

Electric avenue: Electric cars on a two-way street?

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Think of it as the end of cars' slacker days: No more sitting idle for hours in parking lots or garages racking up payments, but instead earning their keep by helping store power for the electricity grid.

"Cars sit most of the time," said Jeff Stein, a mechanical engineering professor at the University of Michigan. "What if it could work for you while it sits there? If you could use a car for something more than just getting to work or going on a family vacation, it would be a whole different way to think about a vehicle, and a whole different way to think about the [power grid](#), too."

Stein leads a National Science Foundation-funded team exploring plug-in hybrid electric vehicles (PHEV) that not only use grid electricity to meet their power needs, but also the car's potential to store electricity from the wind or sun, or even feed electricity back into the grid, earning money for the owner.

The concept is called vehicle-to-grid (V2G) integration. Stein is participating in the symposium "Toward Green Mobility: Integrating Electric Drive Vehicles and Smart [Grid Technology](#)" Feb. 19, at the American Association for the Advancement of Science Annual Meeting [here](#).

The session will discuss the effort to embrace large-scale changes that are needed to improve the sustainability and resilience of the transportation and electric power infrastructures. That heralds a new era

in which vehicles and electric "fuel" infrastructure become a system.

"The vehicles we have now provide freedom and meet the needs of individuals," Stein said. "PHEVs and electric vehicles can be a completely different way of using a car, to be something that is defined as being a part of the greater good in concert with others. It has fascinating possibilities."

Stein and his colleagues envision a world where the [electric cars](#) become "distributed" storage, doubling as mobile holding tanks for electricity, ready to serve in their down time.

"If we had lots of PHEVs all plugged into the grid, then what seems like an insignificant amount of energy storage becomes a large energy storage," he said.

Stein's team already has made some progress understanding battery health and life - a significant issue in a vehicle that depends on large, expensive batteries and the charging and discharging that will be asked of them.

"We're exploring how an owner can charge it and utilize the battery in a way that is battery health conscience to extend the useful life of the battery," Stein said. "That's especially important if we also think about charging vehicles at off-peak hours, and it's also important if we're talking about this shared opportunity for electric storage. What's good for the battery isn't necessarily good for the grid."

Other issues they're working on include:

- Designing new generations of PHEV powertrains, grid systems and intelligent controllers for these powertrains and systems to maximize the benefit of V2G integration.

- Understanding the impacts of PHEVs - no small task since the supply chains for an automobile contain some 20,000 parts and components - the grid and transportation infrastructures. For example, the research team is looking at life-cycle assessment, that is, understanding how energy is distributed through a V2G system throughout its life, what kind of demands PHEV will place on the electric grid, what needs the grid will have and what impact on the grid's carbon footprint and emissions. Building computer models to help understand and predict market penetration of PHEVs is part of the input needed by the life-cycle assessment models.
- Developing models to understand how PHEVs can influence the reliability and stability of the electrical grid. The team looks at issues both of resilience and redundancy—how well a system can shift to a back up plan. The models they create ultimately can be turned over to industry.

Provided by University of Michigan

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