

**Public Service Commission of Wisconsin  
& The Statewide Energy Efficiency and Renewables Administration**

## **Environmental and Economic Research and Development Program**

### **Executive Summary**

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### ***Consumer Adoption and Grid Impact Models for Plug-in Hybrid Electric Vehicles in Wisconsin***

*Part B: Grid Impact Studies*

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## *Executive Summary*

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This study focuses on assessing the demand for plug-in hybrid electric vehicles (PHEV) in Wisconsin and provides near term recommendations to manage its impacts on the State's electric grid.

This study has two main objectives:

- To enhance the understanding of consumers' perception of and demand for PHEVs in order to assess the market potential of PHEVs in Wisconsin, thereby informing policy development for wider PHEV deployment.
- To estimate the associated vehicle charging patterns, electricity consumption, and infrastructure needs.

In view of the time frame for the study, our analyses were limited to the Greater Madison area. As such, the project serves as a demonstration of research methodology as well as a preliminary study for future expansion to analyzing the PHEV impacts to the entire state of Wisconsin.

While the objectives have been accomplished through three major research components, namely, infrastructure readiness assessment, consumer preference analysis and grid impact studies, this report focuses on presenting the results from the grid impact studies.

Demand response is quickly evolving and playing a greater role in the electric industry, particularly with recent promotion of smart grid activities across the nation. PHEV have the potential to provide a significant amount of demand response through a variety of methods. A brief overview of different demand response scenarios from a US-Midwest regional perspective has been studied along with an outline of the different future possibilities of the ways in which PHEV may participate as demand response resources. Furthermore, the case for developing a vision that encourages PHEVs to participate in demand response for their energy storage potential, thus enabling a higher penetration of intermittent and variable generation such as wind and solar energy resources is been put forth.

Specifically, in developing demand response incentives, there should be a clear benefit for PHEV owners who choose to participate in time-of-use programs and charge their vehicles during off-peak hours. However, if PHEV owners are unable to charge during off-peak hours, participation in time-of-use metering programs is detrimental. Additional quantitative studies are needed to determine if the potential savings accrued through time-of-use metering and reduction in gasoline consumption is sufficient to recoup the purchase premium of a PHEV over a hybrid electric vehicle or a conventional vehicle. In addition, if the usable storage capacity of a battery is allowed to time shift household residential electricity usage to off-peak hours, it is likely that the required levels of subsidy may change or even become unnecessary. In such a case, a temporary subsidy would be sufficient to encourage residential customers to participate in time-of-use metering programs.

Continuing comprehensive modeling and analytical studies are necessary to determine the necessary magnitude of these subsidies in order to enable PHEV owners to achieve cost recovery on the purchase premium of a PHEV over the life of the vehicle.