GE Energy

Plug-in Vehicles – Leading the Drive to Clean, Efficient Transportation

Empowering smarter energy choices

The smart grid can help integrate clean, reliable electrically driven cars into our lifestyles. Plug-in vehicles will charge their on-board energy storage from common electrical outlets, reducing the need for oil. And as they shrink petroleum use, plug-ins will help reduce greenhouse gas (GHG) emissions,[1] and improve air quality.[2] Electricity produced from renewable sources will further reduce the environmental impact of our mobile society.

In the future, plug-in vehicles could help utilities avoid electricity demand peaks and help balance electricity demand with generation.

The old way:

Cars burn fossil fuel, depleting natural resources, emitting greenhouse gases and soiling the environment, at a relatively high operating cost per mile.

The smarter way:

Plug-in vehicles use excess (primarily off-peak) grid capacity to charge their electric batteries, greatly reducing combustion-engine use. Plug-in vehicles slash regulated emissions compared to vehicles that run on gasoline, operate at one-third the cost per mile of combustion-engine cars, and are able to use electricity produced by renewable energy sources.

The facts:

- Switching from traditional vehicles to plug-in vehicles could reduce U.S. oil importation by 52%.[3]
- Plug-ins can reduce greenhouse gas emissions by 27% when comparing emissions of gasoline-powered vehicles to plug-in vehicles charged by electricity from the current generation mix — coal, natural gas and renewable power.[4]
- Electricity costs per mile are expected to be approximately one-quarter to one-third the cost of gasoline per mile.[5]
- The existing U.S. electrical infrastructure has sufficient capacity to fuel close to three-quarters of the "light duty fleet" of cars (about 217 million vehicles) for 33 miles of driving per day.[6] Some regions have enough power to fuel 100% of capacity if charged at off-peak hours.
- Because the grid's capacity is designed for "peak demand," which is only five percent of the time, there is sufficient off-peak capacity to charge plug-in vehicles.[7]
- As part of the Energy Improvement and Extension Act of 2008, consumers will receive a tax credit of up to $7,500 for plug-in vehicles.

Smart Grid Technologies Make Electric Cars a Practical Reality

Here is how smart grid technologies and methodologies can overcome the obstacles of the past and enable the world to plug in and drive.

Challenges/Obstacles	Smart Grid Solution
Grid reliability could be compromised if all plug-in owners attempt to recharge during peak-demand times, putting a considerable strain on our electrical infrastructure.	With GE smart meters and time-of-use electricity pricing, plug-in owners will have incentive to charge car batteries during off-peak hours (when the price per kWh is lowest), helping utilities manage peak demand and helping consumers manage their energy spend. Smart meters will also enable consumers to voluntarily offer their cars as "sheddable" load, meaning they receive payments or credits for delaying car charging to offset peak demand.
While plug-in vehicles offer economic benefits to the owner, they will likely double the electrical energy consumption for a typical household.	GE smart meters and time-of-use pricing may help consumers save with off-peak charging. In the future, plug-in car batteries could act as energy storage devices that will help consumers optimize utilization of on-site renewable generation (such as solar power).
As more plug-in vehicles enter the roads, we'll need an infrastructure of vehicle-recharging stations, presenting challenges for billing.	Smart grid two-way communications will ensure that the right vehicle account is billed for vehicle charging, similar to how cell phone users are appropriately billed even while roaming out of their own service network.

[1] This will vary by part of the country, based on generation mix (i.e. higher percentages of renewable power will result in greater reductions in GHG).
[2] EPRI, "Advanced Infrastructure for Plug-in Hybrid Electric Vehicles." 2007.
[3] Pacific Northwest Laboratory, "Impacts Assessment of Plug-in Hybrid Vehicles on Electric Utilities and regional U.S. power grids." http://www.ferc.gov/about/com-mem/wellinghoff/5-24-07-technical-analy-wellinghoff.pdf /. 2007.
[4] Pacific Northwest Laboratory
[5] EPRI. "Plug-in Hyrbids on the Horizon: Building a Business Case." http://mydocs.epri.com/docs/CorporateDocuments/EPRI_Journal/2008-Spring/1016422_PHEV.pdf. Spring 2008.
[6] Pacific Northwest Laboratory.
[7] Pacific Northwest Laboratory

For more information, contact GE Energy T&D Communications:
Margaret Chapman: Margaret.Chapman@ge.com or 678-844-5869
Allison Eckelkamp: Allison.Eckelkamp@ge.com or 678-844-6849

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