Utilizing Level 1 EV Charging at the Workplace

Level 1 charging focuses on replenishing the typical daily driving (40 miles or so) in 8-10 hours of charging, rather than charging batteries from near empty to full. Since a car is parked for about 8 hours while the driver is at work, level 1 charging is well suited for workplace charging applications.

Basics of Level 1 Charging

Level 1 Charging operates at 120 volts, which is the voltage supplied by common electrical outlets. Every EV comes with a cordset that can plug into such an outlet. A workplace has two options for Level 1 charging: to provide access to a 120-V outlet (which could entail nothing more than offering use of an existing outlet, if there is one conveniently located near the parking lot), or to install a Level 1 charging station (referred to as Electric Vehicle Supply Equipment, or EVSE).

If only an outlet is provided, then the EV driver must use their own cordset to charge the vehicle, as EVSE will include the charging cables. In general, an outlet is less expensive for the workplace but less convenient for the EV drivers. Removing the cable from the trunk and plugging it in to the wall outlet and the vehicle is somewhat more onerous than simply plugging in an EVSE cable. And, the owner might prefer to leave the cordset at home. However, most EV drivers would prefer to have an outlet rather than no workplace charging option.

If the workplace decides to install a Level 1 EVSE, such systems are fairly inexpensive in hardware cost and in installation. Many of the costs associated with installation are fixed costs that do not scale with the number of chargers installed, so installing a large number of Level 1 EVSE will result in lower costs per unit.

Is Level 1 Fast Enough?

Level 1 charging will not charge a modern electric vehicle from near-empty to near-full over the course of a workday. However, that is not the use case Level 1 charging stations are intended for. The power supplied by a Level 1 charger is about 1.4 kW, so it provides 1.4 kWh of energy per hour of charging (energy is power multiplied by time). An EV might get 2.5-4 miles per kWh, depending on size, climate, and driving behavior, so each hour of charging gives the vehicle about 3-5 miles of range. Over the course of an 8-hour workday, the EV will regain about 25-40 miles. This covers the one-way commute for the vast majority of American drivers, and the round-trip commute for many.

Level 1 charging enables the EV driver to “top off” and replenish the energy used in their commute, at minimal cost to the employer. It can fully charge the battery of a plug-in hybrid EV (PHEV), enabling that vehicle to do both legs of the commute in all-electric mode. It can provide a substantial charge for an older EV with a smaller battery. Although most of us would fill a gasoline vehicle from near-empty to full about once a week, that is not the only viable model for charging EVs.

Make it Simple

A Level 2 EVSE is more expensive, yet can supply a large amount of electricity (240V) in a faster amount of time. By comparison, the Level 1 EVSE supplies about $1 worth of electricity per day.¹ For this reason, it may not be worth the cost to install a Level 1 system capable of processing payment. Nor, with the lower power draw, is it as important to be able to manage the system’s operations. A non-networked “dumb” charger will have a lower capital cost, no network fees, and will

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¹ A power of 1.4 kW supplied over 8 hours is 11.2 kWh. Using the average U.S. commercial electricity rate of 10.68¢/kWh, this equals $1.20 per day.
have greater reliability (because the payment systems introduce an additional potential point of failure). However, non-networked systems lack capabilities such as load management, access control, payment processing, and a reservation queue.

To explain further, load management is less of an issue for Level 1 EVSE, as these systems draw less power than Level 2 EVSE. Level 1 EVSE will have the majority of their power draw in the lower-demand morning hours, since many of the EV drivers that arrive after shorter commutes will be fully charged by the early afternoon, and so are less likely to increase a facility’s demand charges. Access control is not commonly needed for Level 1 EVSE, but could be managed by an outlet cover and padlock. Finally, payment processing in the EVSE is not essential either. If the employer does desire to recoup the costs from the employee, the employer could set a flat fee to be collected at some regular interval or deducted from the employee’s paycheck.

A reservation queue can be helpful to manage the problem of having more EV drivers than there are charging stations available. These queue systems can alert drivers to move their fully-charged vehicles in order to enable another driver to use the EVSE. Because Level 1 EVSE cost less to install and have a lower power draw, a workplace can install several of them in place of a single Level 2 EVSE. Instead of many EVs rotating through a few faster-charging EVSE, there are a greater number of lower-powered chargers, enough for all of the vehicles and eliminating the need to move vehicles during the workday.

**Will Any Outlet Do?**

If the workplace is only providing a 120V outlet for workplace charging, there are still some considerations to factor in. Since Level 1 charging will typically draw 12-16 amps, the outlet must be rated for 20 amps. Additionally, if the outlet is located outdoors where it might come in contact with water, it must have a Ground Fault Circuit Interrupter (GFCI) to shut off power in the event of a short-circuit. For safety purposes, the outlet must have sufficient tension to keep the plug securely inserted; the UL498 standard requires 3 pounds of retention force after 100 cycles of conditions. Outlets provided for Level 1 charging should be tested at least every 12 months to ensure this tension is present.

These are not unusual requirements, and therefore many existing outlets are suitable for Level 1 charging. In fact, there are likely hundreds of millions of suitable outlets, and as a result, hundreds of millions of available EV charging locations at the workplace in the United States already. These outlets represent a vast and unacknowledged resource for charging EVs.

Additional recommendations are to consider higher-grade commercial outlets for increased durability, and providing a bracket for the cordset to avoid having the weight of the cordset place strain on the outlet or the cordset itself.²

**Installing a Level 1 EVSE**

A wall-mounted Level 1 EVSE is a cost-effective option for workplace charging. It avoids the cost of an underground electrical conduit, and avoids the repeated plugging and unplugging into a receptacle that the “bring your own cord” model entails. Estimates of the hardware cost for a non-networked Level 1 EVSE are $600 per connector (at two connectors per EVSE), with the installation around $900.³ This is an average; some commercial Level 1 EVSE systems are available below this price point.

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Installation cost varies significantly with the infrastructure work required. For example, laying conduit through a parking lot can be expensive.

A Level 1 EVSE mounted on a building’s exterior wall and hard-wired into the electrical infrastructure offers a low-cost reliable EVSE option. Other options such as pedestals exist, but these tend to carry a higher cost due to the need for laying underground conduit.

Many of the costs of EVSE installation are fixed, and do not increase linearly with the number of EVSE installed. So, installing more Level 1 EVSE will tend to result in a lower cost per unit. We encourage employers to install more chargers than there are presently EV-driving employees, with the goal of ensuring that there will continue to be more chargers than drivers as the EV market increases significantly over the next few years. Offering workplace charging will accelerate this adoption and provide an attractive amenity for potential employees. One of the main appeals for installing Level 1 charging is the potential to avoid the need for the EV driver/employee to move the vehicle during the work day, because more Level 1 EVSE can be installed for a given cost or a given electrical capacity than Level 2 EVSE, doubling the amount of charging available to employees.

**Employee Responsibilities**

Employee responsibilities are more significant in cases where the employer only provides access to a 120V outlet. Here, the employee is bringing their own cord, so the employee must ensure that the cord is placed so as to not create a tripping hazard. The employee must also ensure that the cord is in good repair so as to not damage the outlet or cause an electrical hazard. Employees may also be required to pay the costs of EV charging, in which case it is the responsibility of the employee to do so promptly.

**A Mix of Level 1 and Level 2**

Level 2 charging is significantly faster and can replenish around 25 miles of range per hour of charging. It carries a higher capital cost and installation cost, and because it draws more power it more commonly features a network connection for payment collection or load management. (However, there are also instances where having a non-networked Level 2 EVSE may be more favorable.)

A workplace with both Level 1 and Level 2 charging would do well to implement policies that indicate the different use cases of these technologies. For example, the workplace may decide to offer free charging at the Level 1 stations, but may require payment for using the Level 2 stations. With the lower cost associated with Level 1 charging, this could be offered to employees who primarily charge at home and just need to “top off” at the workplace. Level 2 charging could be the sole means of charging for a long-range EV without access to home charging. Or, Level 2 charging could be an option for when a driver needs to get a full charge fairly quickly – perhaps they forgot to charge at home, or perhaps have a long drive to a meeting in the middle of the day. Assigning a higher cost to the Level 2 charging would ensure that it is reserved for those who need the faster charging speed.

**Looking to the Future**

The EV market is poised for rapid acceleration in the next few years. But in addition to growing, the market will change.
The increases in EV range since the launch of the DOE Workplace Charging Challenge in 2013 are astonishing, and this trend in range increase is certainly seen in the new vehicles being released to the market today. Patterns of working and commuting might change in the aftermath of the COVID-19 pandemic, or shared mobility might lead to vehicles not remaining parked and idle for 95% of the day. However, there will no doubt be a role for workplace charging for some employees as the transportation market transitions to an all electric future.

As a low-cost option, Level 1 charging can offer benefits to workplaces, EV drivers, and the environment in the immediate future, without leading to significant stranded assets should workplace conditions dramatically change.4

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. We drive electric. You can too.

www.pluginamerica.org

4 This fact sheet draws on information presented in the below report, and seeks to add information as well. While some of the information presented in the below document is not applicable to the current generation of EVs, the document overall remains a vital resource for Level 1 workplace charging.

Margaret Smith, Level 1 Electric Vehicle Charging Stations at the Workplace, Energetics Incorporated, July 2016.