**VEHICLE TYPES AND IMPACTS**

Electric vehicles (EVs) generally fall under the following three categories:

- **Battery Electric Vehicles (BEVs)** – powered by electric motors and are offered in a wide range of vehicle types for both short- and long-distance travel
- **Low Speed Vehicles (LSVs)** – lightweight vehicles powered by an electric motor with a maximum speed of 25 mph
- **Plug-In Hybrid Vehicles (PHEVs)** – have both an electric motor and a gasoline motor to benefit from both fuel types; these are ideal when charging availability is limited or uncertain
- **Fuel Cell Electric Vehicle (FCEV)** – powered by hydrogen and emit only water vapor and warm air

![Ford Focus, Battery Electric Model (BEV)](image1)
![Columbia Electric Utilitruck (LSV)](image2)
![Chrysler Pacifica, Plugin Hybrid Model (PHEV)](image3)
![Hydrogen Powered Street Sweeper (FCEV)](image4)

Internal combustion engine vehicles (ICEVs) cover all vehicles that are powered by combustion, most commonly by burning gasoline or diesel. Alternative fuel vehicles (AFVs) are a subset of ICEVs that are powered by fuel sources such as compressed natural gas.

In some cases, the utility of a vehicle may not be able to be fulfilled by the current selection of EVs available; however, lower emissions options may be available and should be considered.

**Achieving Penn’s CSAP Goals**

*Penn’s Climate and Sustainability Action Plan (CSAP) 3.0* expands upon the previous two iterations to address reducing Penn’s emissions. The main goals regarding Penn’s campus fleets are as follows:

- Achieve carbon neutrality by 2042
- Encourage purchasing of low- or zero- emissions vehicles
- Increasing the number of electric vehicle charging stations as demand requires

This guide aims to address these goals by providing a comprehensive set of resources and recommendations for purchasing and funding vehicles.

When possible, **preference should be given to battery electric vehicles** (BEVs) because of their greater ability to contribute to Penn’s CSAP carbon neutrality goal. Research shows that the
emissions associated with the lifecycle of BEVs are significantly less than their gas or diesel internal combustion engine vehicle (ICEV) counterparts, especially considering the energy makeup of Philadelphia’s electrical grid combined with projected increases in renewable energy sources both for the electrical grid and through Penn’s Power Purchase Agreement.

For more information on the global warming potential (GWP) of EVs see Appendix I: Global Warming Potential (GWP) of EVs.

Lifecycle Cost

In addition to reduced emissions, one of the major benefits of incorporating electric vehicles (EVs) into Penn’s fleets is the lowered cost of maintenance over time. EVs cost less on average to keep running than internal combustion engine vehicles (ICEVs) since they don’t need regular oil changes and have fewer moving parts that need to be maintained or replaced. According to a 2020 report conducted by Consumer Reports, the lifetime average maintenance cost per mile for EVs, both battery and hybrid, is half that of ICEVs. Battery electric vehicles and plugin hybrid electric vehicles have a lifetime (defined as 200,000 miles) average maintenance cost of about $0.03/mile, whereas ICEVs cost about $0.06/mile.

The cost to power EVs is also lower than it is for ICEVs. In Philadelphia, it costs almost 4 times more to fuel a gasoline powered ICEV than an EV. Based on the average price of commercial electricity for Philadelphia, a compact passenger EV costs about $5.12 to drive 250 miles. In comparison, based on average gasoline prices in Philadelphia, an equivalent gasoline powered ICEV costs about $18.90 for the same distance.

There are also federal tax credits worth up to $7,500 available for certain battery EV and hybrid EV models, as viewed here. Though the University cannot take advantages of these tax credits if purchasing directly, the tax credit can be claimed when purchasing via the Climate Mayors EV Purchasing Collaborative. For more information on the Collaborative, see the Purchasing Process section of this guide or view the Collaborative’s webpage. The commonwealth also provides rebates and other incentives for fleet replacement and installing EV chargers (see the table below for more information).