

Mileage from megawatts: Study finds enough electric capacity to 'fill up' plug-in vehicles across much of the nation

December 11 2006

If all the cars and light trucks in the nation switched from oil to electrons, idle capacity in the existing electric power system could generate most of the electricity consumed by plug-in hybrid electric vehicles. A new study for the Department of Energy finds that "off-peak" electricity production and transmission capacity could fuel 84 percent of the country's 220 million vehicles if they were plug-in hybrid electrics.

Researchers at DOE's Pacific Northwest National Laboratory also evaluated the impact of plug-in hybrid electric vehicles, or PHEVs, on foreign oil imports, the environment, electric utilities and the consumer.

"This is the first review of what the impacts would be of very high market penetrations of PHEVs, said Eric Lightner, of DOE's Office of Electric Delivery and Energy Reliability. "It's important to have this baseline knowledge as consumers are looking for more efficient vehicles, automakers are evaluating the market for PHEVs and battery manufacturers are working to improve battery life and performance."

Current batteries for these cars can easily store the energy for driving the national average commute - about 33 miles round trip a day, so the study presumes that drivers would charge up overnight when demand for electricity is much lower.

Researchers found, in the Midwest and East, there is sufficient off-peak generation, transmission and distribution capacity to provide for all of today's vehicles if they ran on batteries. However, in the West, and specifically the Pacific Northwest, there is limited extra electricity because of the large amount of hydroelectric generation that is already heavily utilized. Since more rain and snow can't be ordered, it's difficult to increase electricity production from the hydroelectric plants.

"We were very conservative in looking at the idle capacity of power generation assets," said PNNL scientist Michael Kintner-Meyer. "The estimates didn't include hydro, renewables or nuclear plants. It also didn't include plants designed to meet peak demand because they don't operate continuously. We still found that across the country 84 percent of the additional electricity demand created by PHEVs could be met by idle generation capacity."

"Since gasoline consumption accounts for 73 percent of imported oil, it is intriguing to think of the trade and national security benefits if our vehicles switched from oil to electrons," added PNNL energy researcher Rob Pratt. "Plus, since the utilities would be selling more electricity without having to build more plants or power lines, electricity prices could go down for everyone."

Lightner noted that "the study suggests the idle capacity of the electric power grid is an underutilized national asset that could be tapped to vastly reduce our dependence on foreign oil."

The study also looked at the impact on the environment of an all-out move to PHEVs. The added electricity would come from a combination of coal-fired and natural gas-fired plants. Even with today's power plants emitting greenhouse gases, the overall levels would be reduced because the entire process of moving a car one mile is more efficient using electricity than producing gasoline and burning it in a car's engine.

Total sulfur dioxide emissions would increase in the near term due to sulfur content in coal. However, urban air quality would actually improve since the pollutants are emitted from power plants that are generally located outside cities. In the long run, according to the report, the steady demand for electricity is likely to result in investments in much cleaner power plants, even if coal remains the dominant fuel for our electricity production.

"With cars charging overnight, the utilities would get a new market for their product. PHEVs would increase residential consumption of electricity by about 30 - 40 percent. The increased generation could lead to replacing aging coal-fired plants sooner with newer, more environmentally friendly versions," said Kintner-Meyer.

"The potential for lowering greenhouse gases further is quite substantial because it is far less expensive to capture emissions at the smokestack than the tailpipe. Vehicles are one of the most intractable problems facing policymakers seeking to reduce greenhouse gas emissions," said Pratt.

Finally, the study looked at the economic impact on consumers. Since, PHEVs are expected to cost about \$6,000 to \$10,000 more than existing vehicles - mostly due to the cost of batteries -- researchers evaluated how long it might take owners to break even on fuel costs. Depending on the price of gas and the cost of electricity, estimates range from five to eight years - about the current lifespan of a battery. Pratt notes that utilities could offer a lower price per kilowatt hour on off-peak power, making PHEVs even more attractive to consumers.

Adding "smart grid" communications technology to ensure the vehicles only charge during off-peak periods and to provide immediate, remote disconnect of chargers in event of problems in the power grid would make them attractive to utilities.

Source: Pacific Northwest National Laboratory

Citation: Mileage from megawatts: Study finds enough electric capacity to 'fill up' plug-in vehicles across much of the nation (2006, December 11) retrieved 7 February 2023 from <https://phys.org/news/2006-12-mileage-megawatts-electric-capacity-plug-in.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.