

Electric Vehicles in Pennsylvania

Pennsylvania residents have many choices to make when purchasing vehicles. There are hundreds of styles, options, and packages available. An option that is becoming increasingly available in new models are vehicles that plug-in and run on electricity. Vehicles that plug-in are often referred to as electric vehicles (EVs). EVs come in different configurations based on a driver's desired driving preferences and availability to re-charge. However, one common theme for EVs is improved air quality, with typically less overall greenhouse gas emissions compared with conventional vehicles. This fact sheet is organized to provide an overview of the EV options and provide the basics of re-charging these vehicles in Pennsylvania, as well as, incentives to purchase.

Types of Electric Vehicles (EVs)

There are two primary types of EVs, and the distinction is based on whether an internal combustion engine is onboard or absent completely from the vehicle. Plug-in hybrid electric vehicles (PHEVs) have two power supplies, an electric motor and an internal combustion engine. Battery electric vehicles (BEVs) use an electric motor as their sole source of power.

Plug-in hybrid electric vehicles (PHEVs) have an electric motor that operates using energy stored in lithium batteries for trips of 50 miles or less. The battery is re-charged through a combination of plugging in to an electrical outlet (or charging station) and use of regenerative braking. After the battery is depleted on a longer trip, an internal combustion engine (usually a gasoline engine) takes over and provides power to the vehicle for longer-range travel. The primary design purpose of PHEVs is to provide a similar driving experience for buyers that are accustomed to driving conventional vehicles. The Chevy Volt and Ford C-Max Energi are examples of leading PHEVs on the market today.

BEVs use an electric motor as their sole source of power. The electric motor is driven by magnets that use energy stored in a lithium battery. The lithium battery is charged through regenerative braking and routinely by being plugged into an electric power source to charge it. The elimination of a gasoline engine reduces vehicle maintenance and weight. BEVs are increasingly being developed for 200+ miles driving range before re-fueling. Lithium battery prices are dropping yearly, making extended driving ranges possible and more affordable. Tesla Model S, X, and 3, Nissan Leaf, BMW i3, and Chevy Bolt are examples of BEVs on the market.

There are new and updated models of PHEVs and BEVs coming from all the major auto makers in the coming years. With over 7,500 BEVs registered in Pennsylvania as of December 2018, these numbers are expected to grow and take more of the new car sales market share.

What to Know About Charging EVs

Electric Vehicle Supply Equipment (EVSE) are the cords/assemblies that connect and safely deliver electricity to the vehicle's battery from an electric power source, such as the electric service in a home or building. Most EVSE are designed to provide Level 1 or Level 2 charging. Level 1 charging uses 120 Volts, which is the standard outlet in the U.S. homes. Level 2 charging uses 208- or 240-Volt, which is similar to the power needs for things like large appliances, such as electric water heaters, dryers, and ranges.

Most drivers do more than 80 percent of their charging at home. Home charging can be done using Level 1 or Level 2. Level 1 charging is the least expensive option, as EVSE associated with Level 1 is typically supplied with your vehicle on purchase. EV owners plug their vehicles in when not in use for extended periods of time, such as, plugging in to a wall outlet overnight. Level 1 charging can deliver about 5 miles of driving range per hour and depending on how much of the battery has been used, this could amount to 8-16 hours (or longer) to receive a full battery charge.

Level 2 charging can be accomplished at home, work, convenience stores, parking garages, shopping plazas, and anywhere a host is willing and able to provide access to a 208- or 240-Volt source of electricity. EVSE associated with Level 2 charging can deliver about 12 to 25 miles of range per hour, depending on the electrical configuration and the specific vehicle. This may take anywhere from 4 to 8 hours depending on how much that battery is depleted and the vehicle type. Level 2 charging usually involves hiring a certified electrician to make upgrades to wiring and circuits in the home (or building).

Most recently, Direct Current (DC) Fast Charging Stations are being installed at public locations throughout Pennsylvania. DC Fast Charging requires high power outputs providing 50 to 350 kilowatts (kW) of power per vehicle connection. These stations require substantial investment and power needs. The electric grid delivers

Alternating Current (AC) to our homes and businesses. DC Fast Charging Stations convert AC into DC. DC power is provided directly to your battery and will provide a faster charge. (Note: PHEVs typically do not have fast charging capabilities.) DC Fast Chargers can deliver over 200 miles of range per hour of charging or provide about 80 percent charge in 30 minutes or less. DC fast chargers are most often located (or will be in the coming years) along heavy traffic corridors like the Pennsylvania Turnpike, interstate highways, and around urban areas.

Types of Plugs

There are no “one plug fits all” for PHEVs and EVs. Automobile manufacturers have developed different types of plug standards, based on what they believed would take off in the market and work well in the future. Manufacturers did not agree on a single standard, and so, we have four primary types of plugs in use today.

- SAE J1772: J1772 is a standard plug for Level 2 charging. All automakers use J1772. (Tesla offers an adaptor to use J1772.)
- CHAdeMO: CHAdeMO is a standard plug used for DC Fast Charging by automakers such as Nissan, Mitsubishi, and Kia. (Tesla offers an adaptor to use CHAdeMO.)
- SAE Combo CCS: SAE Combo CCS is a standard plug used for DC Fast Charging by automakers such as BMW, VW, and Chevy. All upcoming United States (U.S.) and European cars plan to use this standard.
- Tesla: Tesla has its own plug type developed for DC Fast Charging Teslas.

Where to Charge in Pennsylvania

Charging station infrastructure continues to grow. Public charging stations are not as ubiquitous 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 23,000 in 2019. There are currently over 490 public charging stations available across the state of Pennsylvania. More information on charging stations in Pennsylvania is available at: www.afdc.energy.gov or download the Alternative Fueling Station Locator app for smart phones provided by the Department of Energy’s National Renewable Energy Laboratory.

Benefits of EVs

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 \$0.11 per kWh and the vehicle consumes 34 kWh to travel 100 miles, the cost per mile is about \$0.04. According to the U.S. Department of Energy, on average, it costs about half as much to drive an electric vehicle www.energy.gov/eere/electricvehicles/saving-fuel-and-vehicle-costs.

EVs have significant environmental benefits over conventional gasoline or diesel-powered cars, including reduced greenhouse gases as well as oxides of nitrogen and sulphur. BEVs produce zero tailpipe emissions, and PHEVs produce no tailpipe emissions when in all-electric mode. Less (or zero) tailpipe emissions reduces the visible smog in heavily-populated urban areas, while minimizing other pollutants, improving overall air quality and public health.

Using EVs 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)

The Department of Environmental Protection (DEP) offers Alternative Fuels Incentive Grants for projects that improve Pennsylvania’s air quality and reduce consumption of imported oil using homegrown alternative fuels that will help the state’s economy and environment.

AFIG grants continue to be awarded to expand EV adoption and EV charging stations throughout Pennsylvania.

The AFIG Program also offers rebates to assist eligible residents with the incremental cost of the purchase of new Alternative fuel vehicles (AFVs), EVs, PHEVs, and other alternative fuel vehicles. Rebates of up to \$1,500 are available for qualified EVs and PHEVs, and rebates are available for electric motorcycles.

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 to residential customers in their service territory who purchase a new, qualified PEV. For more information, see the PECO Smart Driver Rebate website: <https://secure.peco.com/WaysToSave/ForYourHome/Pages/PECOSmartDriverRebate.aspx>. 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 EVs qualify for a federal tax credit. More information on federal incentives is available at: www.afdc.energy.gov/laws/fed_summary.

For More Information

U.S. Department of Energy-Alternative Fuels Data Center: www.afdc.energy.gov

U.S. Department of Energy-EV Everywhere: energy.gov/eere/electricvehicles/electric-vehicles

Eastern Pennsylvania Alliance for Clean Transportation: www.ep-act.org

Pittsburgh Region Clean Cities: www.pgh-cleancities.org

Plug-In America Home Page: www.pluginamerica.org

Electric Drive Transportation Association: www.electricdrive.org

Electric Automobile Association Online Community: www.electrcauto.org

Drive Electric Pennsylvania Coalition: www.driveselectricpa.org

For more information, visit www.dep.pa.gov.