California Energy Commssion
DOCKETED
12-EPIC-01
TN # 66809
AUG 20 2012

Submission to: Docket # 12-EPIC-01

Submitted by: Tom Turrentine, Dahlia Garas and Tobias Barr, UC Davis

Contact: dmgaras@ucdavis.edu. (530)752-2570

August 17, 2012

The following comments are on behalf of UC Davis, focused on the integration and adoption of Plug-In Electric Vehicles (PEVs) with California's energy system.

Consumer Behavioral Studies

- Study consumer behavior related to the use of PEVs, particularly to look at two things:
  - Charging distribution across Level 1, 2, and DC Fast Charging levels, including variations in when peak charging occurs at the different levels, congestion issues at diff. levels, etc.
  - Household EV miles, looking at a potential shift in miles to a non-PEV in the household fleet and non-PEV miles shifting to PEV. Not looking at per vehicle eVMT(electric vehicle miles traveled) or OEM fleet eVMT.
    Consumer research should be an on-going process to track the growing PEV market and understand the impacts of changing variables such as: PEV model availability, incentives (monetary and other incentives such as HOV lane access), public charging infrastructure changes etc. Research should continue to follow the changes that are occurring in this rapidly growing market on an annual basis including changes in consumer knowledge, perceptions and values.
- Continue to understand, develop and quantify the impacts of energy feedback devices both in vehicles, homes and commercial vehicles in California. Feedback empowers the rate payers to understand and control their energy use behavior. However, there is a need for more research and demonstrations to fully understand feedback and the technologies that successfully allow ratepayers to understand their consumption behavior and endorse change.
- Electric vehicles have very different rules that govern efficient driving than do ICE vehicles. For drivers trying to maximize their EV range, this means that they need effective HMIs to help them learn efficient driving techniques for EVs.
  - A specific research project should perform field tests of various HMIs - in particular various real-time energy consumption metrics, to determine their relative efficacy at teaching drivers EV-specific driving habits and determine their efficacy at maintaining such habits.

Charging Infrastructure Planning

- Study the amount of public, private, and workplace charging necessary to allow EV miles, and look at the point of diminishing returns in investment vs. new EV miles allowed/accessed. This

should look at current, planned, and needed EV charging networks holistically in the context of varying rates of PEV adoption.
- Need to look at interoperability between charger manufacturers and vehicle types and consumer access to various EV charging networks.

Vehicle and Battery Technologies and Cost Reductions

- Continue to test and demonstrate on a larger scale batteries in second use stationary applications – A few demonstrations have been conducted in California, but EPIC should invest in several demonstrations projects at various scales and ancillary service functions in partnership with the utilities.
- Improve battery end-of-life treatment, recycling efficiency, materials removal/reuse. - This is either at the fundamental research or demonstration stage, depending on the state of the current Li-ion recycling practices and future plans.

Grid Integration

- Charging demand modeling for ISO forecasting purposes – EPIC should invest in research to create a better understanding about the regularity and time of charging events for households, workplaces and public charging locations (Level 2 and DC Fast are important to distinguish for Public charging). This charging demand modeling should take into account consumer behaviors with charging, as well as the distribution of battery sizes and charging types to create early, mid and developed market scenarios.
- Integrated Renewables charging protocols – The CEC should invest in studying the impacts of vehicle charging following the wind (or other renewable) generation in real time. Once the impacts and feasibility is understood, studies should look at what implementation and communication protocols will be necessary for CalISO or the utilities to benefit from PEV charging following wind or solar generation in real time.
- Continue to study and develop the impact of smart meters in California. Smart meters have the potential to provide rich data for researchers and utilities to understand the distribution grid in ways not possible with previous technology. However, developing applications for rate payers to fully utilize smart meters have not yet matured. A portion of research should look to understand and develop new ways to effectively engage rate payers' through energy feedback and home and PEV energy consumption controls that have the potential to be enabled through smart meters infrastructure.

Consumer Educations

- PEV Consumer Education – Part of the Market Facilitation stage of their "Innovation Pipeline"
    - Consumer Education about PEVs should be conducted as a statewide, or even as part of an investment in nationwide efforts to educate consumers about travel choices, including public transportation, and the cost and benefits of PEVs.
    - In addition to a general public education campaign, EPIC should invest in the development of curriculum at the high school, junior college, and university level to encourage interest and expertise in the fields necessary to support this growing industry.

- Car Dealers are an important resource and information source for the new-car buying population. EPIC should invest in creating educational packets or courses in order to establish an educated sales force that has the knowledge needed to guide consumers to appropriate vehicles. These packets or courses should cover such topics as purchase and fueling costs, total cost of ownership, available incentives, charging and fueling infrastructure etc. Where a misinformed sales force can hinder the market, an educated one can help spur the growth of a PEV market.
    - The effect of the educational materials should be studied and improvements should be made incrementally to correspond to changes in consumer knowledge and opinions.