The Opportunity in Full-Scale Fast-Charging Facilities
Submission to the California Energy Commission
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The *2012□2013 Investment Plan Update for the Alternative and Renewable Fuel and Vehicle Technology Program* states that "Ensuring adequate charging infrastructure is critical in encouraging the deployment of PEVs" (p.20). The Transportation Program of the Clinton Climate Initiative (CCI) strongly concurs with this statement. Consumer survey data consistently indicates that uptake of PEVs is being retarded by negative perceptions regarding the vehicles' "energy economy", i.e., their ability to support consumer transportation patterns given the configuration of elements needed on-board enough electricity to get through a daily duty cycle[1]. It is fair to expect that uptake of PEVs will continue to disappoint if this issue is not addressed in an effective manner.

The charging infrastructure challenge has two faces. The first is the need to embody a high degree of convenience, user-friendliness, and affordability in the charging system. The second is the need to deliver these attributes with an approach that can attract private-sector investment. It seems neither feasible nor desirable for the public sector to provide the capital for charging infrastructure build-out, or to mandate such investment from electrical utilities.

CCI has studied these issues extensively over the last four years. In particular, we have conducted our own economic modeling and consulted with most important stakeholders in the charging services industry. As a result, we hold the hypothesis that fast-charging will be at the center of the most robust charging services business models – and hence will attract the most private-sector investment.

This belief may not be foreign to the Energy Commission. The *2012-13 Investment Plan* states, "Fast chargers . . . are an opportunity for encouraging customer interest and confidence with BEVs". And note is made of "About 100 fast chargers . . . planned to be installed in California" and the Executive Order directing the Energy Commission and other stakeholders "to develop the infrastructure that will accommodate zero-emission vehicles from 2015 through 2025" (all citations from p. 21).

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[1] Typical research finding: "People considering electric vehicles . . . want an EV that can go the distance as their everyday driver. Overwhelmingly, respondents wanted EVs as their primary vehicles. As such, they were not willing to budge on how many miles they think they need per charge. Without a minimum range of 150 miles per charge, most non-EV driver respondents said they would not seriously consider becoming an EV driver." Source: *A National Study of Consumer Attitudes Toward & Usage of EVs*, Electric Vehicle Information Exchange, November 2012.

In this pursuit, CCI would like to call the Energy Commission's attention to the following considerations. Utilization (measured as revenue-generating hours per day) is among the most important determinants of financial success for public electric vehicle supply equipment (EVSE). In what may seem like a small paradox, utilization is likely to increase with an increasing number of charging heads at a given facility. Drivers will not develop the habit of patronizing a facility if there is more than a remote chance that it will be occupied when they get there. They will be drawn to a facility with many heads since at least one head is likely to be available whenever they arrive. (It's true that a reservation system could change this dynamic, but it remains to be seen if such systems will take root, find consumer acceptance, and prove workable. In general, anything that adds "friction" to the charging process, such as hunting for an available EVSE and making a reservation for a charging time, should be approached cautiously.)

The quest for utilization thus brings to fore the idea of multi-charger facilities. The idea acquires even more cogency when cost – both capital and operating – is factored into the equation. On the capital side strong economies of scale apply. A ten-head facility does not cost anything like ten times more than a single-head facility. CCI has not finished modeling these economics but a reasonable guess at this point is that the cost per charging head in a multi-head facility is between 50 and 75 percent that of a single unit installation.

On the operating cost side, a critical consideration is the fully loaded cost of electricity, with the "full load" including not just the price of the commodity but, significantly, demand charges. One effective way to manage demand charges is to deploy an energy storage buffer between the electrical grid and the charging heads. This will allow minute-by-minute electrical consumption to be held below a targeted demand threshold. (It will also create the possibility of shifting the bulk of electricity supply from the grid to off-peak hours.) This will have the obvious of effect of limiting the size of the monthly demand charge payment and could open the door to productive negotiations with host utilities and public utility commissions regarding the fair structure of demand charges. Realizing the potential economies associated with energy storage will also depend on the scale of the facility. The cost of grid and EVSE interface components, for example, is essentially the same for 100 kWh of storage as for 10 kWh.

The scenario detailed above holds great promise but its realization will be constrained by the incrementalization that is likely to occur in the charging services industry under the business-as-usual approach. In jurisdictions around the world, fast-charging EVSEs are appearing as standalone one- or two-head units. It seems self-evident that investing in a ten-head facility in advance of the appearance of a critical mass of EVs would be ill-advised. In due course, charging service companies will add EVSEs in their more popular locations and in this manner go from one or two to three or four and eventually to ten (or more) heads. However, this incremental approach will miss most of the economies of a facility optimized at full scale.

CCI recommends that the Energy Commission take a leadership role in this area. The first order of business is to determine if the economics of the full-scale facility will have the superiority anticipated in the discussion above. This will require in-depth modeling. If the

"paper" indication is positive, a second phase effort would be needed to build and operate a full-scale demonstration facility. Finally, if the demonstration proves successful, the question should be confronted of how to encourage private-sector investment in the optimal model.

One final point should be made. As the *2012-13 Investment Plan* observes, an EV adoption model premised on the idea that all drivers own garages – and are willing to incur the expense of a personal Level 2 EVSE – is problematic. An adoption model premised on the availability of convenient public charging – equally accessible to all regardless of living situation – would seem to be much more conducive to deep EV penetration. Workplace charging and public Level 2 charging may be part of the solution. As previously indicated, though, the financial case for a fast-charging approach is much stronger and is likelier to support a public charging infrastructure that can play the role of primary "staple" charging solution rather than back-up or "opportunity" option. Hence, it may be the ultimate and indispensable enabler of vigorous EV uptake and realization of California's goals for ZEV penetration by 2025.