

## Charging Infrastructure Principles for Policymakers and Utilities: the Consumer Perspective

Plug-in electric vehicles (PEVs) are fun to drive, have little to zero tailpipe emissions and can be powered with clean, affordable, domestic electricity; it's no doubt that consumers want more of these clean vehicles today. There are currently over 530,000 clean PEVs on the road today, with the market ready to expand.<sup>1</sup> The multiple benefits from PEVs accrue to all citizens, regardless of who may purchase the car or the type of PEV purchased.

PEVs include battery-electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs). The BEVs are charged by electricity from the local grid, while PHEVs drive on electricity from the local grid first, then on gasoline for longer trips. Plug In America supports the nationwide installation of charging infrastructure for PEVs, including by electric utilities. As the national consumer voice for PEVs, Plug In America urges policymakers to adopt the below principles as part of any policy developed on charging infrastructure.



### The Principles:

- 1. Charging infrastructure should include a mix of L1, L2 and DCFC, but is best installed in the following order to save costs: L1 and L2 at homes and workplaces, DCFC, and finally L2 in other public places.**

Consumers already have access to L1 charging and therefore an inexpensive source of electricity. Drivers should be encouraged to charge at home first. Most workplaces also already have L1 charging available through standard 120V outlets on exterior building walls and in parking garages, though these outlets will need a dedicated 15A or 20A circuit, with GFCI if outdoors.<sup>2</sup> A more convenient way to implement Level 1 charging is with a charging station. Although marginally more expensive than a regular outlet, the additional expense is small when amortized over the lifetime of the installation and compared to the cost of electricity dispensed. A Level 1 charging station is more convenient and more secure for the PEV driver.

For some drivers, charging at work will be essential; for others occasionally necessary. Plug In America sees a major opportunity for the widespread use of L1 charging at workplaces, airport long-term parking, park-and-ride facilities, and anywhere else that will leverage longer term parking with the benefit of very low cost to install longer term charging.

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<sup>1</sup> Vehicle count based on HybridCars.com count of U.S. sales of 512,174 plug-in vehicles (BEVs, PHEVs) from December 2010 through the end of September 2016.

<sup>2</sup> The DOE also supports the installation of L1 charging first. See the report:  
[http://www.energy.gov/sites/prod/files/2016/07/f33/WPCC\\_L1ChargingAtTheWorkplace\\_0716.pdf](http://www.energy.gov/sites/prod/files/2016/07/f33/WPCC_L1ChargingAtTheWorkplace_0716.pdf)

Following L1 and L2 charging at homes and workplaces, DC Fast Charging (DCFC) stations should be installed, particularly where concentrations of PEV drivers live in multiple family dwellings without access to garage based home charging. In addition, siting DC Fast Chargers at locations along highway corridors approximately 50 miles from urban PEV concentrations will be advantageous for range extension opportunities.

At the workplace, the combination of L1 (sip) and DCFC (gulp) allows for those drivers with short commutes to “top off” the battery after the morning commute, and “sip” a small amount of electricity to recharge the battery. Those drivers with longer commutes can utilize DCFC to “gulp” electricity to recharge the battery, due to the increased speed of recharge available. This “sip and gulp” approach can reduce the exposure to utility demand charges as well.

With third party charging companies very active in promoting L2 and DCFC, it is important to remember that on average, consumers drive about 40 miles per day.<sup>3</sup> With the current size of batteries, a consumer can drive to the workplace and back on a single charge.

By first taking a survey of employees at the workplace, it is also possible to determine the proper types of charging infrastructure needed for employees.

## **2. Consumers and workplaces need support for DCFC.**

The installation of DCFC stations are higher upfront investments than some small workplaces can likely afford. Therefore, investment in DCFC should be supported by utilities and local and state governments. These DCFC should be located along recently designated PEV Corridors.<sup>4</sup>



## **3. Utilities should be allowed to deploy charging infrastructure.**

Investment in PEVs and the charging infrastructure can result in more off-peak energy sold, and therefore reduced rates for ratepayers. Additional load from PEVs can make more efficient use of existing utility assets, which – especially through off-peak charging – puts downward pressure on electricity rates.<sup>5</sup> Utilities should be allowed to recover the cost of this investment.

In addition, PEVs can be a source of potential load control. Many PEV owners are open to load control programs, such as letting the utility or a third party turn PEV charging on and off as needed, as long as it does not prevent the charge from finishing by a specified time.<sup>6</sup> Going a step further than load control is pulling energy from idle PEVs at peak load times via “vehicle-to-grid” (V2G).

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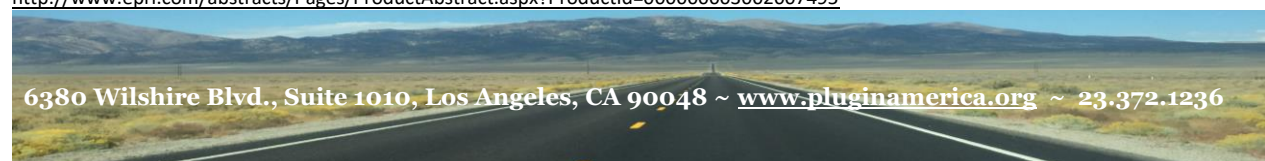
<sup>3</sup> Data collected in the US reveal an average of 29 miles daily driving. See: <http://newsroom.aaa.com/2015/04/new-study-reveals-much-motorists-drive/>

<sup>4</sup> The Alternative Fuels Corridors can be found here: [http://www.fhwa.dot.gov/environment/alternative\\_fuel\\_corridors/](http://www.fhwa.dot.gov/environment/alternative_fuel_corridors/)

<sup>5</sup> Available here: <https://pluginamerica.org/wp-content/uploads/2016/11/PEV-Incentive-Review-October-2016.pdf>

<sup>6</sup> Tal, Gil. 2016. Plug-In Electric Vehicle Multi-State Market and Charging Survey

<http://www.epri.com/abstracts/Pages/ProductAbstract.aspx?ProductId=000000003002007495>



PEVs can also make the integration of renewables easier. PEV loads are generally during low demand times (and can be moved around with TOU rates and other tools), making it easier to justify the addition of renewable power sources that cannot be ramped.<sup>7</sup>

**4. Charging rates should be kept low for ratepayers.**

In order to encourage more adoption of these clean vehicles, PEV charging rates should be kept as low as possible. Optimal PEV charging rates and programs should include a time-of-use rate and low demand charges, are simple for the consumer to understand and are flexible to respond to changing grid conditions.

**5. Demand response programs should include PEVs, as a precursor to V2G**

Utilities should be permitted to include PEVs within demand response programs. Demand response programs enable the vehicle to power up or down based on changing grid conditions.

With V2G charging, PEVs can expand upon the benefits from including PEVs in demand response programs by serving as a generation source for utilities whenever needed, thus reducing ancillary service costs. By serving as literal movable storage for the utility, PEVs can reduce grid congestion in areas of high demand and defer or altogether avoid investment in upgrades of new transmission lines. An upfront investment in charging infrastructure can thus save ratepayers money in the long-term.

**6. Building Codes should include requirements that all new buildings and associated parking lots are “made ready” up to the conduit.**

To reduce costs on the installation of all charging infrastructure, any new buildings and associated parking lots should be constructed with the future ability to connect PEV charging infrastructure. For example, before paving a parking lot, the electric wires should be trenched in the ground up to a conduit for a charging station. The conduit costs during the construction phase are negligible, but can often be the largest cost to installing charging infrastructure if added post-construction.



**7. Consumer protection principles should be adhered to.**

Key consumer protection issues include the following as listed below. These principles should be strictly adhered to:

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<sup>7</sup> (INL) Anonymous, Idaho National Laboratory. 2013. How do PEV owners respond to time-of-use rates while charging EV project vehicles <http://avt.inel.gov/pdf/EVProj/125348-714937.pev-driver.pdf> and (INL) Anonymous, Idaho National Laboratory. 2015 (a). Residential Charging Behavior in Response to Utility Experimental Rates in San Diego <http://avt.inel.gov/pdf/EVProj/ResChargingBehaviorInResponseToExperimentalRates.pdf>

a) *Open Access* – This is defined as the ability to get a charge at any public charger - including L1, L2 and DCFC - either via a credit card swipe or mobile app to enable the charge. PEV drivers should never be stranded at a public charging location where they cannot actually charge.

b) *Transparency* – The price of a charge should be clear when the PEV driver connects to the charger. This price should also be reported in mapping API so that drivers can select a charging station even before they reach a charging station.

c) *Interoperability* - This is a key principle for the entire charging infrastructure ecosystem. Currently, many companies have their own card or key, which means drivers must either join multiple “clubs” or risk being unable to charge.

d) *Mapping data* - all electric vehicle service providers (EVSPs) should provide mapping data for charging locations, including costs for charging (both in and out of network).

e) *Signage* – There is a critical need for charging station signage, from highway visibility down to the last several hundred feet where the charging station is. While the charging station may be listed on a smartphone, car navigation, or web-based maps, the stations are still challenging to locate as the physical hardware is not that large. Directional signage installed on streets around the stations would help immensely, and also reduce consumer range anxiety.

## **Role of the Utility Commissioner**

Utility Commissioners should keep in mind the above charging infrastructure principles and encourage utilities to deploy a range of programs that can aid in the adoption of these clean vehicles. Specifically, utilities should be encouraged to:

- Raise awareness for PEVs by mention in newsletters, social media, bill inserts, etc.
- Host events that offer test drives or rides in PEVs
- Install charging stations, specifically focused on multiunit dwellings, workplaces and PEV corridor designated locations
- Offer a financial incentive, such as a discounted group buy, or by offering a rebate for the purchase and installation of a home charger
- Keep charging rates low for PEV drivers

## **About Plug In America**

Plug In America is the nation’s leading independent consumer voice for accelerating the use of plug-in electric vehicles in the United States to consumers, policymakers, auto manufacturers and others. Formed as a non-profit in 2008, Plug In America provides practical, objective information collected from our coalition of plug-in vehicle drivers, through public outreach and education, policy work and a range of technical advisory services. Our expertise represents the world’s deepest pool of experience of driving and living with plug-in vehicles. The organization conceived National Drive Electric Week and has advanced workplace charging by pioneering ride-and-drive events at such leading corporations as Google, Mattel and Paramount Pictures. We drive electric. You can too.  
[www.pluginamerica.org](http://www.pluginamerica.org)

