MJB Research Review:
Plug In Hybrid Electric Vehicles (PHEV) as Grid Resources

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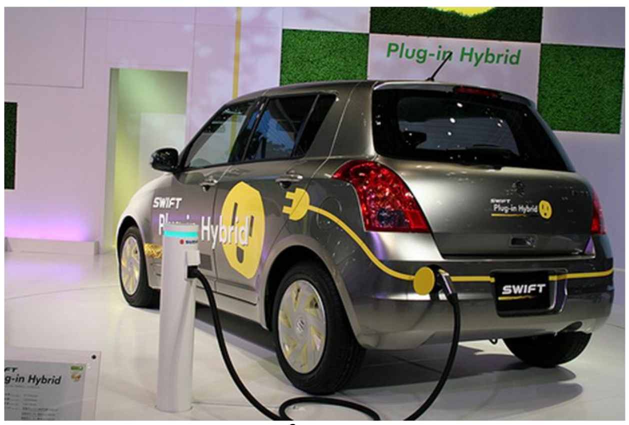
The grid storage potential of plug in hybrid electric vehicles (PHEV) is increasingly being cited as both a boost to the economics of vehicle ownership and as an on-call distributed generation resource. In a study published in the July 2010 edition of *The Energy Journal*, Ramteen Sioshansi and Paul Denholm examine the value of using plug-in hybrid electric vehicles (PHEV) as energy storage devices to provide both power and ancillary services to the electric power system.[1]



Suzuki Swift Plug-in Hybrid[2]

Their findings provide insights into the economics of what will be a key component of the much touted but amorphous Smart Grid of the future. While the study focused on the ERCOT power system, the results have applicability to other parts of the country. The authors found that a PHEV fleet providing Vehicle to Grid (V2G) services can result in substantive cost savings for a power system of up to more than $200 per vehicle per year. Furthermore, the value of providing V2G services to vehicle owners can reduce the payback period of the more costly PHEV vehicle from nine to seven years. Additional findings included;

- Between 10 and 15% PHEV penetration level, the PHEV fleet saturates the spinning reserve requirement
- PHEVs provide virtually no energy storage (although they provide ancillary services, very little energy goes through the charge cycle
- Charging costs increase with PHEV penetration

[1] The Energy Journal, July 2010: The Value of Plug-In Hybrid Vehicles as Grid Resources.
The Energy Journal is a publication of the International Association for Energy Economics. www.iaee.org.

[2] Source: Creative Commons (ikaruga0327)

- The value of V2G services increases with PHEV penetration
- A minimum difference of $15.13 is needed between the cost of energy that is charged and discharged into the battery for energy storage to be economic

Of course a number of variables will impact these conclusions. Three of the most significant are (a) gasoline costs (b) vehicle capital cost, and (c) degree of control over vehicle charging. The first two are obvious; higher gasoline prices will reduce the payback period of a PHEV relative to a hybrid or conventional Internal Combustion Engine (ICE) vehicle. The ability of manufacturers to lower and pass on costs to the customer will also reduce this period. The economics of PHEV charging is more complex especially as it relates to who makes charging decisions. The conclusions above are based on the assumption that the System Operator (SO) determines when the vehicle fleet is charged. This authority enables the SO to direct charging when power is at its cheapest. This however requires sophisticated control, communications and sensing systems which represent a real cost barrier for initial technology adoption. Depending on the level of penetration, allowing uncontrolled charging can substantially increase generation costs.

With over two hundred million vehicles on our nation's roads today, the potential to employ a new generation of PHEVs in balancing the nation's power grid is substantial. While the results of this study should not be overly generalized, it does show that ancillary services delivered to the grid by even a relatively small fleet of PHEV can provide substantial benefit both to vehicle owner and the System Operator. Coupled with the environmental benefits of moving away from liquid transportation fuels, the argument for PHEV playing a role in meeting the complex needs of powering America in the 21st century is a strong one.