

## Electric Vehicles in Pennsylvania

Consumers in Pennsylvania now have many choices to make when purchasing a vehicle, including the option to purchase a vehicle that runs, in part, or in full, on electricity.

Hybrid electric vehicles (HEVs) and plug-in hybrid electric vehicles (PHEVs) are primarily powered by an internal combustion engine that runs on conventional or alternative fuel and an electric motor that uses energy stored in a battery. The battery is charged by the engine and by regenerative braking. PHEVs can be plugged into an electric power source to charge the battery. Electricity is used either as their primary fuel for short urban trips of 25 miles or less or to improve the conventional fuel use efficiency for long range travel. The Chevy Volt, Ford C-Max Energi, Toyota Plug-in Prius, Cadillac ELR, and BMW-i8 are examples of leading PHEV's on the market today.

All-electric vehicles (EVs) use an electric motor as their sole source of power. The electric motor driven by magnets uses energy stored in a battery. The battery is charged by being plugged into an electric power source and through regenerative braking. Tesla Model S and Model X Crossover, the Nissan Leaf, the BMW i3, and the Chevy Bolt are examples of EV cars currently or soon to be on the market.

There are over 2,300 electric vehicles registered in Pennsylvania as of July 2015.

### How and where to charge a PHEV or EV in Pennsylvania

Charging frequently maximizes the range of all-electric vehicles and the EV-only miles of PHEVs. Most drivers accomplish more than 80 percent of their charging at home. Use of a standard electric power outlet is referred to as level 1 charging and is often the least expensive charging option. Level 1 charging provides charging through a 120 Volt AC plug much like any appliance in a home. Time to fully recharge an EV battery from empty usually takes between 8 to 10 hours.

Level 2 chargers can be located at home, work, fueling stations, convenience stores, parking garages, and shopping plazas. Level 2 chargers provide charging through a 208-240 V plug and may require installation of additional charging equipment like transformers. Charging time to fully recharge an EV battery from empty usually takes between 4 to 5 hours.

Direct Current (DC) fast chargers are being installed at public locations throughout Pennsylvania, especially along heavy traffic corridors like the Pennsylvania Turnpike and Philadelphia and Pittsburgh. DC fast chargers provide charging through 480 V AC input and require highly specialized electronic circuits, wiring, and high-powered transformers as well as special equipment in the vehicle itself (PHEVs typically do not have fast charging capabilities). DC fast chargers can deliver 60 to 100 miles of range in 20 minutes of charging.

The U.S. Department of Energy (DOE) and the Pennsylvania Department of Environmental Protection's (DEP) Alternative Fuels Incentive Grant Program are supporting research and pilot projects to develop and improve wireless charging technology. Wireless chargers are currently available for use with certain vehicle models like the Tesla model S. Wireless charging technology uses an electro-magnetic field to transfer electricity to an EV without a cord.

### **Types of Plugs**

There are no "one plug fits all" standards for PHEVs and EVs. Many of the automobile manufacturers have adopted different plug formats and configurations. One type, generally used by Japanese automakers, is called CHAdeMO; another, typically used by American and European companies, is SAE J1772. Tesla has their own type of charging format. Charging formats are not all compatible with each other. Some auto manufacturers will provide adapters to work with other types of charge plug configurations for an additional fee. An increasing number of fast chargers have outlets for both SAE and CHAdeMO fast charging.

### **Where to Charge in Pennsylvania**

Charging station infrastructure continues to grow. Public charging stations are not as common as gas stations, but charging equipment manufacturers, automakers, utilities, Clean Cities coalitions, municipalities, and government agencies are establishing a rapidly expanding network of charging infrastructure. In the U.S., the number of publicly accessible charging stations surpassed 8,800 in 2014. There are currently over 250 public charging

stations available across the state of Pennsylvania. More information on charging stations in Pennsylvania is available [here](#).

DEP has been working to develop a network of EV charging stations throughout Pennsylvania. Level II and Level III charging stations are currently being deployed along the Pennsylvania Turnpike as well as other locations across the state.

### **Benefits of PHEVs and EVs:**

According to DOE, on average, it costs about [half as much to drive an electric vehicle](#). The fuel efficiency of an all-electric vehicle may be measured in kilowatt-hours (kWh) per 100 miles rather than miles per gallon. To calculate the cost per mile of an all-electric vehicle, the cost of electricity (in dollars per kWh) and the efficiency of the vehicle (how much electricity is used to travel 100 miles) must be known. For example, if electricity costs 11 cents per kWh and the vehicle consumes 34 kWh to travel 100 miles, the cost per mile is about 4 cents. When gasoline costs \$2.50 per gallon, a car getting 25 miles per gallon would cost 10 cents per mile to operate.

PHEVs and EV's have significant environmental benefits over conventional gasoline or diesel-powered cars, including reduced greenhouse gases and oxides of nitrogen and sulfur. EVs produce zero tailpipe emissions and have no engine oil or lubricants to change and dispose of. PHEVs produce no tailpipe emissions when in all-electric mode. Fewer tailpipe emissions from PHEV's also reduces the visible smog in heavily-populated urban areas, while minimizing other pollutants, improving overall air quality and public health.

Using PHEV's and EV's instead of conventional vehicles can help reduce U.S. reliance on imported petroleum and increase energy security.

### **Incentives for Electric Vehicles**

#### **Pennsylvania Alternative Fuels Incentive Grant Program (AFIG)**

DEP offers the AFIG Program for projects that improve Pennsylvania's air quality and reduce consumption of imported oil through the use of homegrown alternative fuels that will help the state's economy and environment.

The AFIG Program offers rebates to assist eligible residents with the incremental cost of the purchase of new alternative fuel vehicles, including EVs, PHEVs, and other alternative fuel vehicles. Rebates of up to \$2,000 are available for qualified EVs and PHEVs, and rebates of \$500 are available for electric motorcycles and scooters.

For more information, see the [AFIG Program](#) and [Alternative Fuel Vehicle Rebates](#) websites.

#### **Plug-In Electric Vehicle (PEV) Rebate - PECO**

PECO provides rebates of \$50 for their residential electric customers who purchase a new, qualified PEV. For more information, see the [PECO Smart Driver Rebate website](#). Check with other utility companies to look for similar incentives.

#### **Federal Tax Credit**

The Federal government provides incentives for certain types of alternative fuel vehicles and infrastructure. Certain types of plug-In electric vehicles qualify for a federal tax credit. More information on Federal incentives is available [here](#).

#### **For More Information:**

[U.S. Department of Energy-Alternative Fuels Data Center](#)

[U.S. Department of Energy-EV Everywhere](#)

[Eastern Pennsylvania Alliance for Clean Transportation](#)

[Pittsburgh Region Clean Cities](#)

[Electric Drive Transportation Association](#)

For more information, visit [www.dep.pa.gov](http://www.dep.pa.gov).