

Purpose of the Advanced Vehicle Testing Activity Study

Federal agencies are mandated¹ to purchase alternative fuel vehicles, increase the use 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 vehicles in terms of energy efficiency, reduced petroleum consumption, and reduced emission of greenhouse gasses (GHG). PEVs also provide performance benefits with quieter, smoother operation. This Advanced Vehicle Testing Activity study evaluates the extent that federal agency fleets could convert part or all of their vehicles from petroleum-fueled vehicles to PEVs.

Benefits



Ford Focus BEV

The large number of vehicles in federal fleets in the United States provides a substantial opportunity for introduction of BEVs and PHEVs (collectively referred to as PEVs).

BEVs provide the greatest benefit when it comes to fuel savings and emissions reductions, because the energy stored in the onboard battery pack provides all motive power. These vehicles use no petroleum for transportation and emit no pollutants at their point of use. PHEVs provide similar savings when their battery provides motive power; however, they also have the ability to extend their operating range with an onboard internal combustion engine.

The adoption of a PEV as a replacement for a fleet vehicle is dependent on the vehicle's travel characteristics and "mission" (e.g., other transportation needs such as cargo or passenger carrying). The assessment of the scale of this PEV replacement opportunity requires additional data to characterize the various missions performed by each fleet and to determine which existing vehicles may be suitable for replacement by a PEV.

Methods

The participating agency identifies the vehicles in their federal fleet, along with their mission assignments (as selected from the definitions shown below). Data loggers are installed on a representative subset of the fleet's vehicles and they provide information on travel patterns and vehicle use. Intertek Testing Services, North America analyzes the vehicle data collected, along with the mission assessments, to produce the study observations.

Case Studies

Caribou-Targhee National Forest

Area: more than 3 million acres

Total federal fleet: 132 vehicles

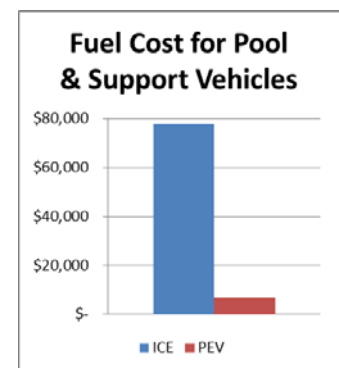
Vehicles studied: 12

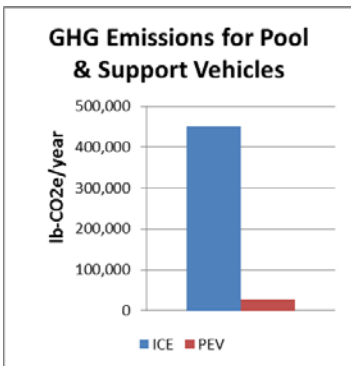
Vehicle missions studied: Pool and support (represents 89 of the 132 vehicles in the fleet)

Observations: PEVs that are currently commercially available cannot replace certain vehicles and missions, such as those requiring heavy-duty trucks and vans (some of which were included in this study). However, based on evaluation of the data collected from the vehicles representing the fleet of 89 vehicles with pool and support missions, the fleet could consist of 16 heavy-duty and/or light-duty pickup trucks, 28 BEVs, and 45 PHEVs.

Electric power generation in the Idaho Falls region relies heavily on hydroelectric sources. This generation mix further increases the benefits of PEVs in this fleet, because the cost of generating electricity is low, resulting in greater fuel savings, and power generation is cleaner, resulting in greater GHG reduction.

The costs and benefits identified involve only those miles traveled where the PEV battery's motive power replaces the petroleum of the existing fleet. Fuel costs are reflective of those in the Idaho Falls, Idaho region.





For the 73 vehicles potentially replaced with PEVs, the fuel costs are estimated to decrease from \$77,896 to \$6,873 (91% reduction). GHG emissions are estimated to decrease from 450,567 lb-CO₂e/yr to 26,846 lb-CO₂e/yr (94% reduction).

PEV recharging assumes the charging stations are located only at the vehicle's home base. Because of the large geographic area of this national forest, there would be little benefit from installation of other opportunity charging stations.

The national forest may benefit from a vehicle replacement plan that considers the projected availability of PEVs, along with their current plan for vehicle replacement.

The full report for Caribou-Targhee National Forest is located at <http://avt.inl.gov/pdf/phev/VehicleUtilizationAtCaribou-Targhee.pdf>.

Golden Gate National Recreation Area

Area: 75,000 acres

Total federal fleet: 182 vehicles

Vehicles studied: 14

Vehicle missions studied: support, enforcement (represents 105 of the 182 vehicles in the fleet)

Observations: Based on evaluation of the data collected from the vehicles representing the fleet of 105 vehicles with support and enforcement missions, the fleet could consist of 68 BEVs and 37 PHEVs.

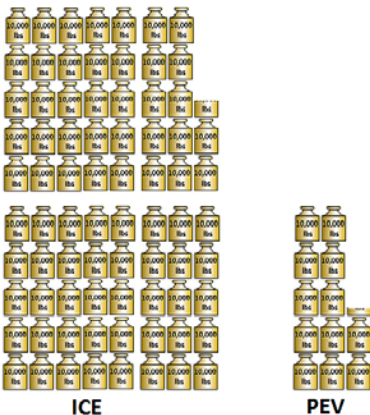
The GHG emissions from energy production in the San Francisco Bay Area and the local energy costs were utilized in this evaluation along with the average local cost of gasoline and internal combustion vehicle GHG emissions.

Fuel Cost



GHG Emissions

lb-CO₂e/yr



The costs and benefits identified involve only those miles traveled where the PEV's battery motive power replaces the petroleum of the existing fleet.

For these 105 vehicles potentially replaced by PEVs, the fuel costs are estimated to decrease from \$156,000 to \$65,000 (58% reduction). GHG emissions are estimated to decrease from 775,000 lb-CO₂e/yr to 123,000 lb-CO₂e/yr (84% reduction).

PEV recharging assumes the charging stations are located at the vehicle's home base. Because this agency is located in the greater San Francisco area, additional charging opportunities at publicly available chargers or additional chargers located at select locations in the recreation area may provide additional benefits to extend the range of the PEVs operating in battery-only mode.

The Golden Gate National Recreation Area may benefit from a vehicle replacement plan that considers the projected availability of PEVs, along with their current plan for

vehicle replacement.

The full report for Golden Gate National Recreation Area is available at <http://avt.inl.gov/pdf/phev/VehicleUtilizationAtGoldenGate.pdf>.

Vehicle Missions

The following figure shows examples of vehicles in each mission type. A **pool vehicle** is any automobile manufactured primarily for use in passenger transportation, with no more than 10 passengers. An **enforcement vehicle** is a light-duty vehicle that is specifically approved for apprehension, surveillance, site security, parking enforcement, police, or other law enforcement work. **Support vehicles** are light-duty vehicles that may contain after-market modifications to support the fleet mission. **Transport vehicles** are light, medium, or heavy-duty vehicles designed to transport equipment or supplies. **Specialty vehicles** provide a specific purpose or mission (such as ambulances, mobile cranes, etc). **Shuttles/buses** carry more passengers than typical pool vehicles. **Low-speed vehicles** are legally limited to roads with posted speed limits up to 45 mph.



Pool Vehicle



Enforcement Vehicle



Support Vehicle



Transport Vehicle



Specialty Vehicle



Shuttle / Bus



*Low Speed
Vehicles*

Company Profiles

Battelle Energy Alliance, LLC, managing and operating contractor for the U.S. Department of Energy's Idaho National Laboratory, is the lead laboratory for the U.S. Department of Energy's Advanced Vehicle Testing. Battelle Energy Alliance, LLC contracted with Intertek Testing Services, North America to collect and evaluate data on federal fleet operations as part of the Advanced Vehicle Testing Activity's Federal Fleet Vehicle Data Logging and Characterization study. This Advanced Vehicle Testing Activity study seeks to collect and evaluate data to validate the utilization of advanced electric drive vehicle transportation.

Intertek Testing Services, North America is part of Intertek Group, which adds value for its customers by helping them achieve their desired level of quality and safety for their products, assets, and processes to protect their brands and enable their success in the global marketplace. Intertek Testing Services, North America has been involved in PEV testing and evaluation since 1989 and works with major automotive manufacturers, utilities, the U.S. Department of Energy, state and municipal governments, and international research institutes to implement and expand the presence of this technology for a greener future.

Idaho National Laboratory is one of the U.S. Department of Energy's 10 multi-program national laboratories. The laboratory performs work in each of the U.S. Department of Energy's strategic goal areas: energy, national security, science, and the environment. Idaho National Laboratory is

the nation's leading center for nuclear energy research and development. Day-to-day management and operation of Idaho National Laboratory is the responsibility of Battelle Energy Alliance, LLC.

References

¹Energy Policy Act of 1992, Energy Policy Act of 2005, Executive Order 13423, Energy Independence and Security Act of 2007

No part of the contents of this document may be reproduced or transmitted in any form or by any means without the express written permission of Intertek Testing Services, North America and the U.S. Department of Energy.



Intertek Testing Services, North America
430 S. 2nd Ave.
Phoenix, AZ 85003



Idaho National Laboratory
2525 North Fremont Avenue
PO Box 1625
Idaho Falls, ID 83415