What were the Cost Drivers for Workplace Charging Installations?

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Key Conclusions

- The average cost for installation of electric vehicle supply equipment (EVSE) at workplace locations was $2,223.
- The average installation cost for workplace charging EVSE was 75% of the average cost to install publicly accessible EVSE ($2,979).
- Twenty-seven percent of the workplace EVSE installed were wall-mount units, while 17% of the publicly accessible EVSE units were wall-mount units.
- Greater flexibility in the location of the workplace installations provided installation cost savings opportunities not typically available to EVSE installed for public use.
- Future expansion of workplace charging infrastructure represents a significant installation cost concern for employers, because these expansions will frequently require additional electrical service capacity.

Introduction

Because workplace charging is the second most popular place to charge a plug-in electric vehicle (PEV), after home charging,[1] the cost of EVSE installations for employers is of interest and one of the subjects that The EV Project was designed to examine.

For the purpose of this evaluation, workplace charge stations are defined as EVSE that were installed for the private use of employees and guests of a particular business. Charging stations installed for public use, but whose use is dominated by a single daytime user during work hours, are not included in this analysis. This paper analyzes the costs of installing workplace charge stations.

The original intent of The EV Project's non-residential alternating current (AC) Level 2 EVSE deployment was to focus on units whose purpose would be to serve the broader electric vehicle marketplace (i.e. publicly accessible charging infrastructure). As the project unfolded, it became more apparent that workplace charging was of significant interest to PEV drivers and potential PEV owners. By the beginning of 2012, deployment efforts began to shift to more workplace charging sites. In the end, approximately 10% of all non-residential AC Level 2 EVSE deployed during The EV Project were installed as workplace chargers. Because this focus on workplace deployment emerged later in the project, a number of workplace installation locations were identified, but not installed before The EV Project terminated. However, costs for these installations, in the form of firm contractor pricing, were available for evaluation.

This paper is a companion to the paper titled, "What were the Cost Drivers for Publicly Accessible Charging Installations?",[2] which discusses, in greater depth, the basis for installation costs of non-residential AC Level 2 EVSE. This paper will analyze the circumstances associated with installation of workplace charging infrastructure that differentiate the cost to install EVSE under these conditions.

Data Analyzed

The primary source for data and information analyzed for this paper came from reports generated from The EV Project database. This database was populated with data from hosts, EV Project administrators, and electrical contractors installing EVSE.

The total costs of installations cited in this report include all costs paid to the electrical contractors to install the Blink AC Level 2 EVSE. These costs would typically include permit costs, contractor's installation and administration labor, subcontracted construction labor or equipment (e.g., concrete, asphalt, trenching, boring, etc.), engineering drawings (when required), and materials other than the AC Level 2 EVSE itself, which was provided by The EV Project. Installation cost data from 280 workplace installations were utilized for these analyses.

Analyses Performed

Installation cost and utilization data recorded from The EV Project charging infrastructure installed as workplace charging stations were segregated from the rest of the AC Level 2 EVSE data for this analysis. The average workplace installation costs and how they compared to other non-residential AC Level 2 EVSE installation costs are shown in Table 1.

Table 1. Average installation costs for EV Project non-residential AC Level 2 EVSE.

Average Installation Cost			
	All Non-Residential	**Publicly Accessible**	**Workplace**
All	$2,979	$3,108	$2,223
Pedestal Units	$3,209	$3,308	$2,305
Wall-Mount Units	$2,035	$2,042	$2,000

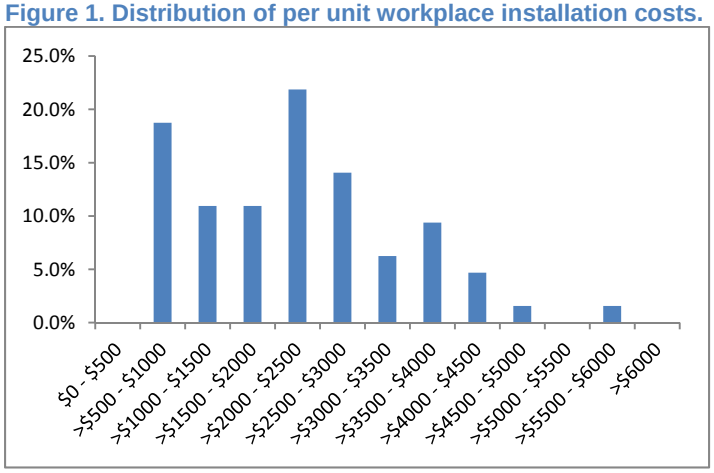
Further analysis in Table 2 shows that the minimum costs were comparable, while the maximum installation cost for units that were publicly accessible was more than twice the maximum workplace installation cost.

Table 2. Maximum and minimum installation costs for EV Project non-residential AC Level 2 EVSE.

Maximum and Minimum Installation Costs			
	All Non-Residential	**Publicly Accessible**	**Workplace**
Maximum	$12,660	$12,660	$5,960
Minimum	$599	$599	$624

Figure 1 shows that installation costs for workplace stations were not only 30% less than stations installed for public use, but 80% of the workplace stations were installed at costs that were below the average installation cost of $3,108 for stations installed for public use.

Figure 1. Distribution of per unit workplace installation costs.



Discussion of Results

Three primary factors drove average workplace EVSE installation costs markedly lower than publicly accessible AC Level 2 EVSE. These factors were location of the site relative to the electric service panel, number of wall-mounted stations, and fewer restrictions on accessibility.

Location Relative to the Facility

AC Level 2 EVSE installed at workplace charging stations were typically installed in existing employee parking lots, which are normally at the rear of the workplace or at the side of the building. In either case, this typically puts the EVSE closer to the building's power distribution panels than for a typical publicly accessible AC Level 2 EVSE. These installation locations resulted in shorter electrical conduit runs and, therefore, less expensive installation costs.

Some workplace charging stations were installed in multi-level parking garages. These EVSE were also located away from the front of the building and were more likely to be nearer electrical service. These units typically utilized surface-mounted electrical conduit, which is less expensive to install than conduit buried underground. This installation cost advantage affected stand-alone pedestal EVSE and wall-mounted units. In fact, the average installation cost for Blink pedestal EVSE units designated as a workplace charger was $2,305, which is more than 30% less than pedestal units installed to be publicly accessible..

This cost advantage, based on proximity to the electrical service panel, can be seen in the average cost to install a pedestal EVSE (typically using buried conduit). For all non-residential AC Level 2 pedestal EVSE installed in The EV Project, the average installation cost was $3,209, but for those pedestal EVSE installed at workplace charging stations, the average was $2,305, which is 28% less than the overall average.

Wall-Mounted Installations

The greater freedom as to the installation location at a site also led to more wall-mounted installations. Wall-mounted EVSE were typically less expensive to install, because they did not require underground conduit to supply power, which is typical for a pedestal unit. The average installation cost for a wall-mounted AC Level 2 EVSE unit in The EV Project was $2,035, while the average cost to install a pedestal unit was $3,209.

Twenty-seven percent of the AC Level 2 EVSE units installed as workplace chargers were wall-mounted. This compares to 17% of AC Level 2 EVSE units installed for all non-residential use. The lower average installation cost for wall-mounted units and the much greater ratio of wall-mounted installations, significantly contributed to the lower average installation cost for workplace chargers.

Flexibility of the Installation Location

The third workplace cost factor contributing to lower workplace EVSE installation costs was the ability to install the units with fewer accessibility requirements. For example, typically there were few, if any, parking signage or striping requirements; ADA accessibility, including an accessible pathway to the workplace building, was only necessary if an employee was a PEV driver and required this accessibility; units did not need to be in conspicuous locations; and public accessibility during hours outside of normal business hours was also not a concern.

Another Installation Cost Consideration when Planning for Workplace Chargers

One workplace installation cost factor that did emerge over the course of The EV Project, was the cost to install additional EVSE. Many of the employers who provided workplace charge stations for their employees found that the offer of refueling commuter vehicles while at work (whether at a cost to the driver or free) encouraged more employees to obtain PEVs for their work commute. This put pressure on employers to add more stations, with the "easy" installations often being the first ones (i.e., ones already done). Additional electrical service and parking places further from the electrical distribution panel usually were required for additional EVSE, which added to the cost of these subsequent installations.

Conclusions

The cost of installation for AC Level 2 EVSE at workplace charging stations in The EV Project was markedly lower than the cost of EVSE installed for public use. This was primarily due to fewer restrictions on where the charging stations were located on the site. The installation cost savings could be found in three factors: location of the charging stations relative to the electrical power distribution panel; the ability to more frequently utilize surface-mounted conduit for wall-mounted units and ; and fewer accessibility restrictions compared to EVSE installed for public use.

About The EV Project

The EV Project was the largest PEV infrastructure demonstration project in the world, equally funded by the U.S. Department of Energy (DOE) through the American Recovery and Reinvestment Act and private sector partners. The EV Project deployed over 12,000 AC Level 2 charging stations for residential and commercial use and over 100 dual-port direct current fast chargers in 17 U.S. regions. Approximately 8,300 Nissan LEAFs™, Chevrolet Volts, and Smart ForTwo Electric Drive vehicles were enrolled in the project.

Project participants gave written consent for EV Project researchers to collect and analyze data from their vehicles and/or charging units. Data collected from the vehicles and charging infrastructure represented almost 125 million miles of driving and 4 million charging events. The data collection phase of The EV Project ran from January 1, 2011, through December 31, 2013. Idaho National Laboratory is responsible for analyzing the data and publishing summary reports, technical papers, and lessons learned on vehicle and charging unit use.

Company Profile

Idaho National Laboratory is one of DOE's 10 multi-program national laboratories. The laboratory performs work in each of DOE's strategic goal areas: energy, national security, science, and the environment. Idaho National Laboratory is the nation's leading center for nuclear energy research and development. Day-to-day management and operation of the laboratory is the responsibility of Battelle Energy Alliance.

For more information, visit avt.inl.gov/evproject.shtml and avt.inl.gov/chargepoint.shtml.

References

1. “Where do Nissan Leaf Drivers in The EV Project Charge When They have the Opportunity to Charge at Work?” http://avt.inel.gov/pdf/EVProj/ChargingLocation-WorkplaceLeafsMar2014.pdf.

2. http://avt.inel.gov/evproject.shtml#LessonsLearned EV Project lesson learned white paper, “What were the Cost Drivers for Publicly Accessible Charging Installations?”