

Mills College Public Policy Program

**Steps to Overcome Barriers to Open Standards
Plug-in Electric Vehicle
Smart Charging and Demand Response Programs
by Regulated Investor Owned Utilities in California**

**Report Prepared for The Energy Division
of the
California Public Utilities Commission**

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Executive Summary

This paper has been developed for the Energy Division staff of the California Public Utilities Commission (Commission) to identify potential barriers to implementation of open standards smart charging and demand response programs for Plug-In Electric Vehicles. The Commission is the designated regulatory body of the Investor Owned Utilities in California and therefore must approve, amongst other things, any programs offered to its customers, ensure ratepayer protection and guarantee service standards. (CPUC, n.d.)

The introduction of electricity as a motor fuel presents several advantages, such as improved energy security, improved fuel economy, reduction of Greenhouse Gas (GHG) emissions. ((Duval, 2002), (Li, Lopes, & Williamson, 2009), (Dickerman & Harrison, 2010) in (Green II, Wang, & Alam, 2011, p. 544)) Moreover, the electrification of the transportation system may present opportunities and barriers. If customers agree mostly to charge during off-peak hours, costs at the distribution level to integrate PEV load may be greatly reduced if compared to charging at peak time. (CPUC Rates Paper, 2010, p. 10) Additionally, off-peak charging can contribute to increasing the load factor of the generation system: increasing the baseline demand and mitigating increase in peak demand. (ibid, p.14) However, uncoordinated charging may pose impacts at the distribution level if charging is not coordinated, i.e. the charge start and stop aligned to minimize system impact. (Clement-Nyns, Haesen, & Driesen, 2010) Finally, if charging is allowed to follow renewable generation, it will contribute to the efficient integration of such sources. As there is still great uncertainty regarding adoption numbers, it is necessary to start understanding what would be the potential barriers to implementation of such programs.

PEV load management can be achieved with demand response mechanisms. Demand response is defined as ‘changes to electric usage by end-use customers from their normal consumption patterns in response to changes in the price of electricity over time, to incentive payments, or to reliability conditions.’ (R.07-01-041 Phase 4 Scoping Memo, 2009, p. 3) According to the California Independent System Operator (CA-ISO) smart charging ‘means managing the flow of electricity to PEVs to minimize the stress on the grid, enabling the ISO and utility to balance real-time grid conditions with an individual’s vehicle charging needs.’(CA-ISO comments on project scope, 12/22/2010) It is not clear if current rates and demand response programs will be adequate to manage PEV load at high penetration levels. The optimal level of load management will depend on the intended flexibility of the resource. The more integrated into the grid the PEV resource must be, the higher the flexibility the program must

offer. The higher the flexibility, the less control and predictability over events the customer may have. Current rates and programs offered by the IOUs may not offer the flexibility to manage PEV load as most designs are based on predictable and structured event calls. Moreover, the necessary technology to allow PEV load management may be tested and ready for deployment until 2013-2015, which creates an issue of timing.

Based on the analysis of the existing Commission approved rates and demand response programs, the necessary technology to implement PEV load management programs and their timing, the existing rules for determining cost effectiveness and suitability of such programs, this paper identified three main barriers to such programs:

Technology barriers: while the introduction of PEVs is already under way, survey of the IOU progress in development, testing and deployment of the necessary architecture to enable smart charging may not be available until 2015-2016. Also, analysis of recent pilots for integration of demand response into wholesale energy markets showed that the necessary technology to meet the system operator's requirements might be costly and burdensome. Finally, the Commission has not yet signal interest in investigating smart charging and demand response and the absence of policy signals may cause difficulties in technology development.

Rate and Program Design Policy barriers: due to the lack of information available regarding PEV load impacts, it is not yet possible to determine if PEV load management programs establish sufficient need for changes in current available rates and programs. Moreover, depending on the level of flexibility necessary to achieve load control, the existing methodology to evaluate cost effectiveness of programs may not be suitable.

Customer acceptance barriers: research that will inform customer behavior and acceptance of load management is still under way, therefore there are still many unknowns as to how customers would accept such programs. Moreover, when analyzing recent demand response wholesale integration pilots, results showed that customers may not be comfortable with the lack of predictability of event calls and duration required in Direct Participation. This may present an issue when attempting to integrate PEVs into the electricity grid.

This paper also identified steps the Commission may take to help overcome these barriers:

- ✓ The Commission can adopt a position as to when it will consider Demand Response and Smart Charging programs;
- ✓ Based on results of preliminary PEV load impact, the Commission could initiate the process to determine the desired flexibility of such programs to ensure cost-effective integration of this resource; as well as if existing methodology is adequate to evaluate cost-effectiveness of PEV load management programs;
- ✓ The Commission should ensure PEV is considered in the Energy Storage System proceeding to determine its suitability in such application This would allow quantifying the value of the onboard storage capacity (if any), its applicability and its potential contribution to the system and ratepayers (if any).
- ✓ Depending on the level of grid integration, it may be necessary to review program design to address issues of integration such as cost and customer acceptance;
- ✓ Depending on the flexibility and grid integration, it may be necessary to review existing legislation and regulatory language;