Electricity pricing policies may make or break plug-in hybrid buys

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California policies aimed at reducing electricity use and curbing greenhouse gas emissions have the unintended consequence of making new plug-in hybrid vehicles uneconomical, according to a Purdue University economist.

Wally Tyner, the James and Lois Ackerman Professor of Agricultural Economics, said California's tiered electricity pricing system means Californians will pay some of the highest electricity rates in the country to recharge plug-in hybrid vehicles. States with flat electricity rates or those that vary price based on the time of use are more economical, according to Tyner's study.

In tiered systems, consumers pay a higher rate for electricity they use beyond a certain amount. California has three rate tiers. It also has a time-of-use system, which reduces the rate during periods of low demand. In addition, Californians pay some of the highest electricity rates - an average of 14.42 cents per kilowatt hour, which is about 35 percent higher than the national average.

"The objective of a tiered pricing system is to discourage consumption. It's meant to get you to think about turning off your lights and conserving electricity. In California, the unintended consequence is that plug-in hybrid cars won't be economical under this system," said Tyner, whose findings were published in the early online version of the journal *Energy Policy*. "Almost everyone in California reaches the third pricing tier each month. If they add a plug-in hybrid, they are charged the

highest rate."

Tyner worked with Purdue researchers Farzad Taheripour, an energy economist in Purdue's Department of Agricultural Economics; Joseph F. Pekny, a professor of chemical engineering; Gintaras V. Reklaitis, the Burton and Kathryn Gedge Distinguished Professor of Chemical Engineering; and Shisheng Huang and Bri-Mathias S. Hodge, graduate research assistants in chemical engineering, to develop a model that would simulate energy use by Californians. They analyzed U.S. Census data to determine types of appliances each household would use. The model closely aligned with actual energy use in California.

Adding a plug-in hybrid would increase the average use of electricity nearly 60 percent per household, according to the findings. In California, most of that increase would be charged at the highest rate.

Tyner said states such as Indiana, which charges a flat rate of about 8 cents per kilowatt hour, would be more economical. Those that employ time-of-use rates would be the most economical because the lower nightly rates would coincide with when people are most likely to charge their cars.

"If you have time-of-use pricing, you have the opportunity to charge the car at the lowest available price," Tyner said.

Tyner said California could change its rate system or issue extra electricity meters for charging cars on flat rates.

California was chosen to study because, given the fact that it is often at the leading edge of energy conservation policy and practices, plug-in hybrids are expected to be popular there. For the simulations, researchers compared the Chevrolet Volt with the Toyota Prius and Chevy Cobalt to estimate relative economics of the alternatives.

The researchers determined the plug-in hybrid would be less economical than the Toyota Prius, a hybrid that does not charge its battery through a plug, or the Chevrolet Cobalt, which uses only an internal combustion engine. When oil prices are high, the Prius would be the most economical, with the advantage going to the Cobalt when oil prices are low.

Tyner said to make the Volt more economical than either the Prius or the Cobalt, oil prices would have to rise to between $171 and $254 per barrel, depending on which electricity pricing system is being used. That's because the Volt has a higher purchase price and will cost more in electricity than gasoline over the life of the vehicle.

The simulations accounted for a $7,500 federal rebate to consumers for purchasing plug-in hybrids. Tyner said electricity costs would have to decrease to allow the plug-in hybrids to compete.

"People who view the Volt as green will pay $10,000 more over the lifetime of the car because it's green," Tyner said. "Most consumers will look at the numbers and won't pay that."

Provided by Purdue University