ABSTRACT:
The electrification of transportation has become a cornerstone of our efforts to conserve energy, protect the environment, and reduce our nation's dependence on fossil fuels, which are a geopolitically insecure and dwindling energy source. This research work focuses on light-duty plug-in electric vehicles (PEVs), because they represent a very significant and timely electric transportation technology. PEVs—either plug-in hybrid electric vehicles or pure electric vehicles—adopt similar drivetrains as hybrid electric vehicles (HEVs), but are equipped with higher-capacity batteries, allowing electricity from the power system to displace a significant portion of petroleum consumed in the transportation sector. Accelerating the development of PEV technology is recognized as an essential part of the solution to the energy and environmental problems around the world.

This work studies various aspects of integrating PEVs into the electric power system, including:

- Power electronics topology that enables bidirectional power transfer between plug-in hybrid electric vehicle (PHEVs) and grid.
- Estimation of the electric energy and power consumption from light-duty PEVs.
- On the choice between uncontrolled and controlled charging by owners of PHEVs.
- Load scheduling and dispatch for aggregators of PEVs.
- Methodology to evaluate the potential impacts of PEVs on distribution systems.
- Modeling light-duty plug-in electric vehicles for national energy and transportation planning.