PJM Interconnection is interested in advancing the electrification of the transportation system, particularly with respect to the role of electric and plug-in hybrid electric vehicles. PJM is helping to demonstrate and evaluate how these vehicles can be integrated into and benefit the electric grid.

While there are different configurations of electric vehicles, a battery EV has a plug for connecting to the electric system to charge the batteries that power it. A plug-in hybrid electric vehicle, or PHEV, is a vehicle with a gasoline engine that also includes batteries that can be recharged by plugging it in. Together, these vehicles are commonly referred to as plug-in electric vehicles, or PEVs.

Ideally, the electrification of the transportation system would use off-peak electricity (nights and weekends) from the grid to charge vehicles. This would enhance the efficiency of the grid by shifting electricity use to the off-peak, nighttime hours, reducing the difference between off-peak and peak demand levels and allowing traditional power plants to operate more steadily and efficiently. However, over the long-term and as the growth of renewable energy continues, it could become better to charge PEVs whenever there is an abundance of renewable energy available on the grid. For example, if there is a large amount of solar energy being produced, this could mean that it would be best to charge PEVs in the middle of the day.

PEVs also are capable of providing electric services to the grid. This concept is called vehicle-to-grid (V2G). With large numbers of such vehicles plugged in and aggregated together through software solutions as a single resource, they could serve as a large “battery on the grid” and provide many electricity services similar to a power plant.

One such service that these vehicles can provide is regulation, which is used to balance short-term variations between load and generation that might affect the stability of the power system. Regulation helps match generation and load and adjusts generation output or load consumption to maintain the desired frequency.

In an initiative with the University of Delaware and NRG Energy, a group of electric vehicles is providing this service through the PJM Regulation Market. The project aggregates power from multiple electric vehicles to create one larger power resource, rather than smaller, individual resources, and demonstrated for the first time that electric vehicle-to-grid technology can sell electricity from the vehicles to the power grid. This kind of energy storage, such as large-scale batteries or those in a fleet of vehicles, can take wind power generated at night and store it to use during the day when demand is higher.

Partnering with the Electric Power Research Institute and The Ohio State University’s Center for Automotive Research, respectively, PJM also has sponsored two electric vehicle summit meetings that brought together representatives of the electric industry, automakers, academia and government to discuss how electric vehicles can be integrated into the grid, their role as storage devices to help expand the use of intermittent resources like wind energy, and their role in the smart grid.