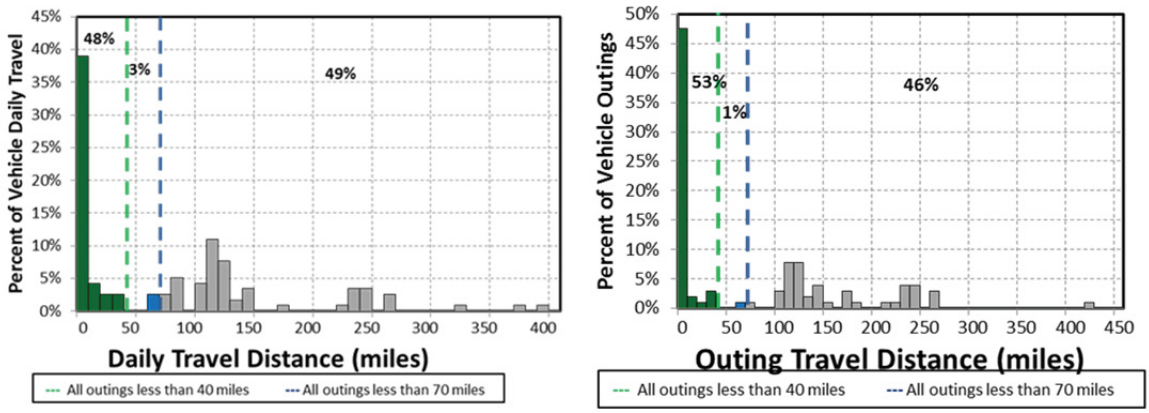

Figure 4. NASWI pool vehicle daily and outing travel.

The highest outing distance of 1008 miles is not displayed on the above graph for clarity of scale. The BEV safe range is considered 70 miles (blue and green bars in Figure 4). That is, while BEV range can vary based on several factors; most BEVs provide at least 70 miles of vehicle range on a single battery charge.

The average travel distance per day when driven for pool vehicles is 80.8 miles. On 51% of the vehicle travel days, the daily travel is less than the 70 miles considered to be within the BEV safe range. Meanwhile, 48% of vehicle travel days are less than 40 miles considered to be within the CD range of a PHEV (green bars of Figure 4).

The average outing distance driven by pool vehicles is 92.5 miles. 54% of the outing travel is less than the 70 miles considered to be within the BEV safe range (blue and green bars in Figure 4). Meanwhile, 53% of vehicle outings are less than 40 miles considered to be within the CD range of a PHEV (green bars of Figure 4).

In general then, if a suitable PEV body style meets vehicle requirements, 51% of a pool fleet could be BEVs and 49% PHEVs to allow for daily travel greater than the range of the BEV. The fleet manager would likely desire a more conservative approach to allow for flexibility, but this shows the high capability of BEVs to meet this pool mission at NASWI.

3.3 Support Mission Guidance

Forty-four of the vehicles monitored at NASWI provided a support mission. These vehicles included compact, medium, and large sedans, SUVs, minivans, pickup trucks, and passenger and cargo vans. The overall summary for these vehicles is shown in Table 11. These vehicles traveled 16,766 miles, logged 1021 hours, and idled for 256 hours.

Table 11. NASWI support vehicle travel summary.

Support Vehicles Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	16.6/379.7	5.6/1008.4	2.6/228.1	16,766
Travel Time (Minutes)	60.5/458.0	20.6/1043.0	9.6/264.0	61,279
Idle Time (Minutes)	15.2/NA	5.2/NA	2.4/NA	15,390

Figure 5 shows the daily travel and outing travel for the group of support vehicles.

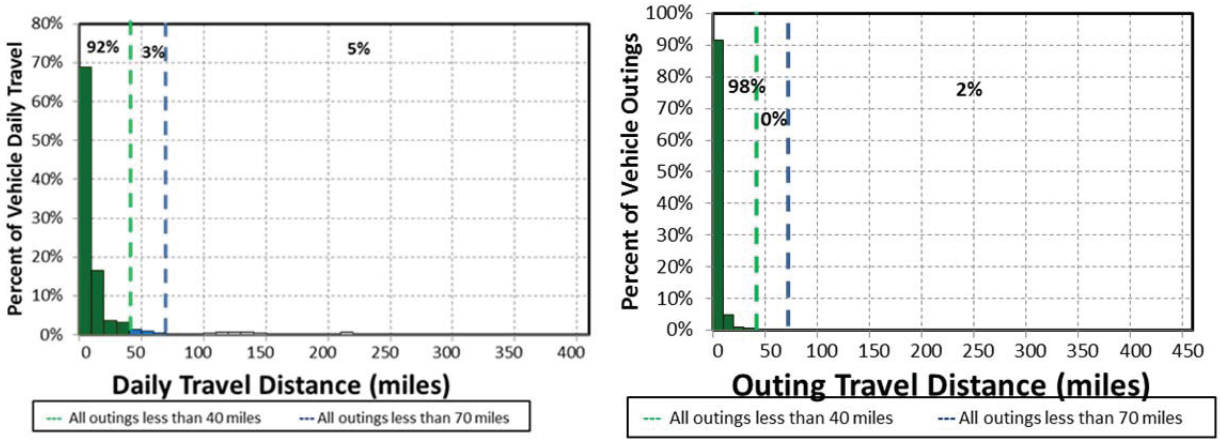

Figure 5. NASWI support vehicle daily and outage distance.

The outing graph does not show the highest outings of 601, 713, and 1008 miles for clarity of scale. The scale of the graphs also do not show well the single trips or outings above 70 miles, which individually provide 0% of the outings but collectively, account for 5% or 2% respectively.

The average travel distance per day when driven for support vehicles is 5.6 miles. On 98% of the vehicle travel days, the daily travel is less than the 70 miles considered to be within the BEV safe range (blue and green bars in Figure 5). In addition, 98% of vehicle travel days are less than 40 miles considered to be within the CD range of a PHEV (green bars of Figure 5).

In general then, if a suitable PEV body style meets vehicle requirements, 98% of a support fleet could be BEVs and 5% PHEV to allow for daily travel greater than the range of the BEV. The fleet manager would likely desire a more conservative approach to allow for flexibility, but this shows the high capability of BEVs to meet this support mission at NASWI.

3.4 Enforcement Mission Guidance

Enforcement vehicles are typically light-duty motor vehicles specifically approved in an agency's appropriation act for use in apprehension, surveillance, police, or other law enforcement work. Enforcement missions can vary by agency, location, and jurisdiction; however, they typically utilize sedans, minivans, vans, or small pickup trucks and typically do not carry specific cargo or equipment with the exception of K-9 units. Seven of the vehicles monitored at NASWI provided the enforcement mission. These vehicles included large sedans, SUVs, a cargo van, and a pickup truck. The overall summary for these vehicles is shown in Table 12. These vehicles traveled 15,219 miles, logged 1,322 hours, and idled for 526 hours.

Table 12. NASWI enforcement vehicle travel summary.

Enforcement Vehicles Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	60.2/294.5	16.5/232.5	4.9/86.7	15,219
Travel Time (Minutes)	313.5/1232.0	86.0/1072.0	25.5/555.0	79,315
Idle Time (Minutes)	124.8/NA	34.2/NA	10.2/NA	31,570

Figure 6 shows the daily travel and outing travel for the group of enforcement vehicles.

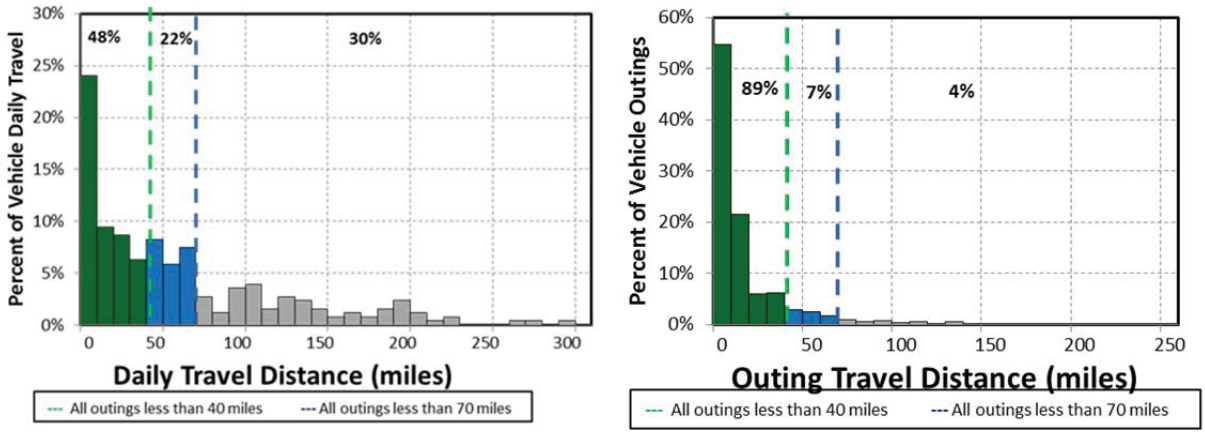

Figure 6. NASWI enforcement vehicle daily and outing travel.

The average travel distance per day when driven for enforcement vehicles is 16.5 miles. On 70% of the vehicle travel days, the daily travel is less than the 70 miles considered to be within the BEV safe range (blue and green bars in Figure 6). Meanwhile, 48% of vehicle travel days are less than 40 miles considered to be within the CD range of a PHEV (green bars of Figure 6).

The average outing distance driven by support vehicles is 16.5 miles. 96% of the outing travel is less than the 70 miles considered to be within the BEV safe range (blue and green bars in Figure 6). Meanwhile, 89% of vehicle outings are less than 40 miles considered to be within the CD range of a PHEV (green bars of Figure 6).

In general then, if a suitable PEV body style meets vehicle requirements, 70% of an enforcement fleet could be BEVs and 30% PHEV to allow for daily travel greater than the range of the BEV. However, enforcement fleet managers typically will desire vehicles without range limitations and thus, would favor a higher percentage of PHEVs. The specific duties of some enforcement vehicles, such as parking enforcement, could be accomplished by BEVs. Although more PHEVs might be desired, this analysis shows the high capability of BEVs to meet this enforcement mission at NASWI.

3.5 Transport Mission Guidance

Transport vehicles are typically used to carry specific cargo and/or equipment. Although no transport vehicles were monitored at NASWI, the Task 3 report suggested the 13 transport vehicles could be replaced by eight BEVs and five PHEVs or 62% BEV and 38% PHEVs.

4. NAVAL AIR STATION WHIDBEY ISLAND REPLACEMENT APPROACH

Sixty vehicles were included in the study at NASWI belonging to Commands and Departments. The specific requirements of each necessitated that these data be analyzed for each individual fleet. The results were then extrapolated to the entire non-tactical fleet at NASWI.

Tables 4 and 5 identified that at the time of this report, GSA has certified four vehicles for replacement as PEVs: three PHEVs and one PEV. Consequently, the group of potential replacements involves only sedans – a rather small subset of fleet vehicles and only **11%** of the vehicles at NASWI.

Tables 6-9 identified other vehicles that are currently or soon to be available but not listed by GSA. These vehicles provide potential replacements for all non-tactical fleet vehicles except heavy-duty trucks, buses, and specialty vehicles. While the PEV market has introduced and delivered several specialty vehicles on heavy-duty truck frames (e.g. bucket trucks) and electric buses to several customers, their charging needs are typically specialized as well and not included in this report. If all the PEVs in the tables are included for replacement consideration, the potential includes **all** (175) of the vehicles at NASWI, except heavy-duty trucks, non-powered vehicles, material handling equipment, and specialty vehicles.

After-market vehicle modifications are also available for converting ICE vehicles to PHEVs and may be considered by NASWI for vehicles types not currently available.

Appendices A and B provide the details of each monitored vehicle as reported in the Task 3 report. The replacement approach for each of the groups and the balance of NASWI vehicles are presented in Appendices C and D.

There are four approaches identified for each group:

- Monitored Vehicles
    - GSA-Listed PEVs only
    - All potential PEV types
- Balance of the Full Fleet
    - GSA-Listed PEVs only
    - All potential PEV types

The extensive analysis conducted for monitored vehicles (Task 3) results in high confidence that the suggested vehicle can meet mission requirements. The suggested vehicles for the full fleet rely on the extrapolation of those monitored vehicles and the guidance identified in Section 3 above.

The overall plan is presented first in this section followed by the effects to each of the fleet groups.

4.1 Naval Air Station Whidbey Island Summary Replacement Approach

Table 1 identified the types of vehicles by fleet group at NASWI at the time of the analysis. Supporting the incorporation of PEVs into this fleet is the objective of this task. The full fleet inventory was analyzed in 2015 and replacement vehicles are projected for 2015 and following years. Table 13 provides the full fleet replacement projections based upon GSA replacement criteria. Many of the NASWI vehicles have exceeded the minimal replacement criteria and this is expected to continue in the coming years in these projections. Note that heavy-duty trucks, specialty vehicles, and buses are excluded from this list.

Table 13. Projected fleet vehicle replacements at NASWI

Year	Sedan - Compact	Sedan - Midsize	Sedan- Large	Minivan	SUV	Cargo Van	Pass. Van	Pickup	Total
2015	-	-	3	-	6	4	-	8	21
2016	1	5	-	1	-	1	-	-	8

2017	-	2	-	1	1	2	-	-	6
2018	-	-	-	-	-	2	2	-	4
2019	1	-	-	-	1	2	2	1	7
2020	1	1	-	1	1	2	3	1	10
2021	1	2	-	2	2	1	2	-	10
2022	1	3	-	-	1	2	-	-	7
2023	1	-	-	-	-	1	-	5	7
2024	-	1	-	-	-	1	4	4	10
2025	-	-	1	3	-	8	-	12	24
2026	-	1	1	1	-	8	-	5	16
2027	-	4	-	-	1	6	2	4	17
2028	-	-	-	-	-	9	2	-	11
2029	-	-	5	2	-	-	-	1	8
2030	-	-	-	-	-	6	2	1	9
Total	6	19	10	11	13	55	19	42	175

The projected approach to PEV introduction is to replace selected ICE vehicles with PEVs as they would normally be replaced. The replacement approach presents a structured and gradual introduction of PEVs into the NASWI fleet. This approach is based upon an increasing percentage of PEVs as replacements are considered over the next sixteen years. While there are no PEVs currently in the NASWI fleet, this approach allows for the growth in experience in management, support, and maintenance of the PEV fleet.

The projected introduction of PEVs into the fleet presented in Table 14 is based upon an initial focus on sedans because they are the easiest to incorporate into the various missions and because these are the only types currently listed on the GSA schedule. Some of the remaining vehicle types are included to gain initial experience with the vehicle types although not listed on the GSA schedule. GSA may in fact list some of these vehicles in the next few years.

Table 14. Projected approach for the introduction of PEVs into the NASWI fleet

Year	Sedan - Compact	Sedan - Midsize	Sedan- Large	Minivan	SUV	Cargo Van	Pass. Van	Pickup	Total	Percent of all Replacements
2015	-	-	2	-	1	-	-	-	3	14%
2016	-	4	-	1	-	1	-	-	6	75%
2017	-	1	-	1	1	-	-	-	3	50%
2018	-	-	-	-	-	2	1	-	3	75%
2019	1	-	-	-	1	1	2	1	6	86%
2020	1	1	-	1	1	-	2	1	7	70%
2021	1	2	-	1	-	-	-	-	4	40%
2022	-	3	-	-	-	1	-	-	4	57%
2023	1	-	-	-	-	1	-	4	6	86%
2024	-	1	-	-	-	-	4	3	8	80%
2025	-	-	1	2	-	1	-	7	11	46%
2026	-	1	-	1	-	3	-	3	8	50%
2027	-	3	-	-	1	-	2	2	8	47%
2028	-	-	-	-	-	-	2	-	2	18%

2029	-	-	5	2	-	-	-	-	7	88%
2030	-	-	-	-	-	-	2	1	3	33%
Total	4	16	8	9	5	10	15	22	89	

The vehicles introduced by this schedule would result in **51% of the fleet as PEVs** in 2030 assuming the size of the fleet remains as it was in 2015. This introduction is illustrated in Figure 7. Certainly, NASWI can include PEVs at a greater rate if desired.

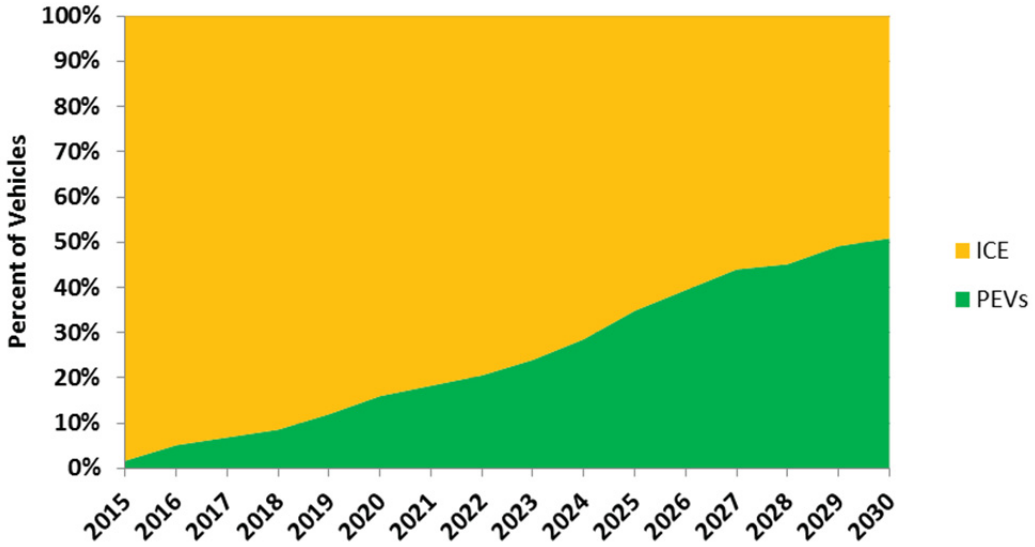

Figure 7. Projected PEVs in NASWI fleet.

When considering the replacement of vehicles with PEVs, NASWI fleet managers may note the vehicle mission guidance of Section 3. It would be most desirable to select a BEV if the body type and capabilities meet the vehicle's mission in order to gain the most benefit in fuel cost and GHG emission reduction. In most cases, the greatest component of a particular fleet can be BEVs. The analysis in Task 3 shows the average vehicle travels less than 5,090 miles per year. This is an average of 424 miles per month or just under 100 miles per week. This also reflects the opportunity to increase the percentage of BEVs over PHEVs in each fleet.

4.1.1 Replacement Approach for Sedans

Table 15 presents a planned approach for the replacement of sedans with PEVs; this is the sedan portion of Table 14. At the end of the sixteen-year period with this approach, **80% of fleet sedans will be PEVs** with 36% BEVs and 64% PHEVs.

Table 15. Planned approach for the introduction of PEV sedans at NASWI

Year	ICE	PHEV	BEV	Total PEVs	Vehicles Replaced	Percentage PEV/Year	Cumulative Percent PEV
2015	1	2	-	2	3	67%	67%
2016	2	4	-	4	6	67%	67%
2017	1	1	-	1	2	50%	64%
2018	-	-	-	-	-	-	64%
2019	-	1	-	1	1	100%	67%
2020	-	2	-	2	2	100%	71%

2021	-	1	2	3	3	100%	76%
2022	1	3	-	3	4	75%	76%
2023	-	-	1	1	1	100%	77%
2024	-	1	-	1	1	100%	78%
2025	-	1	-	1	1	100%	79%
2026	1	-	1	1	2	100%	77%
2027	1	1	2	3	4	75%	77%
2028	-	-	-	-	-	-	77%
2029	-	1	4	5	5	100%	80%
2030	-	-	-	-	-	-	80%
Total	7	18	10	28	35		

Assuming the total fleet inventory remains at 35 sedans, this replacement approach results in the fleet composition shown in Figure 8 for the years 2015 through 2030.

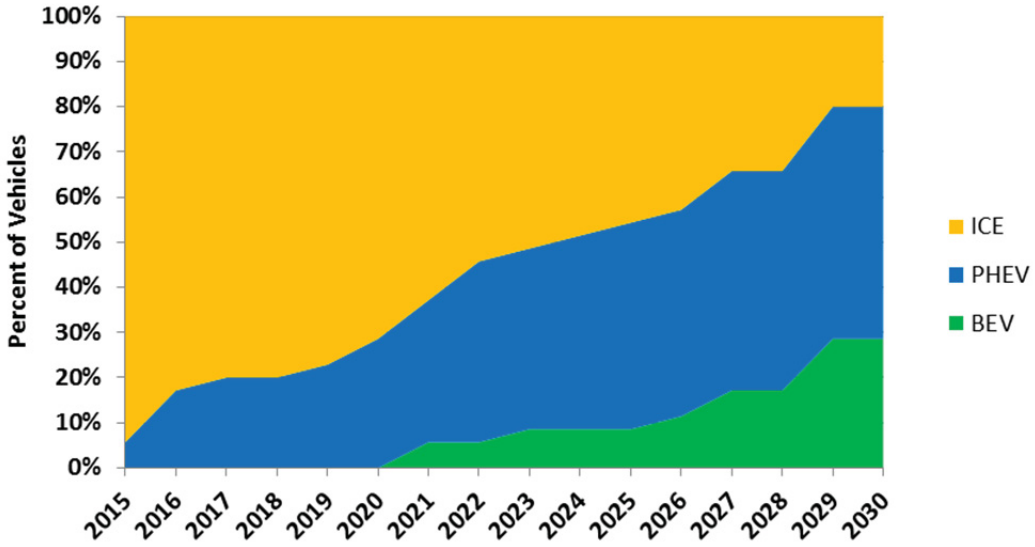

Figure 8. PEV introduction of fleet sedan types 2015 – 2030.

See Appendices A and B for a list of suggested replacement PEV sedans.

4.1.2 Replacement Approach for Non-Sedan Vehicles

As noted above, the non-sedan portion of the NASWI fleet is presented separately because there are no current GSA-listed vehicles as potential replacements. These are included in the suggested replacement approach to allow NASWI to gain initial experience with the vehicle types. GSA may in fact list some of these vehicles in the next few years. The non-sedan portion of Table 14 is shown in Table 16 below.

Table 16. Planned approach for the introduction of non-sedan PEVs at NASWI.

Year	Minivan	SUV	Cargo Van	Pass. Van	Pickup	Total	Percentage PEV/Year
2015	-	1	-	-	-	1	6%

2016	1	-	1	-	-	2	100%
2017	1	1	-	-	-	2	50%
2018	-	-	2	1	-	3	75%
2019	-	1	1	2	1	5	83%
2020	1	1	-	2	1	5	63%
2021	1	-	-	-	-	1	14%
2022	-	-	1	-	-	1	33%
2023	-	-	1	-	4	5	83%
2025	-	-	-	4	3	7	78%
2026	2	-	1	-	7	10	43%
2027	1	-	3	-	3	7	50%
2028	-	1	-	2	2	5	38%
2029	-	-	-	2	-	2	18%
2030	2	-	-	-	-	2	67%
Total	-	-	-	2	1	3	
Percent	9	5	10	15	22	61	

At the end of the sixteen-year period with this approach and assuming 175 vehicles remain in the total fleet, **44% of the non-sedan fleets will be PEVs** with approximately 50% BEVs and PHEVs.

4.2 Analysis Results – Commands Group

The Commands Group fleet contains 69 vehicles of which eighteen were monitored in this study. The vehicles monitored included compact and midsize sedans, minivans, an SUV, a cargo van, a passenger van, and five pickup trucks. The details of each vehicle monitored are included in Appendix A. Appendix C provides the detailed evaluation for the approach summarized in the following sections.

Table 17 identifies the projected year the current vehicle will be replaced based upon GSA requirements and extrapolated vehicle mileage. This table factors into the full table provided in Table 14 above.

Table 17. Commands Group vehicles anticipated replacement schedule at NASWI.

Year	Sedan Compact/ Sub Com	Sedan Midsize	Sedan Large	Mini-van	SUV	Cargo Van	Pass. Van	Pickup or LD Truck	Total
2015	-	-	-	-	-	-	-	-	-
2016	-	-	-	1	-	-	-	-	1
2017	-	-	-	1	-	-	-	-	1
2018	-	-	-	-	-	-	1	-	1
2019	-	-	-	-	-	-	1	-	1
2020	-	-	-	-	1	2	1	-	4
2021	-	-	-	1	-	-	-	-	1
2022	1	3	-	-	1	1	-	-	6
2023	1	-	-	-	-	1	-	3	5
2024	-	-	-	-	-	-	1	2	3
2025	-	-	1	2	-	6	-	6	15
2026	-	-	-	-	-	3	-	2	5

2027	-	1	-	-	-	5	-	4	10
2028	-	-	-	-	-	9	1	-	10
2029	-	-	-	2	-	-	-	-	2
2030	-	-	-	-	-	4	-	-	4
Total	2	4	1	7	2	31	5	17	69

4.2.1 Replacement Approach for Sedans for Commands Group

Table 18 presents a planned approach for the replacement of sedans with PEVs that flows into the totals shown in Table 15. The percentage of vehicles replaced each year by PEVs is also shown in the table. Appendix C notes that none of the sedans in the Commands group is projected for replacement until 2022.

Table 18. Planned approach for the introduction of PEV sedans in Commands Group.

Year	ICE	PHEV	BEV	Total PEVs	Percentage PEV/Year
2015	7	-	-	-	-
2016	7	-	-	-	-
2017	7	-	-	-	-
2018	7	-	-	-	-
2019	7	-	-	-	-
2020	7	-	-	-	-
2021	7	-	-	-	-
2022	4	3	-	3	75%
2023	3	-	1	4	100%
2024	3	-	-	4	-
2025	2	1	-	5	100%
2026	2	-	-	5	-
2027	1	-	-	6	100%
2028	1	-	1	6	-
2029	1	-	-	6	-
2030	1	-	-	6	-
Total	1	4	2	6	
Percent	14%	57%	29%	86%	

The final complement of sedans includes **86% PEVs** with the PEV component of 33% BEVs and 67% PHEVs. See Appendix C for the list of vehicles recommended for replacement in this approach.

4.2.2 Replacement Approach for Non-Sedan Vehicles for Commands Group

Table 19 presents a planned approach for the replacement of non-sedans with PEVs that flows into the totals shown in Table 16. The percentage of non-sedan vehicles replaced each year by PEVs is also shown in the table.

Table 19. Planned approach for the introduction of non-sedan PEVs in the Commands Group.

Year	Minivan	SUV	Cargo Van	Pass. Van	Pickup	Total	Percentage PEV/Year
2015	-	-	-	-	-	-	-

2016	1	-	-	-	-	1	100%
2017	1	-	-	-	-	1	100%
2018	-	-	-	-	-	-	-
2019	-	-	-	1	-	1	100%
2020	-	1	-	1	-	2	50%
2021	1	-	-	-	-	1	100%
2022	-	-	1	-	-	1	50%
2023	-	-	1	-	2	3	75%
2024	-	-	-	1	1	2	67%
2025	1	-	1	-	2	4	29%
2026	-	-	1	-	-	1	20%
2027	-	-	-	-	2	2	22%
2028	-	-	-	1	-	1	10%
2029	2	-	-	-	-	2	100%
2030	-	-	-	-	-	-	-
Total	6	1	4	4	7	22	
Percent	86%	50%	13%	80%	41%	32%	

In this approach, the final complement of non-sedans includes **32% PEVs**. The final composition of each vehicle type in the fleet is also shown in Table 19. See Appendix C for the list of vehicles recommended for replacement in this approach.

4.3 Analysis Results – Departments Group

The Departments group fleet contains 106 vehicles of which forty-two were monitored in this study. This section provides a replacement strategy for this Group. The details of each vehicle monitored are included in Appendix B. Appendix D provides the detailed evaluation for the approach summarized in the following sections.

The projected year the current vehicle will be replaced based upon GSA requirements and extrapolated vehicle mileage is shown in Table 20. Note the heavy-duty trucks and the bus are not included. This table is the Departments Group portion of Table 14 above.

Table 20. Projected Departments Group anticipated vehicle replacement schedule at NASWI.

Year	Sedan Compact/ Sub Com	Sedan Midsize	Sedan Large	Mini-van	SUV	Cargo Van	Pass. Van	Pickup or LD Truck	Total
2015	-	-	3	-	6	4	-	8	21
2016	1	5	-	-	-	1	-	-	7
2017	-	2	-	-	1	2	-	-	5
2018	-	-	-	-	-	2	1	-	3
2019	1	-	-	-	1	2	1	1	6
2020	1	1	-	1	-	-	2	1	6
2021	1	2	-	1	2	1	2	-	9
2022	-	-	-	-	-	1	-	-	1
2023	-	-	-	-	-	-	-	2	2

2024	-	1	-	-	-	1	3	2	7
2025	-	-	-	1	-	2	-	6	9
2026	-	1	1	1	-	5	-	3	11
2027	-	3	-	-	1	1	2	-	7
2028	-	-	-	-	-	-	1	-	1
2029	-	-	5	-	-	-	-	1	6
2030	-	-	-	-	-	2	2	1	5
Total	4	15	9	4	11	24	14	25	106

4.3.1 Replacement Approach for Sedans for Departments Group

Error! Reference source not found. presents a planned approach for the replacement of sedans with PEVs that flows into the totals shown in Table 15. The percentage of sedans replaced each year by PEVs is also shown in the table.

Table 21. Planned approach for the introduction of PEV sedans in Departments Group.

Year	ICE	PHEV	BEV	Total PEVs	Percentage PEV/Year
2015	1	2	-	2	67%
2016	2	4	-	4	67%
2017	1	1	-	1	50%
2018	-	-	-	-	-
2019	-	1	-	1	100%
2020	-	2	-	2	100%
2021	-	1	2	3	100%
2022	-	-	-	-	-
2023	-	-	-	-	-
2024	-	1	-	1	100%
2025	-	-	-	-	-
2026	1	-	1	1	50%
2027	1	1	1	2	67%
2028	-	-	-	-	-
2029	-	1	4	5	100%
2030	-	-	-	-	-
Total	6	14	8	22	
Percent	21%	64%	36%	79%	

The final complement of sedans includes **79% PEVs** with the PEV component of 36% BEVs and 64% PHEVs. See Appendix D for the list of vehicles recommended for replacement in this approach.

4.3.2 Replacement Approach for Non-Sedan Vehicles for Departments Group

Table 22 presents a planned approach for the replacement of non-sedans with PEVs that flows into the totals shown in Table 16. The percentage of non-sedan vehicles replaced each year by PEVs is also shown in the table.

Table 22. Planned approach for the introduction of non-sedan PEVs in the Departments Group.

Year	Minivan	SUV	Cargo Van	Pass. Van	Pickup	Total	Percentage PEV/Year
2015	-	1	-	-	-	1	6%
2016	-	-	1	-	-	1	100%
2017	-	1	-	-	-	1	33%
2018	-	-	2	1	-	3	100%
2019	-	1	1	1	1	4	80%
2020	1	-	-	1	1	3	75%
2021	-	-	-	-	-	-	-
2022	-	-	-	-	-	-	-
2023	-	-	-	-	2	2	100%
2024	-	-	-	3	2	5	83%
2025	1	-	-	-	5	6	67%
2026	1	-	2	-	3	6	67%
2027	-	1	-	2	-	3	75%
2028	-	-	-	1	-	1	100%
2029	-	-	-	-	-	-	-
2030	-	-	-	2	1	3	60%
Total	3	4	6	11	15	39	
Percent	75%	36%	25%	79%	60%	37%	

In this approach, the final complement of non-sedans includes **50% PEVs**. The proportion of each vehicle type is also shown in Table 22. See Appendix D for the list of vehicles recommended for replacement in this approach.

4.4 Balance of Naval Air Station Whidbey Island Fleet

The balance of the NASWI fleet consists of LSV, heavy-duty trucks, material handling equipment, non-powered vehicles, and specialty equipment. Most of the LSVs are electric drive. The balance of powered equipment was not analyzed because there are few PEVs available as potential replacements. Nevertheless, many after-market manufacturers are converting specialty equipment to electric drive. These are expected to become commercially available in the next several years. None of these types of vehicles was monitored as part of the study.

5. PLUG-IN ELECTRIC VEHICLE CHARGING INFRASTRUCTURE

Preparations for the adoption of PEVs also require the consideration of recharging stations. With the potential replacements identified in the previous section, the deployment of fleet EVSE can be provided.

The Task 3 Infrastructure report provides a detailed review of EVSE types and installation considerations. A detailed review of potential charging locations was completed and for all of the monitored fleets, charging at the vehicle's home base is all that is typically required. NASWI may find future value in locating additional charging stations for employee or visitor use for privately owned vehicles, but those locations are not identified as part of this study.

The Task 3 report identifies AC Level 1 EVSE is sufficient for charging PHEVs whereas AC Level 2 EVSE is recommended for BEVs. As NASWI begins the planned introduction of PEVs into the fleets, it is recommended that the initial vehicles be provided with AC Level 2 EVSE in order to gain experience

with the charging systems and to provide the greatest charge return for all vehicles. In this manner, NASWI need not be concerned in the early years whether the vehicle is a PHEV or a BEV but rather focus on adding infrastructure to accommodate AC Level 1 EVSE (that come standard with a PEV purchase) in later years. In addition, the Task 3 report identified that as experience is gained in the management of PEVs, there need not be an EVSE unit for every PEV. However, for these first vehicles, it is recommended that each be assigned its EVSE unit at its home base. It was also noted in Task 3 that many locations had a single monitored vehicle assigned.

Based upon the replacement approach identified in Section 4, the charging infrastructure needs of sedans and non-sedan vehicles are discussed separately.

5.1 Plug-in Electric Vehicle Charging Infrastructure for Sedans

Table 23 provides the projected schedule for the introduction of EVSE to support the sedan replacement approach. As noted, AC Level 2 infrastructure is emphasized in the early adoption years over AC Level 1. Typically, the EVSE are installed as dual units to reduce installation costs. However, because many facilities host a single PEV, the installation should at least include the stub-in of a second unit.

Table 23. EVSE infrastructure adoption for sedans.

	Commands Group	Department Group	Total
Year	AC L2/AC L1	AC L2/AC L1	ACL2/ACL1
2015	-	2 / -	2 / -
2016	-	4 / -	4 / -
2017	-	- / 1	- / 1
2018	-	-	-
2019	-	- / 1	- / 1
2020	-	- / 2	- / 2
2021	-	2 / 1	2 / 1
2022	3 / -	-	3 / -
2023	1 / -	-	1 / -
2024	-	- / 1	- / 1
2025	- / 1	-	- / 1
2026	-	1 / -	1 / -
2027	-	1 / 1	1 / 1
2028	- / 1	-	- / 1
2029	-	4 / 1	4 / 1
2030	-	-	-
Total	4 / 2	14 / 8	18 / 10

The Task 3 report detailed the potential for maximizing each group's conversion to PEVs and the potential savings in fuel costs and GHG emissions that result. The above table assumes that each PEV is assigned its own EVSE. The Task 3 report identified that with management attention, fewer units may be sufficient as some PEVs can share convenient EVSE.

5.2 Plug-in Electric Vehicle Charging Infrastructure for Non-Sedan Fleet

As above, Table 24 provides the schedule for the introduction of EVSE to support the non-sedan fleet replacement approach. Again, AC Level 2 infrastructure is emphasized in the early adoption years over AC Level 1. Typically, the EVSE are installed as dual units to reduce installation costs. As above, the facility may not need more than one EVSE because many facilities host a single PEV. In that case, the installation should at least include the stub-in of a second unit.

Table 24. EVSE infrastructure adoption for non-sedan fleets

	Commands Group	Department Group	Total
Year	AC L2/AC L1	AC L2/AC L1	AC L2/AC L1
2015	-	1 / -	1 / -
2016	1 / -	1 / -	2 / -
2017	1 / -	1 / -	2 / -
2018	-	3 / -	3 / -
2019	1 / -	1 / 3	2 / 3
2020	2 / -	1 / 2	3 / 2
2021	- / 1	-	- / 1
2022	- / 1	-	- / 1
2023	1 / 2	2 / -	3 / 2
2024	- / 2	2 / 3	2 / 5
2025	3 / 1	4 / 2	7 / 3
2026	1 / -	4 / 2	5 / 2
2027	1 / 1	2 / 1	3 / 2
2028	1 / -	1 / -	2 / -
2029	2 / -	-	2 / -
2030	-	2 / 1	2 / 1
Total	14 /8	25 / 14	39 / 22

The Task 3 report detailed the potential for maximizing each group's conversion to PEVs and the potential savings in fuel costs and GHG emissions that result. The above table only considers the adoption approach identified in this report. Table 25 summarizes the fleet charging needs.

Table 25. NASWI charging infrastructure approach

	Commands Group	Departments Group	Total
Year	AC L2/AC L1	AC L2/AC L1	AC L2/AC L1
Sedan	4 / 2	14 / 8	18 / 10
Non-Sedan	14 / 8	25 / 14	39/ 22
Total	18 / 10	39 / 22	57 / 32

The Task 3 Infrastructure report provides recommendations regarding placement of these EVSE units.

6. OBSERVATIONS

As a result of this intensive study, Intertek suggests NASWI is poised for the successful introduction of PEVs into the daily operation and that BEVs can provide support for most of the vehicle missions while providing savings in fuel costs and GHG emissions. In meeting the directives and mandates, the adoption approach outlined here should provide input to NASWI's overall strategy and presents an opportunity to gain experience in the operation, support, and maintenance of PEVs. It is suggested that NASWI may wish to move forward in the near future with the replacement of pool, support, and enforcement vehicles with PEVs as current budget considerations allow. Certainly, the vehicle types studied in this report may be candidates for immediate replacement.

Intertek appreciates presenting the results of this evaluation and working with NASWI personnel in this study.

Appendix A - Commands Group Vehicle Data Sheets

Note: the replacement year identified in the following data sheets is the earliest year available for potential replacement based upon the GSA requirements noted in Table 2. The final replacement approach below may suggest later years based upon vehicle use.

Table A-1 identifies a potential replacement approach for sedan vehicles currently on the GSA list.

Table A-1. NASWI Commands Group vehicle replacement (GSA-listed vehicle).

GSA-Listed Vehicle Replacements					
	Current Vehicle			PEV Replacement	Replacement
Vehicle ID	Model	Year	EPA Class	PEV Make	Year
G10-1138M	Chevrolet Malibu	2012	Sedan - Midsize	Ford Fusion	2022
G10-1140M	Chevrolet Malibu	2012	Sedan - Midsize	Nissan Leaf	2027
G10-3576L	Chevrolet Malibu	2015	Sedan - Midsize	Ford Fusion	2022
G10-7547F	Dodge Avenger	2008	Sedan–Midsize	Nissan Leaf	2023

Table A-2 identifies a potential replacement approach using all currently or soon-to-be available PEVs.

Table A-2. NASWI Commands Group vehicle replacement (all potential vehicles).

All Vehicle Replacement Approach					
Fleet Vehicle Id	**Make/Model**	**Year**	**EPA Class**	**Potential Replacement Vehicle**	**Replacement Year**
G41-1136K	Dodge Grd Caravan	2010	Minivan	Nissan Leaf	2016
G41-1139K	Dodge Grd Caravan	2010	Minivan	Honda Fit	2017
G41-1140K	Dodge Grd Caravan	2010	Minivan	Honda Fit	2025
G41-1155K	Dodge Grd Caravan	2010	Minivan	Mitsubishi Outlander	2021
G41-1351G	Dodge Dakota	2008	Pickup	Toyota Rav4	2023
G41-2911M	Chevrolet Colorado	2012	Pickup	Via VTRUX PU	2027
G41-3153P	Dodge Grd Caravan	2014	Minivan	Honda Fit	2029
G41-3159P	Dodge Grd Caravan	2014	Minivan	Honda Fit	2029
G42-0587K	Chevrolet Silverado	2010	Pickup	Via VTRUX PU	2025
G42-0590K	Chevrolet Silverado	2010	Pickup	Nissan eNV200	2025
G42-1232M	Ford F-150	2012	Pickup	Toyota Rav4	2027
G42-1281M	Ford E-350	2013	Van - Pass	Via VTRUX Van	2019
G43-3437B	Ford E-350	2006	Van - Cargo	Nissan eNV200	2026
G61-0513K	Ford Explorer	2010	SUV	Outlander	2020

Vehicle G10-1138M

	Make / Model / Year	Chevrolet Malibu - 2012
	EPA Class Size	Sedan - Midsize
	Mission	Support
	Contact	NAVFAC NW
	Parking Location	Near Bldg 385, Lexington St
	Fleet Vehicle ID	G10-1138M
	Fuel Type	Gas E85
	Potential Replacement PEV Make/Model	Ford Fusion
	Potential Annual Fuel Cost Savings	$207
	Potential Annual GHG Reduction (lbs-CO2e)	1,390
	EVSE Type for Recharging	ACL1
	Estimated Replacement Year	2022
	Vehicle Age at Est. Replacement (Yr)	10
	Odometer at Est. Replacement Date	60,284

Vehicle G10-1140M

	Make / Model / Year	Chevrolet Malibu – 2012
	EPA Class Size	Sedan – Midsize
	Mission	Support
	Contact	NAVFAC NW
	Parking Location	Bldg 2593, Orion St
	Fleet Vehicle ID	G10-1140M
	Fuel Type	Gas E85
	Potential Replacement PEV Make/Model	Nissan Leaf
	Potential Annual Fuel Cost Savings	$525
	Potential Annual GHG Reduction (lbs-CO2e)	2,931
	EVSE Type for Recharging	ACL2
	Estimated Replacement Year	2027
	Vehicle Age at Est. Replacement (Yr)	15
	Odometer at Est. Replacement Date	46,846

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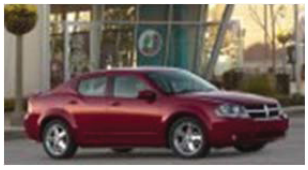
Vehicle G10-3576L

	Make / Model / Year	Chevrolet Malibu – 2015
	EPA Class Size	Sedan – Midsize
	Mission	Support
	Contact	NAVFAC NW
	Parking Location	Bldg 993, Franklin St
	Fleet Vehicle ID	G10-03576L
	Fuel Type	Gas
	Potential Replacement PEV Make/Model	Fusion
	Potential Annual Fuel Cost Savings	$270
	Potential Annual GHG Reduction (lbs-CO2e)	1,390
	EVSE Type for Recharging	ACL1
	Estimated Replacement Year	2022
	Vehicle Age at Est. Replacement (Yr)	7
	Odometer at Est. Replacement Date	84,693

Vehicle G10-7547F

	Make / Model / Year	Dodge Avenger – 2008
	EPA Class Size	Sedan – Midsize
	Mission	Support
	Contact	NAVFAC NW
	Parking Location	Bldg 386, Charles Porter Ave
	Fleet Vehicle ID	G10-7547F
	Fuel Type	Gas E85
	Potential Replacement PEV Make/Model	Leaf
	Potential Annual Fuel Cost Savings	$2,577
	Potential Annual GHG Reduction (lbs-CO2e)	15,082
	EVSE Type for Recharging	ACL2
	Estimated Replacement Year	2023
	Vehicle Age at Est. Replacement (Yr)	15
	Odometer at Est. Replacement Date	41,895

Vehicle G41-1136K

	Make / Model / Year	Dodge Grand Caravan - 2010
	EPA Class Size	Minivan
	Mission	Support
	Contact	NAVFAC NW
	Parking Location	Bldg 2547, Essex Rd
	Fleet Vehicle ID	G41-1136K
	Fuel Type	Gas E85
	Potential Replacement PEV Make/Model	Leaf
	Potential Annual Fuel Cost Savings	$690
	Potential Annual GHG Reduction (lbs-CO2e)	4,169
	EVSE Type for Recharging	ACL2
	Estimated Replacement Year	2016
	Vehicle Age at Est. Replacement (Yr)	6
	Odometer at Est. Replacement Date	104,032

Vehicle G41-1139K

	Make / Model / Year	Dodge Grand Caravan - 2010
	EPA Class Size	Minivan
	Mission	Support
	Contact	NAVFAC NW
	Parking Location	Bldg 410, Charles Porter Ave
	Fleet Vehicle ID	G41-1139K
	Fuel Type	Gas E85
	Potential Replacement PEV Make/Model	Fit
	Potential Annual Fuel Cost Savings	$979
	Potential Annual GHG Reduction (lbs-CO2e)	5,955
	EVSE Type for Recharging	ACL2
	Estimated Replacement Year	2017
	Vehicle Age at Est. Replacement (Yr)	7
	Odometer at Est. Replacement Date	97,029

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Vehicle G41-1140K

	Make / Model / Year	Dodge Grand Caravan - 2010
	EPA Class Size	Minivan
	Mission	Support
	Contact	NAVFAC NW
	Parking Location	Bldg 410, Charles Porter Ave
	Fleet Vehicle ID	G41-1140K
	Fuel Type	Gas E85
	Potential Replacement PEV Make/Model	Fit
	Potential Annual Fuel Cost Savings	$397
	Potential Annual GHG Reduction (lbs-CO2e)	2,416
	EVSE Type for Recharging	ACL2
	Estimated Replacement Year	2025
	Vehicle Age at Est. Replacement (Yr)	15
	Odometer at Est. Replacement Date	27,788

Vehicle G41-1155K

	Make / Model / Year	Dodge Grand Caravan - 2010
	EPA Class Size	Minivan
	Mission	Support
	Contact	NAVFAC NW
	Parking Location	Bldg 993, E Franklin St
	Fleet Vehicle ID	G41-1155K
	Fuel Type	Gas E85
	Potential Replacement PEV Make/Model	Outlander
	Potential Annual Fuel Cost Savings	$415
	Potential Annual GHG Reduction (lbs-CO2e)	2,266
	EVSE Type for Recharging	ACL1
	Estimated Replacement Year	2021
	Vehicle Age at Est. Replacement	11
	Odometer at Est. Replacement Date	64,932

Vehicle G41-1351G

	Make / Model / Year	Dodge Dakota - 2008
	EPA Class Size	Pickup
	Mission	Support
	Contact	NAVFAC NW
	Parking Location	Bldg 2544, Prowler St
	Fleet Vehicle ID	G41-1351G
	Fuel Type	Gas E85
	Potential Replacement PEV Make/Model	RAV4
	Potential Annual Fuel Cost Savings	$422
	Potential Annual GHG Reduction (lbs-CO2e)	2,470
	EVSE Type for Recharging	ACL2
	Estimated Replacement Year	2023
	Vehicle Age at Est. Replacement	15
	Odometer at Est. Replacement Date	61,773

Vehicle G41-2911M

	Make / Model / Year	Chevrolet Colorado – 2012
	EPA Class Size	Pickup
	Mission	Support
	Contact	NAVFAC NW
	Parking Location	Bldg 975, Midway St
	Fleet Vehicle ID	G41-2911M
	Fuel Type	Gas
	Potential Replacement PEV Make/Model	VTRUX PU
	Potential Annual Fuel Cost Savings	$401
	Potential Annual GHG Reduction (lbs-CO2e)	2,025
	EVSE Type for Recharging	ACL1
	Estimated Replacement Year	2027
	Vehicle Age at Est. Replacement (Yr)	15
	Odometer at Est. Replacement Date	20,122

Vehicle G41-3153P

	Make / Model / Year	Dodge Grand Caravan- 2014
	EPA Class Size	Minivan
	Mission	Support
	Contact	NAVFAC NW
	Parking Location	Bldg 385, Charles Porter Ave
	Fleet Vehicle ID	G41-3153P
	Fuel Type	Gas E85
	Potential Replacement PEV Make/Model	Fit
	Potential Annual Fuel Cost Savings	$2,814
	Potential Annual GHG Reduction (lbs-CO2e)	16,952
	EVSE Type for Recharging	ACL2
	Estimated Replacement Year	2029
	Vehicle Age at Est. Replacement	15
	Odometer at Est. Replacement Date	12,524

Vehicle G41-3159P

	Make / Model / Year	Dodge Grand Caravan- 2014
	EPA Class Size	Minivan
	Mission	Support
	Contact	NAVFAC NW
	Parking Location	Bldg 976, Princeton St
	Fleet Vehicle ID	G41-3159P
	Fuel Type	Gas E85
	Potential Replacement PEV Make/Model	Fit
	Potential Annual Fuel Cost Savings	$505
	Potential Annual GHG Reduction (lbs-CO2e)	3,044
	EVSE Type for Recharging	ACL2
	Estimated Replacement Year	2029
	Vehicle Age at Est. Replacement	15
	Odometer at Est. Replacement Date	32,340

Vehicle G42-0587K

	Make / Model / Year	Chevrolet Silverado – 2010
	EPA Class Size	Pickup
	Mission	Support
	Contact	NAVFAC NW
	Parking Location	No Data
	Fleet Vehicle ID	G42-0587K
	Fuel Type	Gas E85
	Potential Replacement PEV Make/Model	VTRUX PU
	Potential Annual Fuel Cost Savings	$1,308
	Potential Annual GHG Reduction (lbs-CO2e)	7,072
	EVSE Type for Recharging	ACL1
	Estimated Replacement Year	2025
	Vehicle Age at Est. Replacement	15
	Odometer at Est. Replacement Date	47,569

Vehicle G42-0590K

	Make / Model / Year	Chevrolet Silverado – 2010
	EPA Class Size	Pickup
	Mission	Support
	Contact	NAVFAC NW
	Parking Location	Bldg 385, Lexington St
	Fleet Vehicle ID	G42-0590K
	Fuel Type	Gas E85
	Potential Replacement PEV Make/Model	eNV200
	Potential Annual Fuel Cost Savings	$1,448
	Potential Annual GHG Reduction (lbs-CO2e)	8,283
	EVSE Type for Recharging	ACL2
	Estimated Replacement Year	2025
	Vehicle Age at Est. Replacement	15
	Odometer at Est. Replacement Date	71,502

Vehicle G42-1232M

	Make / Model / Year	Ford F150 – 2012
	EPA Class Size	Pickup
	Mission	Support
	Contact	NAVFAC NW
	Parking Location	Bldg 2737, Lexington St
	Fleet Vehicle ID	G42-1232M
	Fuel Type	Gas E85
	Potential Replacement PEV Make/Model	Rav4
	Potential Annual Fuel Cost Savings	$157
	Potential Annual GHG Reduction (lbs-CO2e)	859
	EVSE Type for Recharging	ACL2
	Estimated Replacement Year	2027
	Vehicle Age at Est. Replacement	15
	Odometer at Est. Replacement Date	25,143

Vehicle G42-1281M

	Make / Model / Year	Ford E350 – 2013
	EPA Class Size	Van – Passenger
	Mission	Support
	Contact	NAVFAC NW
	Parking Location	Bldg 2737,Charles Porter Ave
	Fleet Vehicle ID	G42-1281M
	Fuel Type	Gas E85
	Potential Replacement PEV Make/Model	VTRUX Van
	Potential Annual Fuel Cost Savings	$1,263
	Potential Annual GHG Reduction (lbs-CO2e)	7,510
	EVSE Type for Recharging	ACL1
	Estimated Replacement Year	2019
	Vehicle Age at Est. Replacement	6
	Odometer at Est. Replacement Date	101,796

Vehicle G43-3437B

	Make / Model / Year	Ford E350 - 2006
	EPA Class Size	Van – Cargo
	Mission	Support
	Contact	NAVFAC NW
	Parking Location	Bldg 2642, Essex Rd
	Fleet Vehicle ID	G43-3437B
	Fuel Type	Gas
	Potential Replacement PEV Make/Model	eNV200
	Potential Annual Fuel Cost Savings	$285
	Potential Annual GHG Reduction (lbs-CO2e)	1,702
	EVSE Type for Recharging	ACL2
	Estimated Replacement Year	2026
	Vehicle Age at Est. Replacement	20
	Odometer at Est. Replacement Date	21,697

Vehicle G61-0513K

	Make / Model / Year	Ford Explorer – 2010
	EPA Class Size	SUV
	Mission	Support
	Contact	NAVFAC NW
	Parking Location	Bldg 2897, Ranger St
	Fleet Vehicle ID	G61-0513K
	Fuel Type	Gas
	Potential Replacement PEV Make/Model	Outlander
	Potential Annual Fuel Cost Savings	$965
	Potential Annual GHG Reduction (lbs-CO2e)	5,460
	EVSE Type for Recharging	ACL1
	Estimated Replacement Year	2020
	Vehicle Age at Est. Replacement	10
	Odometer at Est. Replacement Date	86,748

Appendix B - Departments Vehicle Data Sheets

Note: the replacement year identified in the following data sheets is the earliest year available for potential replacement based upon the GSA requirements noted in Table 2. The final replacement approach below may suggest later years based upon vehicle use.

Table B-1 identifies a potential replacement approach for sedan vehicles currently or previously on the GSA list.

Table B-1. NASWI Departments vehicle replacement (GSA-listed vehicle).

GSA0Listed Vehicle Replacement Approach					
Fleet Vehicle Id	**Make/Model**	**Year**	**EPA Class**	**GSA Replacement Vehicle**	**Replacement Year**
G10-0984N	Dodge Avenger	2008	Sedan-Compact	Ford Focus	2021
G10-1137M	Chevrolet Malibu	2012	Sedan-Midsize	Nissan Leaf	2027
G10-1139M	Chevrolet Malibu	2012	Sedan-Midsize	Ford Fusion	2021
G10-1141M	Chevrolet Malibu	2012	Sedan-Midsize	Ford Fusion	2020
G10-2844L	Chevrolet Malibu	2011	Sedan-Midsize	Ford Fusion	2016
G10-3590P	Chevrolet Malibu	2015	Sedan-Midsize	Nissan Leaf	2021
G10-2848L	Chevrolet Malibu	2011	Sedan-Midsize	Ford Fusion	2016
G10-2850L	Chevrolet Malibu	2011	Sedan-Midsize	Ford Fusion	2016
G10-2968L	Chevrolet Malibu	2011	Sedan-Midsize	Ford Fusion	2016
G10-5286H	Pontiac G6	2009	Sedan-Compact	Chevrolet Volt	2019
G11-0472L	Chevrolet Impala	2011	Sedan–Large	Ford Fusion	2015
G11-1424L	Chevrolet Impala	2012	Sedan-Large	Ford Fusion	2015
G11-2898K	Chevrolet Impala	2014	Sedan-Large	Ford Fusion	2029

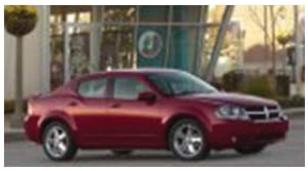
Table B-2 identifies a potential replacement approach using all currently or soon-to-be available PEVs.

Table B-2. NASWI Departments vehicle replacement (all potential vehicles).

All Vehicle Replacement Approach					
Fleet Vehicle Id	**Make/Model**	**Year**	**EPA Class**	**Potential Replacement Vehicle**	**Replacement Year**
G42-1940N	Chevrolet G1300	2014	Van – Pass	Via VTRUX Van	2024
G61-0245G	Ford Escape	2008	SUV	Mitsubishi Outlander	2017
G41-1137K	Grd Caravan SE	2010	Minivan	Honda Fit	2025
G41-1142K	Grd Caravan SE	2010	Minivan	Mitsubishi Outlander	2020
G41-1349G	Dakota	2008	Pickup	Toyota Rav4	2023
G41-1350G	Dakota	2008	Pickup	Nissan eNV200	2023
G41-1536L	Grd Caravan Exp	2011	Minivan	Honda Fit	2026
G41-1597L	Dakota	2011	Pickup	Nissan eNV200	2026
G41-1763H	Ranger	2009	Pickup	Toyota Rav4	2024
G41-1765H	Ranger	2009	Pickup	VTRUX PU	2024
G41-1767H	Ranger	2009	Pickup	Nissan eNV200	2025

G41-1768H	Ranger	2009	Pickup	Nissan eNV200	2025
G41-4334M	Colorado	2012	Pickup	Via VTRUX PU	2030
G42-0334G	G1300	2008	Van - Pass	Via VTRUX Van	2018
G42-0335G	G1300	2008	Van - Pass	Via VTRUX Van	2020
G42-0656K	Silverado	2010	Pickup	Nissan eNV200	2025
G42-0766L	C1500	2011	Pickup	Via VTRUX PU	2026
G42-0881H	F-150	2009	Pickup	Nissan eNV200	2019
G42-1222M	G1300 Express	2012	Van - Pass	Via VTRUX Van	2027
G42-1223M	G1300 Express	2012	Van - Pass	Nissan eNV200	2030
G42-2035L	Tahoe	2012	SUV	Honda Fit	2027
G43-0895K	E-350	2010	Van - Pass	Nissan eNV200	2024
G43-0896K	E-350	2010	Van - Pass	Nissan eNV200	2030
G43-0936K	C2500HD	2011	Van - Cargo	Nissan eNV200	2026
G43-2287M	G2300	2012	Van - Pass	Nissan eNV200	2027
G43-2288M	G2300 Express	2012	Van - Pass	Nissan eNV200	2028
G62-0203H	F-150	2009	Pickup	Nissan Rav4	2016
G62-0871K	Expedition	2010	SUV	Mitsubishi Outlander	2015
G62-2420P	FI50 SSV	2014	Pickup	Via VTRUX Van	2026

Vehicle G10-0984N

	Make / Model / Year	Dodge Avenger – 2008
	EPA Class Size	Sedan – Compact
	Mission	Support
	Contact	NAVFAC NW
	Parking Location	Bldg 382, Charles Porter Ave
	Fleet Vehicle ID	G10-0984N
	Fuel Type	Gas E85
	Potential Replacement PEV Make/Model	Focus
	Potential Annual Fuel Cost Savings	$518
	Potential Annual GHG Reduction (lbs-CO2e)	3,006
	EVSE Type for Recharging	ACL2
	Estimated Replacement Year	2021
	Vehicle Age at Est. Replacement (Yr)	13
	Odometer at Est. Replacement Date	60,231

Vehicle G10-1137M

	Make / Model / Year	Chevrolet Malibu – 2012
	EPA Class Size	Sedan – Midsize
	Mission	Support
	Contact	NAVFAC NW
	Parking Location	Bldg 243, Midway St
	Fleet Vehicle ID	G10-1137M
	Fuel Type	Gas E85
	Potential Replacement PEV Make/Model	Leaf
	Potential Annual Fuel Cost Savings	$287
	Potential Annual GHG Reduction (lbs-CO2e)	1,603
	EVSE Type for Recharging	ACL2
	Estimated Replacement Year	2027
	Vehicle Age at Est. Replacement (Yr)	15
	Odometer at Est. Replacement Date	58,384

Vehicle G10-1139M

	Make / Model / Year	Chevrolet Malibu – 2012
	EPA Class Size	Sedan – Midsize
	Mission	Support
	Contact	NAVFAC NW
	Parking Location	Bldg 103, Eisenhower St
	Fleet Vehicle ID	G10-1139M
	Fuel Type	Gas E85
	Potential Replacement PEV Make/Model	Fusion
	Potential Annual Fuel Cost Savings	$115
	Potential Annual GHG Reduction (lbs-CO2e)	593
	EVSE Type for Recharging	ACL1
	Estimated Replacement Year	2021
	Vehicle Age at Est. Replacement (Yr)	9
	Odometer at Est. Replacement Date	57,196

Vehicle G10-1141M

	Make / Model / Year	Chevrolet Malibu – 2012
	EPA Class Size	Sedan – Midsize
	Mission	Support
	Contact	NAVFAC NW
	Parking Location	Bldg 103, Eisenhower St
	Fleet Vehicle ID	G10-1141M
	Fuel Type	Gas E85
	Potential Replacement PEV Make/Model	Fusion
	Potential Annual Fuel Cost Savings	$937
	Potential Annual GHG Reduction (lbs-CO2e)	4,817
	EVSE Type for Recharging	ACL1
	Estimated Replacement Year	2020
	Vehicle Age at Est. Replacement (Yr)	8
	Odometer at Est. Replacement Date	70,613

Vehicle G10-2844L

	Make / Model / Year	Chevrolet Malibu – 2011
	EPA Class Size	Sedan – Midsize
	Mission	Pool
	Contact	NAVFAC NW
	Parking Location	Bldg 124, Midway St
	Fleet Vehicle ID	G10-2844L
	Fuel Type	Gas E85
	Potential Replacement PEV Make/Model	Fusion
	Potential Annual Fuel Cost Savings	$10
	Potential Annual GHG Reduction (lbs-CO2e)	52
	EVSE Type for Recharging	ACL2
	Estimated Replacement Year	2016
	Vehicle Age at Est. Replacement	5
	Odometer at Est. Replacement Date	90,598

Vehicle G10-3590P

	Make / Model / Year	Chevrolet Malibu – 2015
	EPA Class Size	Sedan – Midsize
	Mission	Support
	Contact	NAVFAC NW
	Parking Location	BLDG 243, Midway St
	Fleet Vehicle ID	G10-3590P
	Fuel Type	Gas
	Potential Replacement PEV Make/Model	Leaf
	Potential Annual Fuel Cost Savings	$309
	Potential Annual GHG Reduction (lbs-CO2e)	1,659
	EVSE Type for Recharging	ACL2
	Estimated Replacement Year	2021
	Vehicle Age at Est. Replacement (Yr)	6
	Odometer at Est. Replacement Date	78,473

Vehicle G10-2848L

	Make / Model / Year	Chevrolet Malibu – 2011
	EPA Class Size	Sedan – Midsize
	Mission	Pool
	Contact	NAVFAC NW
	Parking Location	Bldg 124, Midway St
	Fleet Vehicle ID	G10-2848L
	Fuel Type	Gas E85
	Potential Replacement PEV Make/Model	Fusion
	Potential Annual Fuel Cost Savings	$66
	Potential Annual GHG Reduction (lbs-CO2e)	339
	EVSE Type for Recharging	ACL1
	Estimated Replacement Year	2016
	Vehicle Age at Est. Replacement (Yr)	5
	Odometer at Est. Replacement Date	84,828

Vehicle G10-2850L

	Make / Model / Year	Chevrolet Malibu – 2011
	EPA Class Size	Sedan – Midsize
	Mission	Pool
	Contact	NAVFAC NW
	Parking Location	Bldg 124, Midway St
	Fleet Vehicle ID	G10-2850L
	Fuel Type	Gas E85
	Potential Replacement PEV Make/Model	Fusion
	Potential Annual Fuel Cost Savings	$247
	Potential Annual GHG Reduction (lbs-CO2e)	1,272
	EVSE Type for Recharging	ACL1
	Estimated Replacement Year	2016
	Vehicle Age at Est. Replacement (Yr)	5
	Odometer at Est. Replacement Date	86,597

Vehicle G10-2968L

	Make / Model / Year	Chevrolet Malibu – 2011
	EPA Class Size	Sedan – Midsize
	Mission	Pool
	Contact	NAVFAC NW
	Parking Location	Bldg 124, Midway St
	Fleet Vehicle ID	G10-2968L
	Fuel Type	Gas E85
	Potential Replacement PEV Make/Model	Fusion
	Potential Annual Fuel Cost Savings	$243
	Potential Annual GHG Reduction (lbs-CO2e)	1,249
	EVSE Type for Recharging	ACL1
	Estimated Replacement Year	2016
	Vehicle Age at Est. Replacement (Yr)	5
	Odometer at Est. Replacement Date	80,563

G10-5286H

	Make / Model / Year	Pontiac G6 – 2009
	EPA Class Size	Sedan – Compact
	Mission	Support
	Contact	NAVFAC NW
	Parking Location	Bldg 960, Intruder St
	Fleet Vehicle ID	G10-5286H
	Fuel Type	Gas E85
	Potential Replacement PEV Make/Model	Volt
	Potential Annual Fuel Cost Savings	$607
	Potential Annual GHG Reduction (lbs-CO2e)	3,252
	EVSE Type for Recharging	ACL1
	Estimated Replacement Year	2019
	Vehicle Age at Est. Replacement (Yr)	10
	Odometer at Est. Replacement Date	61,236

Vehicle G42-1940N

	Make / Model / Year	Chevrolet G1300 – 2014
	EPA Class Size	Van – Passenger
	Mission	Pool
	Contact	NAVFAC NW
	Parking Location	Bldg 124, Midway St
	Fleet Vehicle ID	G42-1940N
	Fuel Type	Gas E85
	Potential Replacement PEV Make/Model	VTRUX Van
	Potential Annual Fuel Cost Savings	$421
	Potential Annual GHG Reduction (lbs-CO2e)	2,459
	EVSE Type for Recharging	ACL1
	Estimated Replacement Year	2024
	Vehicle Age at Est. Replacement (Yr)	10
	Odometer at Est. Replacement Date	85,836

Vehicle G61-0245G

	Make / Model / Year	Ford Escape - 2008
	EPA Class Size	SUV
	Mission	Pool
	Contact	NAVFAC NW
	Parking Location	Bldg 124, Midway St
	Fleet Vehicle ID	G61-0245G
	Fuel Type	Gas
	Potential Replacement PEV Make/Model	Outlander
	Potential Annual Fuel Cost Savings	$1,214
	Potential Annual GHG Reduction (lbs-CO2e)	6,360
	EVSE Type for Recharging	ACL1
	Estimated Replacement Year	2017
	Vehicle Age at Est. Replacement (Yr)	9
	Odometer at Est. Replacement Date	95,205

Vehicle G11-0472L

	Make / Model / Year	Chevrolet Impala – 2011
	EPA Class Size	Sedan – Large
	Mission	Enforcement
	Contact	NAVFAC NW
	Parking Location	Bldg 994, Charles Porter Ave
	Fleet Vehicle ID	G11-0472L
	Fuel Type	Gas E85
	Potential Replacement PEV Make/Model	Fusion
	Potential Annual Fuel Cost Savings	$123
	Potential Annual GHG Reduction (lbs-CO2e)	666
	EVSE Type for Recharging	ACL1
	Estimated Replacement Year	2015
	Vehicle Age at Est. Replacement (Yr)	4
	Odometer at Est. Replacement Date	121,380

Vehicle G11-1424L

	Make / Model / Year	Chevrolet Impala – 2012
	EPA Class Size	Sedan – Large
	Mission	Enforcement
	Contact	NAVFAC NW
	Parking Location	Bldg 994, Charles Porter Ave
	Fleet Vehicle ID	G11-1424L
	Fuel Type	Gas E85
	Potential Replacement PEV Make/Model	Fusion
	Potential Annual Fuel Cost Savings	$306
	Potential Annual GHG Reduction (lbs-CO2e)	1,931
	EVSE Type for Recharging	ACL1
	Estimated Replacement Year	2015
	Vehicle Age at Est. Replacement (Yr)	3
	Odometer at Est. Replacement Date	100,543

Vehicle G11-2898K

	Make / Model / Year	Chevrolet Impala – 2014
	EPA Class Size	Sedan – Large
	Mission	Enforcement
	Contact	NAVFAC NW
	Parking Location	Bldg 994, Charles Porter Ave
	Fleet Vehicle ID	G11-2898K
	Fuel Type	Gas E85
	Potential Replacement PEV Make/Model	Fusion
	Potential Annual Fuel Cost Savings	$243
	Potential Annual GHG Reduction (lbs-CO2e)	1,338
	EVSE Type for Recharging	ACL1
	Estimated Replacement Year	2029
	Vehicle Age at Est. Replacement (Yr)	15
	Odometer at Est. Replacement Date	41,109

Vehicle G41-1137K

	Make / Model / Year	Dodge Grand Caravan - 2010
	EPA Class Size	Minivan
	Mission	Support
	Contact	NAVFAC NW
	Parking Location	Bldg 2556, Lexington St
	Fleet Vehicle ID	G41-1137K
	Fuel Type	Gas E85
	Potential Replacement PEV Make/Model	Fit
	Potential Annual Fuel Cost Savings	$769
	Potential Annual GHG Reduction (lbs-CO2e)	4,679
	EVSE Type for Recharging	ACL2
	Estimated Replacement Year	2025
	Vehicle Age at Est. Replacement (Yr)	15
	Odometer at Est. Replacement Date	30,308

Vehicle G41-1142K

	Make / Model / Year	Dodge Grand Caravan – 2010
	EPA Class Size	Minivan
	Mission	Pool
	Contact	NAVFAC NW
	Parking Location	Bldg 385, Lexington St
	Fleet Vehicle ID	G41-1142K
	Fuel Type	Gas E85
	Potential Replacement PEV Make/Model	Outlander
	Potential Annual Fuel Cost Savings	$312
	Potential Annual GHG Reduction (lbs-CO2e)	1,703
	EVSE Type for Recharging	ACL1
	Estimated Replacement Year	2020
	Vehicle Age at Est. Replacement (Yr)	10
	Odometer at Est. Replacement Date	84,137

Vehicle G41-1349G

	Make / Model / Year	Dodge Dakota – 2008
	EPA Class Size	Pickup
	Mission	Support
	Contact	NAVFAC NW
	Parking Location	Bldg 378, Intruder St
	Fleet Vehicle ID	G41-1349G
	Fuel Type	Gas E85
	Potential Replacement PEV Make/Model	Rav4
	Potential Annual Fuel Cost Savings	$390
	Potential Annual GHG Reduction (lbs-CO2e)	2,286
	EVSE Type for Recharging	ACL2
	Estimated Replacement Year	2023
	Vehicle Age at Est. Replacement (Yr)	15
	Odometer at Est. Replacement Date	39,729

Vehicle G41-1350G

	Make / Model / Year	Dodge Dakota – 2008
	EPA Class Size	Pickup
	Mission	Support
	Contact	NAVFAC NW
	Parking Location	Bldg 385, Lexington St
	Fleet Vehicle ID	G41-1350G
	Fuel Type	Gas E85
	Potential Replacement PEV Make/Model	eNV200
	Potential Annual Fuel Cost Savings	$177
	Potential Annual GHG Reduction (lbs-CO2e)	892
	EVSE Type for Recharging	ACL2
	Estimated Replacement Year	2023
	Vehicle Age at Est. Replacement (Yr)	15
	Odometer at Est. Replacement Date	15,735

Vehicle G41-1536L

	Make / Model / Year	Dodge Grand Caravan – 2011
	EPA Class Size	Minivan
	Mission	Support
	Contact	NAVFAC NW
	Parking Location	Bldg 103, Eisenhower St
	Fleet Vehicle ID	G41-1536L
	Fuel Type	Gas E85
	Potential Replacement PEV Make/Model	Fit
	Potential Annual Fuel Cost Savings	$537
	Potential Annual GHG Reduction (lbs-CO2e)	3,234
	EVSE Type for Recharging	ACL2
	Estimated Replacement Year	2026
	Vehicle Age at Est. Replacement (Yr)	15
	Odometer at Est. Replacement Date	23,184

Vehicle G41-1597L

	Make / Model / Year	Dodge Dakota – 2011
	EPA Class Size	Pickup
	Mission	Support
	Contact	NAVFAC NW
	Parking Location	Bldg 103, Eisenhower St
	Fleet Vehicle ID	G41-1597L
	Fuel Type	Gas E85
	Potential Replacement PEV Make/Model	eNV200
	Potential Annual Fuel Cost Savings	$566
	Potential Annual GHG Reduction (lbs-CO2e)	3,335
	EVSE Type for Recharging	ACL2
	Estimated Replacement Year	2026
	Vehicle Age at Est. Replacement (Yr)	15
	Odometer at Est. Replacement Date	69,109

Vehicle G41-1763H

	Make / Model / Year	Ford Ranger – 2009
	EPA Class Size	Pickup
	Mission	Support
	Contact	NAVFAC NW
	Parking Location	Bldg 2734, Lexington St
	Fleet Vehicle ID	G41-1763H
	Fuel Type	Gas
	Potential Replacement PEV Make/Model	Rav4
	Potential Annual Fuel Cost Savings	$539
	Potential Annual GHG Reduction (lbs-CO2e)	2,826
	EVSE Type for Recharging	ACL2
	Estimated Replacement Year	2024
	Vehicle Age at Est. Replacement (Yr)	15
	Odometer at Est. Replacement Date	38,174

Vehicle G41-1765H

	Make / Model / Year	Ford Ranger – 2009
	EPA Class Size	Pickup
	Mission	Support
	Contact	NAVFAC NW
	Parking Location	No Data
	Fleet Vehicle ID	G41-1765H
	Fuel Type	Gas
	Potential Replacement PEV Make/Model	VTRUX PU
	Potential Annual Fuel Cost Savings	$399
	Potential Annual GHG Reduction (lbs-CO2e)	2,016
	EVSE Type for Recharging	ACL1
	Estimated Replacement Year	2024
	Vehicle Age at Est. Replacement (Yr)	15
	Odometer at Est. Replacement Date	52,244

Vehicle G41-1767H

	Make / Model / Year	Ford Ranger – 2009
	EPA Class Size	Pickup
	Mission	Support
	Contact	NAVFAC NW
	Parking Location	Bldg 103, Eisenhower St
	Fleet Vehicle ID	G41-1767H
	Fuel Type	Gas
	Potential Replacement PEV Make/Model	eNV200
	Potential Annual Fuel Cost Savings	$1,231
	Potential Annual GHG Reduction (lbs-CO2e)	6,703
	EVSE Type for Recharging	ACL2
	Estimated Replacement Year	2025
	Vehicle Age at Est. Replacement (Yr)	16
	Odometer at Est. Replacement Date	55,293

Vehicle G41-1768H

	Make / Model / Year	Ford Ranger – 2009
	EPA Class Size	Pickup
	Mission	Support
	Contact	NAVFAC NW
	Parking Location	No Data
	Fleet Vehicle ID	G41-1768H
	Fuel Type	Gas
	Potential Replacement PEV Make/Model	eNV200
	Potential Annual Fuel Cost Savings	$161
	Potential Annual GHG Reduction (lbs-CO2e)	877
	EVSE Type for Recharging	ACL2
	Estimated Replacement Year	2025
	Vehicle Age at Est. Replacement (Yr)	16
	Odometer at Est. Replacement Date	34,128

Vehicle G41-4334M

	Make / Model / Year	Chevrolet Colorado – 2012
	EPA Class Size	Pickup
	Mission	Support
	Contact	NAVFAC NW
	Parking Location	Bldg 2699, Ranger St
	Fleet Vehicle ID	G41-4334M
	Fuel Type	Gas
	Potential Replacement PEV Make/Model	VTRUX PU
	Potential Annual Fuel Cost Savings	$183
	Potential Annual GHG Reduction (lbs-CO2e)	927
	EVSE Type for Recharging	ACL1
	Estimated Replacement Year	2030
	Vehicle Age at Est. Replacement (Yr)	18
	Odometer at Est. Replacement Date	13,440

Vehicle G42-0334G

	Make / Model / Year	Chevrolet G1300- 2008
	EPA Class Size	Van – Passenger
	Mission	Pool
	Contact	NAVFAC NW
	Parking Location	Bldg 124, Midway St
	Fleet Vehicle ID	G42-0334G
	Fuel Type	Gas E85
	Potential Replacement PEV Make/Model	VTRUX Van
	Potential Annual Fuel Cost Savings	$180
	Potential Annual GHG Reduction (lbs-CO2e)	1,051
	EVSE Type for Recharging	ACL1
	Estimated Replacement Year	2018
	Vehicle Age at Est. Replacement (Yr)	10
	Odometer at Est. Replacement Date	86,042

Vehicle G42-0335G

	Make / Model / Year	Chevrolet G1300- 2008
	EPA Class Size	Van – Passenger
	Mission	Support
	Contact	NAVFAC NW
	Parking Location	Bldg 2704, Prowler St
	Fleet Vehicle ID	G42-0335G
	Fuel Type	Gas E85
	Potential Replacement PEV Make/Model	VTRUX Van
	Potential Annual Fuel Cost Savings	$341
	Potential Annual GHG Reduction (lbs-CO2e)	1,993
	EVSE Type for Recharging	ACL1
	Estimated Replacement Year	2020
	Vehicle Age at Est. Replacement (Yr)	12
	Odometer at Est. Replacement Date	80,628

Vehicle G42-0656K

	Make / Model / Year	Chevrolet Silverado – 2010
	EPA Class Size	Pickup
	Mission	Support
	Contact	NAVFAC NW
	Parking Location	Bldg 103, Eisenhower St
	Fleet Vehicle ID	G42-0656K
	Fuel Type	Gas E85
	Potential Replacement PEV Make/Model	eNV200
	Potential Annual Fuel Cost Savings	$1,005
	Potential Annual GHG Reduction (lbs-CO2e)	5,747
	EVSE Type for Recharging	ACL2
	Estimated Replacement Year	2025
	Vehicle Age at Est. Replacement (Yr)	15
	Odometer at Est. Replacement Date	35,265

Vehicle G42-0766L

	Make / Model / Year	Chevrolet C1500 – 2011
	EPA Class Size	Pickup
	Mission	Support
	Contact	NAVFAC NW
	Parking Location	Bldg 2555, Langley Blvd
	Fleet Vehicle ID	G42-0766L
	Fuel Type	Gas E85
	Potential Replacement PEV Make/Model	VTRUX PU
	Potential Annual Fuel Cost Savings	$812
	Potential Annual GHG Reduction (lbs-CO2e)	4,005
	EVSE Type for Recharging	ACL1
	Estimated Replacement Year	2026
	Vehicle Age at Est. Replacement (Yr)	15
	Odometer at Est. Replacement Date	47,026

Vehicle G42-0881H

	Make / Model / Year	Ford F150 – 2009
	EPA Class Size	Pickup
	Mission	Pool
	Contact	NAVFAC NW
	Parking Location	Bldg 124, Midway St
	Fleet Vehicle ID	G42-0881H
	Fuel Type	Gas E85
	Potential Replacement PEV Make/Model	eNV200
	Potential Annual Fuel Cost Savings	$1,497
	Potential Annual GHG Reduction (lbs-CO2e)	8,828
	EVSE Type for Recharging	ACL2
	Estimated Replacement Year	2019
	Vehicle Age at Est. Replacement (Yr)	10
	Odometer at Est. Replacement Date	98,920

Vehicle G42-1222M

	Make / Model / Year	Chevrolet G1300 Exp - 2012
	EPA Class Size	Van – Passenger
	Mission	Support
	Contact	NAVFAC NW
	Parking Location	Bldg 385, Lexington St
	Fleet Vehicle ID	G42-1222M
	Fuel Type	Gas E85
	Potential Replacement PEV Make/Model	VTRUX Van
	Potential Annual Fuel Cost Savings	$1,410
	Potential Annual GHG Reduction (lbs-CO2e)	8,240
	EVSE Type for Recharging	ACL1
	Estimated Replacement Year	2027
	Vehicle Age at Est. Replacement (Yr)	15
	Odometer at Est. Replacement Date	54,649

Vehicle G42-1223M

	Make / Model / Year	Chevrolet G1300 Exp - 2012
	EPA Class Size	Van – Passenger
	Mission	Support
	Contact	NAVFAC NW
	Parking Location	Bldg 2734, Lexington St
	Fleet Vehicle ID	G42-1223M
	Fuel Type	Gas E85
	Potential Replacement PEV Make/Model	eNV200
	Potential Annual Fuel Cost Savings	$2,037
	Potential Annual GHG Reduction (lbs-CO2e)	12,361
	EVSE Type for Recharging	ACL2
	Estimated Replacement Year	2030
	Vehicle Age at Est. Replacement (Yr)	18
	Odometer at Est. Replacement Date	19,760

Vehicle G42-2035L

	Make / Model / Year	Chevrolet Tahoe – 2012
	EPA Class Size	SUV
	Mission	Enforcement
	Contact	NAVFAC NW
	Parking Location	Bldg 994, Charles Porter Ave
	Fleet Vehicle ID	G42-2035L
	Fuel Type	Gas E85
	Potential Replacement PEV Make/Model	Fit
	Potential Annual Fuel Cost Savings	$1,604
	Potential Annual GHG Reduction (lbs-CO2e)	9,952
	EVSE Type for Recharging	ACL2
	Estimated Replacement Year	2027
	Vehicle Age at Est. Replacement (Yr)	15
	Odometer at Est. Replacement Date	62,560

Vehicle G43-0895K

	Make / Model / Year	Ford E350 - 2010
	EPA Class Size	Van - Passenger
	Mission	Support
	Contact	NAVFAC NW
	Parking Location	Bldg 2734, Lexington St
	Fleet Vehicle ID	G43-0895K
	Fuel Type	Gas
	Potential Replacement PEV Make/Model	eNV200
	Potential Annual Fuel Cost Savings	$813
	Potential Annual GHG Reduction (lbs-CO2e)	5,064
	EVSE Type for Recharging	ACL2
	Estimated Replacement Year	2024
	Vehicle Age at Est. Replacement (Yr)	14
	Odometer at Est. Replacement Date	77,478

Vehicle G43-0896K

	Make / Model / Year	Ford E350 – 2010
	EPA Class Size	Van – Passenger
	Mission	Support
	Contact	NAVFAC NW
	Parking Location	Bldg 2734, Lexington St
	Fleet Vehicle ID	G43-0896K
	Fuel Type	Gas
	Potential Replacement PEV Make/Model	eNV200
	Potential Annual Fuel Cost Savings	$1,421
	Potential Annual GHG Reduction (lbs-CO2e)	8,854
	EVSE Type for Recharging	ACL2
	Estimated Replacement Year	2030
	Vehicle Age at Est. Replacement	20
	Odometer at Est. Replacement Date	30,822

Vehicle G43-0936K

	Make / Model / Year	Chevrolet C2500HD – 2011
	EPA Class Size	Van – Cargo
	Mission	Enforcement
	Contact	NAVFAC NW
	Parking Location	Bldg 2815, Langley Blvd
	Fleet Vehicle ID	G43-0936K
	Fuel Type	Gas
	Potential Replacement PEV Make/Model	eNV200
	Potential Annual Fuel Cost Savings	$1,521
	Potential Annual GHG Reduction (lbs-CO2e)	9,475
	EVSE Type for Recharging	ACL2
	Estimated Replacement Year	2026
	Vehicle Age at Est. Replacement (Yr)	15
	Odometer at Est. Replacement Date	39,215

Vehicle G43-2287M

	Make / Model / Year	Chevrolet G2300 – 2012
	EPA Class Size	Van – Passenger
	Mission	Support
	Contact	NAVFAC NW
	Parking Location	Bldg 2737, Lexington St
	Fleet Vehicle ID	G43-2287M
	Fuel Type	Gas E85
	Potential Replacement PEV Make/Model	eNV200
	Potential Annual Fuel Cost Savings	$938
	Potential Annual GHG Reduction (lbs-CO2e)	5,766
	EVSE Type for Recharging	ACL2
	Estimated Replacement Year	2027
	Vehicle Age at Est. Replacement (Yr)	15
	Odometer at Est. Replacement Date	24,497

Vehicle G43-2288M

	Make / Model / Year	Chevrolet G2300 Exp – 2012
	EPA Class Size	Van – Passenger
	Mission	Support
	Contact	NAVFAC NW
	Parking Location	Bldg 385, Lexington St
	Fleet Vehicle ID	G43-2288M
	Fuel Type	Gas E85
	Potential Replacement PEV Make/Model	eNV200
	Potential Annual Fuel Cost Savings	$601
	Potential Annual GHG Reduction (lbs-CO2e)	3,695
	EVSE Type for Recharging	ACL2
	Estimated Replacement Year	2028
	Vehicle Age at Est. Replacement (Yr)	16
	Odometer at Est. Replacement Date	17,580

Vehicle G62-0203H

	Make / Model / Year	Ford F150 – 2009
	EPA Class Size	Pickup
	Mission	Support
	Contact	NAVFAC NW
	Parking Location	No Data
	Fleet Vehicle ID	G62-0203H
	Fuel Type	Gas E85
	Potential Replacement PEV Make/Model	Rav4
	Potential Annual Fuel Cost Savings	$1.390
	Potential Annual GHG Reduction (lbs-CO2e)	8,000
	EVSE Type for Recharging	ACL2
	Estimated Replacement Year	2016
	Vehicle Age at Est. Replacement (Yr)	7
	Odometer at Est. Replacement Date	101,271

Vehicle G62-0871K

	Make / Model / Year	Ford Expedition – 2010
	EPA Class Size	SUV
	Mission	Enforcement
	Contact	NAVFAC NW
	Parking Location	Bldg 994, Charles Porter Ave
	Fleet Vehicle ID	G62-0871K
	Fuel Type	Gas E85
	Potential Replacement PEV Make/Model	Outlander
	Potential Annual Fuel Cost Savings	$219
	Potential Annual GHG Reduction (lbs-CO2e)	1,259
	EVSE Type for Recharging	ACL1
	Estimated Replacement Year	2015
	Vehicle Age at Est. Replacement (Yr)	5
	Odometer at Est. Replacement Date	132,115

Vehicle G62-2420P

	Make / Model / Year	Ford F150 SSV – 2014
	EPA Class Size	Pickup
	Mission	Enforcement
	Contact	NAVFAC NW
	Parking Location	Bldg 994, Charles Porter Ave
	Fleet Vehicle ID	G62-2420P
	Fuel Type	Gas E85
	Potential Replacement PEV Make/Model	VTRUX PU
	Potential Annual Fuel Cost Savings	$118
	Potential Annual GHG Reduction (lbs-CO2e)	624
	EVSE Type for Recharging	ACL1
	Estimated Replacement Year	2026
	Vehicle Age at Est. Replacement (Yr)	12
	Odometer at Est. Replacement Date	63,756

Appendix C - Commands Fleet Vehicle Replacement Approach

There are four replacement approaches identified for the Commands fleet vehicles:

- Monitored Vehicles
  - GSA-Listed PEVs only for sedans
  - All other potential PEV types
- Un-monitored Vehicles part of the Full Fleet
  - GSA-Listed PEVs only for sedans
  - All potential PEV types for non-sedan vehicles

The extensive analysis conducted for monitored vehicles (Task 3) results in high confidence that the suggested vehicle can meet mission requirements. The suggested vehicles for the full fleet rely on the extrapolation of those monitored vehicles and the guidance identified in Section 3.

C.1 Monitored Sedan Vehicle GSA Replacement Approach

The vehicles monitored include one compact sedan and three midsize sedans. Table C-1 provides a replacement approach using currently available PEVs on or recently on the GSA schedule. The replacement of these vehicles by PEVs is assumed in the analysis of Section 4.

Table C- 1. Command fleet all monitored sedan vehicle replacement approach.

GSA Replacement Approach						
Fleet Vehicle Id	**Make**	**Model**	**Year**	**EPA Class**	**Potential Replacement Vehicle**	**Replacement Year**
G10-1138M	Chevrolet	Malibu	2012	Sedan - Midsize	Fusion	2022
G10-1140M	Chevrolet	Malibu	2012	Sedan - Midsize	Leaf	2027
G10-3576L	Chevrolet	Malibu	2015	Sedan - Midsize	Fusion	2022
G10-7547F	Dodge	Avenger	2008	Sedan - Compact	Leaf	2023

C.2 All Monitored Non-Sedan Vehicle Replacement Approach

Table C-2 provides a replacement approach using currently or soon-to-be available PEVs. Although not currently listed by GSA, these or similar vehicles may be listed by the year identified or NASWI may choose to justify the replacement. The replacement of these vehicles by PEVs is assumed in the analysis of Section 4.

Table C- 2. Command fleet all monitored non-sedan vehicle replacement approach.

GSA Replacement Approach						
Fleet Vehicle Id	**Make**	**Model**	**Year**	**EPA Class**	**Potential Replacement Vehicle**	**Replacement Year**
G41-1136K	Dodge	Grd Caravan	2010	Minivan	Leaf	2016
G41-1139K	Dodge	Grd Caravan	2010	Minivan	Fit	2017
G41-1140K	Dodge	Grd Caravan	2010	Minivan	Fit	2025
G41-1155K	Dodge	Grd Caravan	2010	Minivan	Outlander	2021
G41-1351G	Dodge	Dakota	2008	Pickup	Rav4	2023
G41-2911M	Chevrolet	Colorado	2012	Pickup	VTRUX PU	2027
G41-3153P	Dodge	Grd Caravan	2014	Minivan	Fit	2029
G41-3159P	Dodge	Grd Caravan	2014	Minivan	Fit	2029

G42-0587K	Chevrolet	Silverado	2010	Pickup	eNV200	2025
G42-0590K	Chevrolet	Silverado	2010	Pickup	eNV200	2025
G42-1232M	Ford	F150	2012	Pickup	Rav4	2027
G42-1281M	Ford	E0350	2013	Van 0 Pass	VTRUX Van	2019
G43-3437B	Ford	E0350	2006	Van 0 Cargo	eNV200	2026
G61-0513K	Ford	Explorer	2010	SUV	Outlander	2020

C.3 Unmonitored Sedan Fleet Replacement Approach

GSA currently lists only sedans for PEVs. It is assumed that additional sedans will be added to the list in the next few years. Table C-3 provides the list of sedans in the Commands fleet other than those monitored and included in Section C.1 above. The projected year of replacement is identified based upon the GSA requirements and expected usage. The mileage is projected from the odometer reading in 2015 and annual mileage provided by NASWI. The vehicles identified in green are candidates for replacement by PEVs in the analysis of Section 4.

Table C- 3. Departments fleet unmonitored sedan fleet replacement options.

GSA Replacement Approach						
Fleet Vehicle Id	**Make**	**Model**	**Year**	**EPA Class**	**Potential Replacement Vehicle**	**Replacement Year**
G10-3576P	Chevrolet	Malibu	2015	Sedan - Midsize	Volt	2022
G10-7550F	Dodge	Avenger	2008	Sedan - Compact	Volt	2022
G13-2162P	Ford	C0Max Hyb	2014	Sedan - Large	Fusion	2025

C.4 Unmonitored Non-Sedan Vehicle Replacement Approach

Table C-4 provides the list of non-sedans in the Commands fleet other than those monitored and included in Section C.2 above. The projected year of replacement is identified based upon the GSA requirements and expected usage. The mileage is projected from the odometer reading in 2015 and annual mileage provided by NASWI. The vehicles identified in green are candidates for replacement by PEVs in the analysis of Section 4. Certainly more vehicles can be replaced if desired.

Table C- 4. Command fleet unmonitored non-sedan replacement options.

GSA Replacement Approach						
Fleet Vehicle Id	**Make**	**Model**	**Year**	**EPA Class**	**Potential Replacement Vehicle**	**Replacement Year**
G41-1119K	Dodge	Dakota	2010	Pickup	VTRUX PU	2024
G41-1598L	Dodge	Dakota	2011	Pickup	Rav4	2026
G41-1599L	Dodge	Dakota	2011	Pickup	Rav4	2026
G41-2910M	Chevrolet	Colorado	2012	Pickup	Rav4	2027
G41-3122M	Chevrolet	Colorado	2012	Pickup	Rav4	2027
G41-3282L	Dodge	Grd Caravan	2012	Minivan	Outlander	2025
G41-5872H	Dodge	Dakota	2009	Pickup	eNV200	2024
G42-0281G	Chevrolet	G1300	2008	Van - Cargo	eNV200	2028
G42-0442M	Chevrolet	G1300	2012	Van - Cargo	VTRUX Van	2025
G42-0589K	Chevrolet	Silverado	2010	Pickup	Rav4	2025
G42-0591K	Chevrolet	Silverado	2010	Pickup	VTRUX PU	2025
G42-0596K	Chevrolet	Silverado	2010	Pickup	VTRUX PU	2025

G42-0611M	Chevrolet	G1300	2012	Van - Cargo	eNV200	2027
G42-0664K	Chevrolet	G1300	2010	Van - Cargo	Rav4	2030
G42-0665K	Chevrolet	G1300	2010	Van - Cargo	eNV200	2030
G42-0669K	Chevrolet	G1300	2011	Van - Cargo	eNV200	2026
G42-0671K	Chevrolet	G1300	2011	Van - Cargo	eNV200	2026
G42-1283M	Chevrolet	G1300	2013	Van - Pass	eNV200	2028
G42-2839H	Chevrolet	Silverado	2010	Pickup	VTRUX PU	2025
G43-0866K	Ford	E0350	2010	Van - Cargo	VTRUX Van	2022
G43-0867K	Ford	E0350	2010	Van - Cargo	eNV200	2030
G43-0894K	Ford	E0350	2010	Van - Pass	VTRUX Van	2018
G43-0898K	Ford	E0350	2010	Van - Pass	VTRUX Van	2020
G43-0912G	Ford	F250	2008	Van - Cargo	VTRUX Van	2023
G43-0916G	Ford	E0350	2008	Van - Cargo	eNV200	2028
G43-0917G	Ford	E0350	2008	Van - Cargo	eNV200	2028
G43-1169L	Chevrolet	G2300	2011	Van - Pass	VTRUX Van	2024
G43-2292M	Chevrolet	CG 3300	2012	Van - Cargo	eNV200	2027
G43-2326M	Ford	E0350	2012	Van - Cargo	eNV200	2027
G43-2327M	Ford	E0350	2012	Van - Cargo	eNV200	2027
G43-2328M	Ford	E0350	2012	Van - Cargo	eNV200	2027
G62-0166M	Chevrolet	Tahoe	2012	SUV	Outlander	2022
G63-0672K	Ford	F250	2011	Van - Cargo	Rav4	2025
G71-0087G	Ford	E0450	2008	Van - Cargo	VTRUX Van	2028
G71-0088G	Ford	E0450	2008	Van - Cargo	eNV200	2028
G71-0089G	Ford	E0450	2008	Van - Cargo	VTRUX Van	2028
G71-0090G	Ford	E0450	2008	Van - Cargo	eNV200	2028
G71-0091G	Ford	E0450	2008	Van - Cargo	eNV200	2028
G71-00984	Chevrolet	CP3144 Van	1998	Van - Cargo	VTRUX Van	2028
G71-03216	Chevrolet	C7500	2005	Van - Cargo	eNV200	2030
G71-0532B	Chevrolet	P42	2005	Van - Cargo	VTRUX Van	2025
G71-0673A	Chevrolet	P42	2005	Van - Cargo	eNV200	2025
G71-0677A	Chevrolet	P42	2005	Van - Cargo	eNV200	2025
G71-0678A	Chevrolet	P42	2005	Van - Cargo	eNV200	2020
G71-0679A	Chevrolet	P42	2005	Van - Cargo	eNV200	2025
G71-0681A	Chevrolet	P42	2005	Van - Cargo	VTRUX Van	2020
N9470757	Chevrolet	2500HD	2003	Pickup	Rav4	2023
N9480057	Chevrolet	2500HD	2008	Pickup	VTRUX PU	2023

Appendix D – Departments Fleet Vehicle Analysis

There are four replacement approaches identified for the Departments fleet:

- Monitored Vehicles
  - GSA-Listed PEVs only for sedans
  - All potential PEV types
- Un-monitored Vehicles part of the Full Fleet
  - GSA-Listed PEVs only for sedans
  - All potential PEV types for non-sedan vehicles

The extensive analysis conducted for monitored vehicles (Task 3) results in high confidence that the suggested vehicle can meet mission requirements. The suggested vehicles for the full fleet rely on the extrapolation of those monitored vehicles and the guidance identified in Section 3.

D.1 Monitored Vehicle GSA Replacement Approach

The sedans monitored are shown in Table D-1 along with potential replacement PEVs and year of potential replacement. The replacement of these vehicles by PEV is assumed in the analysis of Section 5.

Table D- 1. Departments fleet GSA sedan monitored vehicle replacement approach

GSA Replacement Approach						
Fleet Vehicle Id	**Make**	**Model**	**Year**	**EPA Class**	**Potential Replacement Vehicle**	**Replacement Year**
G10-0984N	Dodge	Avenger	2008	Sedan - Compact	Focus	2021
G10-1137M	Chevrolet	Malibu	2012	Sedan - Midsize	Leaf	2027
G10-1139M	Chevrolet	Malibu	2012	Sedan - Midsize	Fusion	2021
G10-1141M	Chevrolet	Malibu	2012	Sedan - Midsize	Fusion	2020
G10-2844L	Chevrolet	Malibu	2011	Sedan - Midsize	Fusion	2016
G10-2848L	Chevrolet	Malibu	2011	Sedan - Midsize	Fusion	2016
G10-2850L	Chevrolet	Malibu	2011	Sedan - Midsize	Fusion	2016
G10-2968L	Chevrolet	Malibu	2011	Sedan - Midsize	Fusion	2016
G10-3590P	Chevrolet	Malibu	2015	Sedan - Midsize	Leaf	2021
G10-5286H	Pontiac	G6	2009	Sedan - Compact	Volt	2019
G11-0472L	Chevrolet	Impala	2011	Sedan - Large	Fusion	2015
G11-1424L	Chevrolet	Impala	2012	Sedan - Large	Fusion	2015
G11-2898K	Chevrolet	Impala	2014	Sedan - Large	Fusion	2029

Note that the GSA schedule does not currently list the Leaf although it did in previous years. It is expected that it will be listed again by 2015.

D.2 Monitored Non-sedan Vehicle All Replacement Approach

Table D-2 provides a replacement approach for the non-sedan type monitored vehicles using currently or soon-to-be available PEVs. Although not currently listed by GSA, these or similar vehicles may be listed by the year identified or NASWI may choose to justify the replacement.

Table D- 2. Departments fleet non-sedan monitored vehicle replacement approach.

Monitored Vehicle All Replacement Approach					
Fleet Vehicle Id	**Model**	**Year**	**EPA Class**	**Potential Replacement PEV**	**Replacement Year**
G41-65991	Dodge Dakota	2002	Pickup Truck	VTRUX PU	2015

G43-25839	Ford F350	2003	Pickup Truck	eNV200	2015
G41-1288A	Sport Trac	2004	Pickup Truck	Rav4 EV	2015
G43-3717A	Ford E350	2004	Cargo Van	VTRUX Van	2015
G43-4937A	Ford E350	2004	Cargo Van	VTRUX Van	2015
G63-0271A	Ford F350Stake	2004	Stake Truck	NA	2015
G71-0674A	Ford F650 18'BO	2004	Delivery -Van	VTRUX Van	2015
G42-3471A	Chevrolet G2300	2005	Cargo-Van	eNV200	2015
G61-1155D	Ford Escape HYB	2006	SUV	Rav4 EV	2015
G42-0988F	Chev. Express 13	2007	Cargo -Van	VTRUX Van	2015
G41-1161G	Chevrolet Uplander	2008	Minivan	Rav4 EV	2015
G41-1180G	Chevrolet Uplander	2008	Minivan	Rav4 EV	2015
G41-1367G	Dodge Dakota	2008	Pickup Truck	Rav4 EV	2015
G41-1373G	Dodge Dakota	2008	Pickup Truck	Rav4 EV	2015
G41-1376G	Dodge Dakota	2008	Pickup Truck	Rav4 EV	2015
G41-1392G	Chevrolet Uplander	2008	Minivan	Outlander	2015
G41-1395G	Chevrolet Uplander	2008	Minivan	Rav4 EV	2015
G43-0860G	Chevrolet CG3300	2008	Passenger Van	VTRUX Van	2015
G62-0979G	Dodge 1500	2008	Pickup Truck	VTRUX PU	2015
G82-0509A	Ford F650 Stake	2004	Stake Truck	NA	2016
G43-3881H	Ford E350	2009	Passenger Van	VTRUX Van	2016
G62-4526H	Chevrolet Tahoe	2009	SUV	Outlander	2016
G41-1100K	Dodge GR Caravan	2010	Minivan	Outlander	2017
G43-0790K	Chevrolet CG3300	2010	Passenger Van	VTRUX Van	2017
G43-0792K	Chevrolet CG3300	2010	Passenger Van	VTRUX Van	2017
G43-0801K	Chevrolet CG3300	2010	Passenger Van	VTRUX Van	2017
G43-0875K	Ford E350	2010	Cargo Van	VTRUX Van	2017
G43-1389K	Chevrolet CG3300	2010	Passenger Van	VTRUX Van	2017
G71-0062G	Ford F750	2008	Stake Truck	NA	2018
G42-0698K	Chevrolet C1500	2011	Pickup Truck	VTRUX PU	2018
G43-1191L	Chevrolet CG3300	2011	Passenger Van	VTRUX Van	2018
G62-1094L	Chev. Avalanche	2011	SUV	Rav4 EV	2018

D.3 Unmonitored Sedan Fleet Replacement Approach

GSA currently lists only sedans for PEVs. It is assumed that additional sedans will be added to the list in the next few years. Table D-3 provides the list of sedans in the Departments fleet other than those monitored and included in Section D.1 above. The projected year of replacement is identified based upon the GSA requirements and expected usage. The mileage is projected from the odometer reading in 2015 and annual mileage provided by NASWI. The vehicles identified in green are candidates for replacement by PEVs in the analysis of Section 5.

Table D- 3. Departments fleet unmonitored sedan fleet replacement approach.

GSA Replacement Approach						
Fleet Vehicle Id	**Make**	**Model**	**Year**	**EPA Class**	**Potential Replacement Vehicle**	**Replacement Year**
G10-1142M	Chevrolet	Malibu	2012	Sedan - Midsize	Fusion	2017
G10-2845L	Chevrolet	Malibu	2011	Sedan - Midsize	Leaf	2026

G10-2849L	Chevrolet	Malibu	2011	Sedan - Midsize	Fusion	2016
G10-2945K	Chevrolet	Malibu	2010	Sedan - Midsize	Fusion	2017
G10-3568P	Chevrolet	Malibu	2015	Sedan - Midsize	Fusion	2024
G10-6402L	Chevrolet	Malibu	2012	Sedan - Midsize	Volt	2027
G10-7542F	Dodge	Avenger	2008	Sedan - Compact	Volt	2020
G10-7690F	Dodge	Avenger	2008	Sedan - Compact	Volt	2016
G11-0471L	Chevrolet	Impala	2011	Sedan - Large	Fusion	2015
G11-2120L	Chevrolet	Impala	2014	Sedan - Large	Leaf	2029
G11-2897K	Chevrolet	Impala	2014	Sedan - Large	Leaf	2029
G11-2899K	Chevrolet	Impala	2014	Sedan - Large	Leaf	2029
G12-0370L	Chevrolet	Malibu	2012	Sedan - Midsize	Volt	2027
G13-2163P	Ford	C-Max Hyb	2014	Sedan - Large	Fusion	2026
G13-2165P	Ford	C-Max Hyb	2014	Sedan - Large	Leaf	2029

D.4 Unmonitored Non-sedan Vehicle Replacement Approach

Table D-4 provides the list of sedans in the Departments fleet other than those monitored and included in Section D.2 above. The projected year of replacement is identified based upon the GSA requirements and expected usage. The mileage is projected from the odometer reading in 2015 and annual mileage provided by NASWI. The vehicles identified in green are candidates for replacement by PEVs in the analysis of Section 4. Certainly more can be replaced if desired.

Table D- 5. Departments fleet unmonitored non-sedan replacement options.

GSA Replacement Approach						
Fleet Vehicle Id	**Make**	**Model**	**Year**	**EPA Class**	**Potential Replacement Vehicle**	**Replacement Year**
CDC4960	Chevrolet	2500HD	2001	Pickup	Rav4	2020
G41-1121K	Dodge	Dakota	2010	Pickup	Rav4	2025
G41-1138K	Dodge	Grd Caravan	2010	Minivan	Outlander	2021
G41-1595L	Dodge	Dakota	2011	Pickup	VTRUX PU	2025
G42-0480M	Chevrolet	G1300	2012	Van - Cargo	eNV200	2030
G42-0594K	Chevrolet	Silverado	2010	Pickup	VTRUX PU	2025
G42-0891H	Ford	E0150	2009	Van 0 Pass	VTRUX Van	2019
G42-0892H	Ford	E0150	2009	Van 0 Pass	VTRUX Van	2024
G42-2034L	Chevrolet	Tahoe	2012	SUV	Outlander	2021
G43-0395M	Ford	E0350	2012	Van - Cargo	VTRUX Van	2022
G43-0826P	Ford	E350	2014	Van - Cargo	VTRUX Van	2019
G43-0887K	Ford	E0350	2010	Van - Cargo	eNV200	2030
G43-0893K	Ford	E0350	2010	Van - Pass	VTRUX Van	2020
G43-1166L	Chevrolet	G2300	2011	Van - Pass	VTRUX Van	2021
G43-1182L	Chevrolet	CG3300	2011	Van - Pass	VTRUX Van	2021
G43-1198L	Ford	F250	2011	Van - Cargo	VTRUX Van	2024
G43-1239L	Ford	F250	2011	Van - Cargo	eNV200	2026
G43-2284M	Chevrolet	C2500HD	2012	Van - Cargo	VTRUX Van	2025
G62-0872K	Ford	Expedition	2010	SUV	Outlander	2021
G62-0873K	Ford	Expedition	2010	SUV	Outlander	2015
G62-0874K	Ford	Expedition	2010	SUV	Outlander	2015

G62-0876K	Ford	Expedition	2010	SUV	Outlander	2015
G62-0877K	Ford	Expedition	2010	SUV	Outlander	2015
G62-1060G	Chevrolet	Tahoe	2008	SUV	Outlander	2019
G62-2418P	Ford	F150 SSV	2014	Van - Cargo	VTRUX Van	2026
G62-2436P	Ford	F150 SSV	2014	Pickup	eNV200	2029
G62-4519H	Ford	Expedition	2009	SUV	Outlander	2015
G63-0623G	Chevrolet	K3500	2008	Van - Cargo	eNV200	2025
G63-0660K	Ford	F350	2011	Van - Cargo	VTRUX Van	2021
G63-0661K	Ford	F350	2011	Van - Cargo	VTRUX Van	2017
G63-0662K	Ford	F350	2011	Van - Cargo	eNV200	2026
G63-0671K	Ford	F250	2011	Van - Cargo	VTRUX Van	2019
G71-0091M	Ford	E0450	2012	Van - Cargo	VTRUX Van	2027
N9413660	Chevrolet	CP20842	1982	Van - Cargo	eNV200	2018
N9415459	Ford	Ranger	1983	Pickup	Rav4	2015
N9415462	Ford	Ranger	1983	Pickup	Rav4	2015
N9415470	Ford	Ranger	1983	Pickup	Rav4	2015
N9415974	Dodge	B150	1984	Van - Cargo	eNV200	2015
N9418510	Dodge	Ram 50	1985	Pickup	Rav4	2015
N9420381	Dodge	D150	1985	Van - Cargo	Rav4	2015
N9431404	Chevrolet	C30	1988	Van - Cargo	eNV200	2015
N9433319	Chevrolet	Astro	1988	Van - Cargo	eNV200	2018
N9443221	Dodge	Ram150	1990	Pickup	Rav4	2015
N9443893	Ford	Ranger	1990	Pickup	Rav4	2015
N9445978	Chevrolet	S10	1991	Pickup	Rav4	2015
N9445981	Chevrolet	S10	1991	Pickup	Rav4	2015
N9449268	Dodge	Ram 350	1992	Van - Cargo	eNV200	2017
N9484841	Ford	F450	2011	Van - Cargo	eNV200	2026
N9498710	Chevrolet	C10	1976	Van - Cargo	Rav4	2015