

Researchers examining electric vehicles and the power grid

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As plug-in electric vehicles become an ever more central part of America's daily life, University of Notre Dame researchers are anticipating what that development will mean for the nation's power grid.

Under funding from the National Science Foundation's Cyber-Physical Systems Program, a research group is attempting to develop [mathematical algorithms](#) to help guide the integration of plug-in hybrid electric vehicles (PEVs) into the power grid.

Specifically, the researchers are working to anticipate and solve [optimization problems](#) critical to various parties, such as PEV owners, commercial [charging station](#) owners, aggregators and distribution companies, at the distribution and retail level of the emerging PEV system.

The research team, which includes Vijay Gupta, Yih-Fang Huang and Peter Bauer from the Department of Electrical Engineering, and Patrick Murphy from the Initiative for Global Development, view an [electric transport](#) system as an eventual win-win for consumers, electric and transportation companies, and the environment. However, they see software and hardware challenges that must be met before such a system can operate optimally.

For example, the team will be examining issues related to charging at both commercial charging stations and at residences, and scenarios when

PEVs function only as consumers of power also those in which PEVs could conceivably serve as a sort of battery, reinjecting energy from the vehicle to the home (V2H) or from the vehicle to the grid ([V2G](#)).

"Electrification of the transportation market offers revenue growth for utility companies and [automobile manufacturers](#), lower operational costs for consumers, and benefits to the environment," Gupta said. "By addressing problems that will arise as PEVs impose extra load on the grid, and by solving challenges that currently impede the use of PEVs as distributed storage resources, this research will directly impact society."

The Notre Dame team will work in close collaboration with industrial partners to help ground the research in real problems and to facilitate quick dissemination of results to the marketplace. They also will be working with academic partners from the University of Washington and the University of Pennsylvania.

The project also will have a strong educational component that will integrate the research into the classroom to allow better training of both undergraduates and graduates students for participation in an electrified transportation market.

Provided by University of Notre Dame

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