



PJM Interconnection has helped demonstrate and evaluate how plug-in electric vehicles can benefit, and be integrated into, the electric grid.

## What Are Plug-In Electric Vehicles?

Battery-powered electric vehicles and plug-in hybrid electric vehicles are two types of plug-in electric vehicles (PEVs). A battery-powered electric vehicle has a large, rechargeable battery pack. A plug-in hybrid electric vehicle has both a gasoline engine and a smaller battery pack.

Ideally, PEVs would draw electricity from the grid during off-peak or low-price periods. This timing would enhance the efficiency of the grid by reducing the difference between off-peak and peak demand levels and enable traditional power plants to operate more steadily and efficiently. Currently, those hours typically are on nights and weekends.

A sharply higher outlook for PEV sales spurred the decision to factor the impacts of plug-in electric vehicles into the PJM Load Forecast Report beginning in 2020.

## Returning Energy to the Grid

Some PEVs are also capable of providing electric services to the grid. This concept is called vehicle-to-grid (V2G) technology or demand response. Large numbers of electric vehicles plugged in and virtually aggregated as a single resource, such as a fleet of school buses, can serve as a large “battery on the grid” or “virtual power plant.” As such, they can provide some electricity services similar to what more traditional power plants supply today.

One such service is frequency regulation, used to balance short-term variations between load and generation that might affect the stability of the power system. Frequency regulation, a service procured through PJM’s Regulation Market, adjusts generation output or load consumption to maintain the desired frequency and power flow on the system.

## Learning From Past Partnerships

PJM was an integral partner in one of the first successful demonstrations of V2G technology at the University of Delaware. The initiative showed that the cars can both charge and discharge, and earn revenue, similar to a generation asset.

PJM also has previously partnered with companies, including BMW North America and General Motors OnStar, to demonstrate the potential of aggregated fleets of PEVs to respond to certain types of grid signals, such as prices.

Most recently, Dominion Energy, a PJM member, has deployed 50 electric buses to Virginia school districts with the intention of them providing additional energy storage technology for the grid. The bus batteries can inject stored energy back into the system when the vehicle is not needed for transport.

PJM looks forward to playing a role in powering the future fleet of PEVs and enabling their ability to interact with the grid in innovative ways to maintain reliable and cost-efficient electricity.

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### Key Facts

- PJM has helped demonstrate how electric vehicles can benefit the power grid.
- PEVs ideally draw power from the grid during off-peak periods. Now, that’s on nights and weekends.
- PEVs are capable of providing services to the grid similar to traditional power plants. One such service is frequency regulation.
- PJM partnered with the University of Delaware to demonstrate V2G technology.

