Planning Commission Agenda

Tuesday, October 19, 2021 at 7:00 PM
27400 Southfield Road, Lathrup Village, Michigan 48076

ZOOM REMOTE MEETING INFORMATION
Webinar ID: 996 6174 3524
Password: 435623
CLICK HERE: Online Link
Telephone: 646.558.8656 or 312.626.6799
CLICK HERE: Public Comment Form Link

In accordance with Emergency Orders issued by the Michigan Department of Health and Human Services, Oakland County, local officials, and State of Michigan legislation, which allows for electronic meetings of public bodies, notice is hereby given that the City of Lathrup's Planning Commission will be meeting electronically using www.Zoom.us for videoconference and public access.

1. **Call to Order**
2. **Pledge of Allegiance**
3. **Roll Call**
4. **Approval of Agenda**
5. **Approval of Meeting Minutes**
   A. Meeting Minutes - July 20, 2021
6. **Public Comment**
7. **New Business**
   A. Capital Improvement Plan Committee discussion
   B. Comprehensive Plan Implementation Priority discussion
   C. Electric Vehicle (EV) Charging Station Ordinance discussion
8. **Old Business and Tabled Items**
9. **Other Matters for Discussion**
   A. Building Materials Study Group - update
10. **General Communication**

11. **Adjourn**

Planning Commission Meeting Minutes

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Call to Order at 7:04p.m. by Chair Piotrowski

Pledge of Allegiance
All present joined in the Pledge of Allegiance.

Roll Call

Commissioners Present:	Mark Piotrowski, Chair
	Jason Hammond – Vice Chair
	Bruce Kantor, City Council Liaison
	Les Stansbery, Secretary
	Robin Dillard-Russaw,
	Terrence Hicks,
Absent:	Commissioner Wilbert Fobbs, III

This meeting is being held remotely. All Commissioners who were present announced they are in Lathrup Village, Michigan, Oakland County with the exception of Anna Thompson who is located in Ann Arbor, Michigan, Washtenaw County.

Staff Present: Dr. Sheryl Mitchell, City Administrator, Leann Kimberlin, Representing the City Attorney's Office, Susie Stec, Community and Economic Development Manager, Kelda London Government Operations Assistant

Also Present: Jill Bahm, Giffels Webster Engineering

Approval of Agenda

Motion by Vice Chair Hammond to adjust the agenda by moving items A., B., & C relating to the Comprehensive Plan to the end of New Business after items D., & E. Motion was seconded by Commissioner Dillard-Russaw.

Yes: Piotrowski, Hammond, Kantor, Stansbery, Dillard-Russaw, Hicks,
No: None

Motion carried.

Approval of Meeting Minutes of June 15, 2021

Motion by Board member Dillard-Russaw, seconded by Board member Stansbery to approve the minutes of June 15, 2021 as written.

Yes: Hammond, Dillard-Russaw, Kantor, Piotrowski, Stansbery, Hicks
No: None

Motion carried.

Public Comment

Bo Tamarelli – (18486 Delores) Submitted a written statement that was read into the record, expressing his objection to the Planning Commission for the zoning change.

New Business

A. Public Hearing – Cannabis /Marijuana Zoning Ordinance Text Amendment

Chair Piotrowski opened the public hearing.

Planner Jill Bahm, Giffels Webster presented a PowerPoint Presentation that provides additional background information on the zoning regulations.

Lathrup Village Planning Commission Minutes July 20, 2021

Residents/Speakers with comments and questions for the Public Hearing

Ian Zitron	28265 Sunset Blvd, Lathrup Village, MI 48076
Kalyn Danforth	
Marylou Reznik	18880 San Jose Lathrup Village, MI 48076
Elsie Babcock	27661 Lathrup Blvd, Lathrup Village, MI 48076
Nick Aiello	32411 Mound Rd, Warren, MI 48092
Martha Moore	28050 Red River, Lathrup Village, MI 48076
Tate McBroom	26415 Meadowbrook Way

Planner Jill Bahm went through and addressed the questions in the Chat and Q&A portion of the public comments.

B. Recommendation to City Council -Cannabis / Marijuana Zoning Text

Motion by Commissioner Stansbery to recommend the Cannabis/Marijuana Zoning Text to City Council as proposed. Motion seconded by Vice Chair Hammond.

Yes: Hammond, Dillard-Russaw, Kantor, Piotrowski, Stansbery, Hicks
No: None

Motion carried.

C. Public Hearing – Comprehensive Plan

D. Comprehensive Plan Presentation & Discussion

Planner, Jill Bahm presented the highlights of the Comprehensive Plan.

Residents/Speakers with comments and questions for the Public Hearing

Elsie Babcock 27661 Lathrup Blvd., Lathrup Village, MI 48076

E. Comprehensive Plan – Resolution of Adoption

Commissioner Kantor made a motion to adopt the comprehensive plan seconded by Vice Chair Hammond

Yes: Hammond, Dillard-Russaw, Kantor, Piotrowski, Stansbery, Hicks
No: None

Motion carried.

9. Other Matters of Discussion

A. Building Materials Study Group

Vice Chair Hammond gave an update on the addition of new members to the Study Group. The first meeting of the Study Group was set for Tues August 24th @ 7:00PM

B. The Block Party discussion

In an effort to encourage neighborhood participation there were a number of suggestions for neighborhood gatherings in each of the 5 quadrants of the City that have were highlighted in the comprehensive plan.

10. General Communication

DDA Manager Susie Stec gave some updates on the ongoing projects in the City. The gas station is moving forward after some delays. The Lathrup Village Apartments is completing their site work. There will be a delay in construction until spring.

11. Adjourn

Commissioner Kantor made a motion to adjourn, seconded by Commissioner Hill.

Meeting adjourned at 9:08 PM

Submitted by Kelda London

Recording Secretary

giffels webster

memorandum

DATE: **October 15, 2021**

TO: **Susie Stec, Community & Economic Development Director**

FROM: **Jill Bahm and Eric Pietsch, Giffels Webster**

SUBJECT: Electric Vehicle (EV) Charging Station Ordinance

Introduction

What prompted this discussion?

- The Planning Commission has expressed interest in amending the Zoning Ordinance to encourage and support sustainability. One fairly straightforward amendment is to provide standards for electric vehicle (EV) charging stations.

Background on Issue

Why consider an amendment?

According to the US Department of Energy, consumers and businesses with fleet vehicles are increasingly considering plug-in electric vehicles (PEVs). These include plug-in hybrid electric vehicles (PHEVs) and all-electric vehicles (EVs)—all of which need access to charging stations. Most users will charge at home or at fleet facilities, but the availability of charging stations at workplaces and public destinations is a factor in the decision-making process. Making more stations available may help increase visibility and confidence in EVs.

- There are three types of EV chargers:
    - Level 1 chargers: These chargers use a regular 120-volt outlet, common to most home and commercial plugs. These chargers provide two to five miles of range per one hour of charging. This would result in about 40 miles of range for a vehicle parked overnight. According to the Department of Energy, the cost for this type of charging is between $200-500 (roughly the cost of adding a new outlet to an existing 120-v circuit).
    - Level 2 chargers: These chargers use 208/240-volt outlets, which may be used in a residential home or commercial setting. These chargers provide between 18-28 miles of range per one hour of charging and can result in a full charge for a vehicle parked overnight.
    - Direct current (DC) fast chargers: These chargers use 208/480-volt outlets and provide rapid charging. They provide about 60 to 80 miles of range per 20 minutes of charging. These are mainly found in heavy traffic corridors.
- In general, when provided for users of a site, charging stations are reasonable accessory uses in all zoning districts, particularly when intended for those who live or work on the property. Non-residential properties may also offer charging for visitors of a site and may even charge for this service.
- Charging at Level 1 chargers costs around 14 cents per kilowatt hour, public Level 2 chargers cost around 44 cents/kWh and fast chargers up to 59 cents/kWh, according to a PwC analysis.

- The Department of Energy promotes public charging stations and estimates that there are approximately 43,000 public EV charging stations across the US. Over 80% are Level 2 chargers, 15% are DC fast chargers and less than five percent are Level 1 chargers.
    - Demand for EV charging is increasing, and new tools are being developed to help drivers find charging sites. The US Department of Energy has a search tool that can identify public stations and fuel corridors: https://afdc.energy.gov/stations/#/find/nearest?location=lathrup%20village,%20mi

Current Ordinance

The ordinance does not include any provisions for EV charging stations.

Recommendation

A draft amendment is attached that provides a definition for EV charging station and includes standards that address location, parking, lighting, signage and general maintenance. The Planning Commission may wish to discuss whether EV stations should be required for new non-single-family residential development as a proactive measure. An additional standard could be added to Section 5.13, Parking that could require all new, expanded and reconstructed parking areas to provide the electrical capacity necessary to accommodate the future hardwire installation of Level 2 EVCSs for a specific amount of required parking. (10-15% may be appropriate.)

Amend Section 2.2: Definitions to add:

Electric vehicle charging station (EVCS). A public or private parking space that is served by battery charging station equipment that has as its primary purpose the transfer of electric energy (by conductive or inductive means) to a battery or other energy storage device in an electric vehicle. EVCS may include Level 1, 2 and 3 charging stations.

Amend Article 4 to add a new section:

Section 4.20: Electric Vehicle Infrastructure

1. **Intent.** The intent of this section is to facilitate the use of electric vehicles and to expedite the establishment of a convenient electric vehicle infrastructure that such use necessitates.
2. **Permitted Locations**
   - A. When accessory to the principal permitted use, and when no fees are collected for such use, electric vehicle charging stations are permitted in every zoning district.
   - B. When accessory to the principal permitted use, and when fees are collected for such use, electric vehicle charging stations are permitted in all non-single-family residential zoning districts.
3. **General Requirements**
   - **A. Parking**
     - i. An electric vehicle charging station space may be included in the calculation for minimum required parking spaces required in accordance with Section 5.13. All such spaces shall comply with ADA requirements.
     - ii. Public electric vehicle charging stations are reserved for parking and charging electric vehicles only. Electric vehicles may be parked in any space designated for public parking, subject to the restrictions that would apply to any other vehicle that would park in that space.
   - B. **Lighting**. Site lighting shall be provided in compliance with Section 5.8, where an electric vehicle charging station is installed, unless charging takes place during daytime hours only.
   - **C. Equipment Standards and Protection**
     - i. Battery charging station outlets and connector devices shall be no less than 36 inches and no higher than 48 inches from the surface where mounted. Equipment mounted on pedestals, lighting posts, bollards, or other devices shall be designed and located as to not impede pedestrian travel or create trip hazards.
     - ii. Adequate battery charging station protection, such as concrete-filled steel bollards, shall be used. Curbing may be used in lieu of bollards, if the battery charging station is setback a minimum of 24 inches from the face of the curb. Bumper blocks shall not be used for protection of such charging devices.
     - iii. All equipment installed shall meet building code requirements.
     - iv. Equipment mounted on pedestals, lighting posts, bollards, or other devices for on-street charging station shall be designed and located as to not impede pedestrian travel or create trip hazards within the right of-way
   - **D. Signage.** Signs shall meet the standards of the City of Lathrup Village Sign Ordinance, Article 2 of the City's municipal code, as well as the following:

i. Information shall be posted identifying voltage and amperage levels and any time of use, fees, or safety information related to the electric vehicle charging station.

ii. Each electric vehicle charging station space shall be posted with City-approved signage clearly indicating the space is only for electric vehicle charging purposes. For purposes of this subsection, “charging” means that an electric vehicle is parked at an electric vehicle charging station and is connected to the battery charging station equipment.

E. **Maintenance**. Electric vehicle charging stations shall be maintained in all respects, including the functioning of the equipment. A phone number or other contact information shall be provided on the equipment for reporting when it is not functioning, or other problems are encountered.

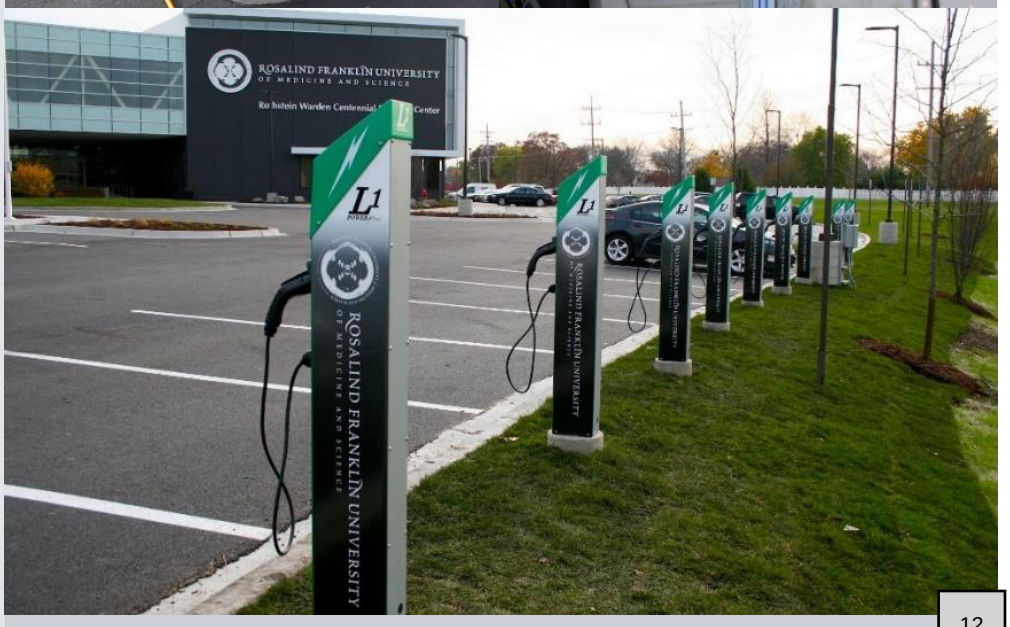
U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Level 1 Electric Vehicle Charging Stations at the Workplace

Margaret Smith, Energetics Incorporated

July 2016

Prepared for the U.S. Department of Energy Vehicle Technologies Office



Workplace Charging Challenge
U.S. DEPARTMENT OF ENERGY

EV Everywhere
U.S. DEPARTMENT OF ENERGY

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Level 1 Charging at Work

Level 1 charging (110–120 V) can be a good fit for many workplace charging programs. For electric vehicles typically purchased by most employees, Level 1 charging often has sufficient power to fully restore vehicle driving range during work hours. Level 1 electric vehicle supply equipment (EVSE) replenishes 2 to 5 miles of range during one hour of charging.[1] If plug-in electric vehicle (PEV) drivers park their cars for 6.5–8 hours each day, they can replenish 30 to 40 miles in one work day.[2] More than 90% of employees in the United States commute less than 35 miles,[3] which means that Level 1 charging could adequately replenish the battery capacity used to travel to work. Having access to Level 1 charging at home and at work could meet the charging needs of over 92% of U.S. drivers' workday travel.[4] While the installation and management of PEV charging stations requires planning, the U.S. Department of Energy (DOE) Workplace Charging Challenge, launched in 2013, aims to support these efforts. This document highlights the experiences of a selection of Workplace Charging Challenge partners that use Level 1 charging.

Photo 1.This Level 1 outlet is available for electric vehicle charging at the U.S. Senate parking lot.
Photo from Sarah Olexsak, DOE.

Workplaces can provide Level 1 charging using two main ways: (1) using a Level 1 outlet for employees to plug in their own charging equipment, and (2) providing a Level 1 charging station with the EVSE charging equipment installed at the workplace. In either situation, having a proper workplace charging policy in place is critical to program success. For instance, appropriate signage, a policy for who can use the charging stations, and a well-thought-out fee structure can have a large impact on how happy the employer and employees are with the workplace charging program.

To obtain estimates for a specific project, contact electricians and EVSE manufacturers.

When evaluating the cost of any PEV charging station, consider the hardware, installation, electricity consumption charges, electricity demand charges, and maintenance. Offering an electrical outlet is usually the lowest-cost scenario. Providing EVSE has the additional cost of the purchased equipment. Generally, a pedestal-mounted EVSE has higher installation costs than a wall-mounted EVSE. If a

[1] Alternative Fuels Data Center - http://www.afdc.energy.gov/fuels/electricity_infrastructure.html.
[2] Assuming a Level 1 EVSE that replenishes 5 miles of range during one hour of charging.
[3] U.S. Department of Transportation (DOT) Bureau of Transportation Statistics' October 2003 OmniStats report, Volume 3, Issue 4.
[4] *Charging Ahead on the Transition to Electric Vehicles with Standard 120 V Wall Outlets,* S. Saxena. Lawrence Berkeley National Laboratory. Applied Energy. June 2015.

site requires electrical service upgrades to accommodate the power used by PEV charging stations, installation costs can rise significantly. To obtain estimates for a specific project, contact electricians and EVSE manufacturers.

Scenario A: Making a Level 1 Electrical Outlet Available

Overview

Most PEVs come with a cordset that on one end has a standard, three-prong household plug that plugs into a Level 1 outlet (110–120 V) and on the other end has an SAE J1772 standard connector that plugs into the vehicle. Making Level 1 charging available to an employee could simply mean offering electrical outlets for drivers to plug in their own cordsets. Offering an outlet for charging is usually the lowest-cost option for providing workplace charging because it requires no EVSE purchase and the installation costs are minimal (see Estimated Costs for Scenario A section below).

Photo 2. This Level 1 cordset comes standard with a MY16 and MY17 Chevrolet Volt.
Photo from GM.

Employers that offer an outlet for employee charging rather than purchase and install charging equipment do not have access to the selection of management features available with networked Level 2 EVSE. They can still manage employee charging habits but will need to consider separate management solutions. Employers that want to track the energy consumed by PEV charging at the Level 1 outlet can install an energy monitor near the control panel for the PEV charging circuit. Energy monitors are available that can track the power consumed during each charging event and provide online access to the information. Organizations that want to ensure the outlet is used only by certain individuals can use an outlet cover and padlock to restrict access.

Although a Level 1 outlet may be the preferred workplace charging scenario for an employer, it may not be the preferred scenario for employees. Some employees may consider it a hassle to bring and use their own cordsets and would prefer to have Level 1 EVSE installed at the workplace. Many PEV drivers prefer to leave their cordsets at home for convenient charging at home, or they may have concerns about vandalism or cordset theft. Some cordsets have an anti-theft feature that allows the driver to use a simple padlock to prevent anyone from removing the connector from the vehicle without a key. If the charging station is outdoors and there is inclement weather, drivers may object to putting a wet, snow-covered, or muddy cordset back in their car trunks after charging. For plug-in hybrid electric vehicles (PHEVs), drivers can simply leave their cordsets in the vehicle and use gasoline if they are concerned about inclement weather. Despite the disadvantages, most employees interested in workplace charging would prefer to have a Level 1 outlet available over having no option for workplace charging.

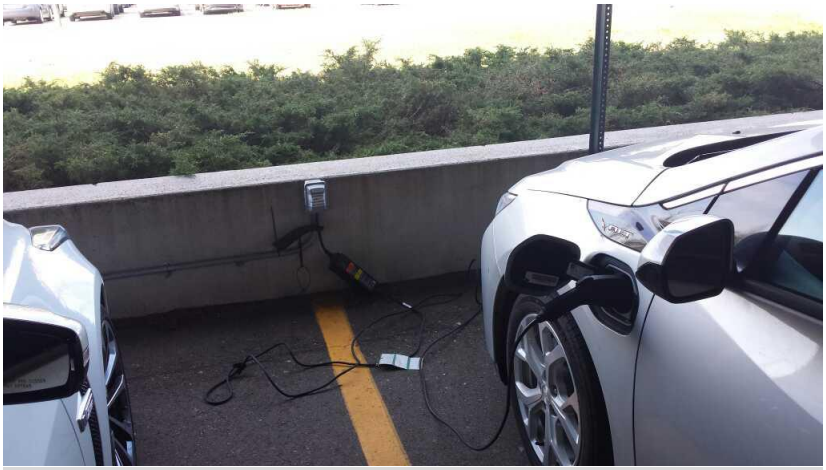

Photo 3. Over 150 Level 1 outlets are available for workplace charging at GM worksites.
Photo from GM.

Level 1 outlets used for PEV charging should be National Electrical Manufacturers Association (NEMA) commercial grade outlets that meet National Electric Code (NEC) requirements.[5] These outlets must be on a dedicated circuit, preferably rated for 20 amps.[6] Using a ground fault circuit interrupter (GFCI) outlet with an outlet cover is required for outdoor use or anywhere the outlet could get wet. If an electrical outlet that does not meet these requirements is used for PEV charging, there can be sparks, damage, or injury. An electrician can inspect an existing outlet to determine if it meets these specifications or install a new electrical outlet on a dedicated circuit. Products are also available that allow site hosts to install multiple electrical outlets mounted to a wall or a pedestal. This enables site hosts to place outlets in a convenient location for PEV drivers to plug in their portable Level 1 EVSE cordsets.

For an electrical receptacle to function safely, there needs to be sufficient tension to keep the plug securely inserted into the receptacle.[7] Receptacle tension should be tested a minimum of every 12 months in electrical receptacles that are frequently used for plugging in and unplugging a cordset. This preventative maintenance step can identify safety hazards and avoid potential down time. Little data is available on the performance of different types of outlets used for Level 1 charging. Higher quality commercial grade outlets, such as hospital grade outlets, may be more durable and retain optimal tension longer than lower quality outlets.

Employers are encouraged to consider cordset weight and typical length of the cord when determining the Level 1 outlet height. Putting strain on the Level 1 outlet or the cordset by having the cordset hang in the air, as shown in Photo 4, should be avoided.

Photo 4. This cordset is hanging from an outlet which may cause strain on the cordset and outlet.
Photo from Don Francis, Clean Cities-Georgia.

[5] Consult National Electric Code NFPA 70, 2014 edition, sections 210.17, 511.10, 625.1 and 625.44.
[6] Some cordsets are rated for 15 amps but many are 20 amps.
[7] The UL498 standard requires 3lbs of retention force after 100 cycles of conditions.

It should be noted that safety standards for standard residential and commercial outlets were not developed with repeated operations for charging plug-in electric vehicles in mind. The current safety standard that covers 120 volt/20 amp electrical outlets is UL 498, the Standard for Safety for Attachment Plugs and Receptacles. The protocol recommends that these electrical outlets (which are the type typically used for Level 1 charging) complete a number of tests to pass safety standards. These include tests in which the receptacle has a plug inserted and removed 250 times in various conditions without sustained flaming of the material in excess of five seconds duration.

Workplace Charging Challenge Partner Examples

General Motors (GM) – Detroit, MI

Photo 5. GM installs Level 1 outlets on parking lot lamp posts for convenient workplace charging.
Photo from GM.

GM, a Workplace Charging Challenge Partner, started a workplace charging program in 2010 by installing over 100 Level 2 EVSE across key employee parking lots. A few years later, GM wanted to provide more charging stations to keep up with demand as more employees purchased new Chevrolet Volts. Not only did GM choose to expand its Level 2 offerings, but it also chose to start installing Level 1 outlets to maximize the number of employees that would have access to workplace charging while staying within available budgets. Installing Level 1 outlets cost significantly less than installing a Level 2 EVSE. GM reported a rule-of-thumb estimate in March 2016 of $10,000 to install a Level 2 EVSE and $1,000 to install a Level 1 outlet. Considering the available parking lot power supply, (generally) GM could install twice as many Level 1 outlets than Level 2 before it needed to pay for more costly electrical upgrades. Overall, choosing Level 1 outlets enabled GM to expedite workplace charging projects and provide workplace charging for many more employees than it could have if it only chose Level 2 EVSE.

Many of GM's employee parking lots are located a long distance away from employee work areas, and Michigan winters can be cold. Leaving a vehicle at a Level 1 charging station all day can be more convenient and a better use of an employee's time than having to move a vehicle mid-day to share a Level 2 EVSE.

GM now has over 150 Level 1 outlets for employee PEV charging and almost 350 Level 2 EVSE at its locations around the country as part of its free workplace charging program. Offering Level 1 outlets became such a successful strategy that it is now standard GM practice to install Level 1 outlets near a parking space whenever they can easily be added as part of electrical work on a building or parking lot. For example, a conversion of a parking lot lamp post to use more efficient lighting can also include

installing several Level 1 outlets on the lamp post. The incremental cost of adding a Level 1 outlet is minimal when electrical work is already being done.

Coca-Cola – Atlanta, GA

The Coca-Cola Company, a Workplace Charging Challenge Partner, started its workplace charging program in 2012 by offering 12 Level 1 outlets in one of its parking garages. Spaces were in such high demand that Coca-Cola installed an additional 12 Level 1 outlets in a different parking garage. As employees continued to purchase PEVs, the company continued to install Level 1 outlets and now has 75 Level 1 charging stations spread over multiple parking garages. Coca-Cola chose Level 1 outlets because they were a low cost option and allowed employees to park at the charging station without having to return during the day to move their vehicle or EVSE connector. About 160 Coca-Cola employees drive PEVs and use the free workplace charging on a first-come, first-serve basis. Additionally, Coca-Cola has two Level 2 EVSE available for visitors and a DC fast charger (DCFC) station that can be reserved in 30 minute slots through a Microsoft Outlook room reservation tool. The DCFC provides piece of mind if there is not enough time for a vehicle to charge at a Level 1 outlet. It was donated by Nissan and has a CHAdeMO connector compatible with Nissan, Mitsubishi, and Kia electric vehicles. Generally, PHEVs do not have DC fast charge capability, but they can run on gasoline if they run out of electric miles.

Photo 6. One of many highly visible Level 1 charging stations at Coca-Cola. The driver straps the cordset to the electrical conduit so there is no strain on the plug and outlet. The parking spot is well marked with an Electric Vehicle Parking Only sign.
Photo from Don Francis, Clean Cities-Georgia.

The Level 1 outlets are located about four feet off the ground and each parking space has an "Electric Vehicle Parking Only" sign for high visibility. One challenge from having the outlet so high is that the weight of the cordset may pull on the plug and outlet. Out of concern for the lifespan of the plug and outlet, some drivers strap their cordset to the electrical conduit to relieve the tension as shown in Photo 6.

Estimated Costs for Scenario A (Making an Electrical Outlet Available)

Installation

At some sites, there may already be a Level 1 outlet located near a parking spot that can be used for Level 1 charging. Before using it for charging, it is important to have an electrician inspect the outlet and confirm that it meets PEV charging requirements. If a new outlet or an upgrade to an existing 120 V

circuit is needed, this may cost around $200–$500, assuming no unusual construction is needed.[8] An employer may choose to install outlets along a row of parking spaces, as shown in Photo 7. Generally, the cost range for installing an outlet and dedicated circuit in a parking lot or garage is $300–$1,000 per outlet[9] (installing multiple outlets on a site can result drive costs toward the lower end of that range). If a site requires electrical service upgrades to accommodate the power used by PEV charging stations, installation costs may increase significantly. Electricians can provide estimates for a specific project.

Employers can minimize charging station installation costs by choosing a location close to the electrical service. Wayfinding signage can be used to direct drivers to the charging stations as an alternative to placing the charging station in a prominent location with a more costly installation. Station signage is used to help PEV drivers identify charging stations and communicate restrictions on which vehicles are allowed to use the parking spot. Station signage and painted parking spots can be especially helpful when offering a Level 1 outlet since the small outlet may not be noticeable to drivers. Visit the Workplace Charging Challenge website (http://www.energy.gov/eere/vehicles/workplace-charging-challenge-signage-guidance) to find signage templates and learn how proper signage can optimize charging station usage.

Photo 7. Electrical outlets are available along a row of parking stalls for PEV drivers to charge their vehicles using a Level 1 cordset.
Photo from Jonathan Kirchner, Coca-Cola.

Electricity Consumption and Demand

A major benefit to Level 1 charging is the lower electricity consumption costs compared to higher power charging options. Assuming drivers have a commute of 10–25 miles one-way, the potential electricity consumed by one Level 1 charging station could range from 867–2,167 kWh/year. Assuming a commercial electricity rate of 10.59 cents per kilowatt-hour[10] results in an annual cost of $92–$229 electricity consumption for each Level 1 charging station.

In addition to consumption costs, many commercial and industrial sites may be subject to power demand charges from the utility. Each utility has its own threshold for demand charges, typically between 20 and 50 kW. Once a site's power usage exceeds that threshold, the site is charged a fee based on the site's peak demand, regardless of the duration of that peak demand. Using PEV charging stations may result in

[8] *Plug-In Electric Vehicle (PEV) Roadmap for North Carolina*, North Carolina Plug-in Electric Vehicle Taskforce. February 2013
[9] U.S. Department of Energy, November 2015, Costs Associated with Non-Residential Electric Vehicle Supply Equipment http://www.afdc.energy.gov/uploads/publication/evse_cost_report_2015.pdf.
[10] Table 5.3 at http://www.eia.gov/electricity/monthly/pdf/epm.pdf

higher demand fees by increasing the facility's peak electricity demand. Sites with charging stations can experience demand charges from $0 to over $2,000/month. This is more commonly a concern for sites that have DC fast charging or multiple Level 2 EVSE and rarely a concern for Level 1 charging. Contact the utility prior to charging station installation for information about demand charges and how they may be minimized or eliminated.

Maintenance

Over time, the commercial grade NEMA electrical outlet used with Level 1 cordsets may need to be replaced. Depending on the outlet age, type, and use, the outlet should function appropriately for many years. The cost of an outlet can range from $1–$40 depending on whether it is for an indoor or outdoor application, the quality level, and if it protects against electrical shock (GFCI rated). Estimated electrician's fees for replacing outlets are in the $50–$75 range, depending on how many outlets need to be changed and the labor rates in the geographic region.

Sample Employee Fee for Scenario A (Making an Electrical Outlet Available)

If an employer wants to recover the entire cost of offering workplace charging, providing a Level 1 outlet may be the best option for both employers and employees. The table below provides an example in which drivers pay $11.67–$17.50 per month (equivalent to $0.54–$0.81 per workday) to connect their own cordsets to electrical outlets. Actual costs will depend on the installation cost and the electricity consumption.

Table 1. Example for Recovering Level 1 Charging Costs when Making a Level 1 Electrical Outlet Available

SCENARIO A Example for Recovering Level 1 Charging Costs	Annual Cost	Monthly Cost
Electricity Consumption Cost for 1,039 kWh/yr*	$110/yr	$9.17/mo.
Installation for a Level 1 Outlet $300–$1,000** over 10 years	$30–$100/yr	$2.50–$8.33/mo.
PEV Driver Fee to Cover All Costs	**$140–$210/yr**	**$11.67–$17.50/mo.**

* Average one-way commute (12 miles, 2009 National Highway Transportation Survey, nhts.ornl.gov), Average PEV efficiency (3 miles per kilowatt-hour, U.S. Department of Energy, 2014 PEV Models, www.fueleconomy.gov), Average commercial customer electricity price (10.59 cents per kilowatt-hour, Energy Information Administration, 2015 Table 5.3 at http://www.eia.gov/electricity/monthly/pdf/epm.pdf).
** U.S. Department of Energy, November 2015, Costs Associated with Non-Residential Electric Vehicle Supply Equipment http://www.afdc.energy.gov/uploads/publication/evse_cost_report_2015.pdf.

Scenario B: Providing Level 1 EVSE

Overview

Employers can install permanent wall mounted or pedestal mounted Level 1 EVSE so drivers do not have to provide their own cordsets. The additional expense of the EVSE increases the cost of this option relative to offering only a Level 1 outlet. Since drivers can leave their cordsets at home, this option is more convenient for employees, as there is no risk of personal property (cordset) theft or damage.

A simple installation could entail plugging a cordset into a Level 1 outlet and mounting the equipment on a wall. Alternatively, wall-mounted or pedestal-mounted Level 1 EVSE can be hardwired to the electrical system. Placing the EVSE on a wall is generally the most cost-effective design because it avoids the costs of underground electrical conduit. It is also possible to install a pedestal-mounted Level 1 EVSE next to a parking space but this is often the highest cost Level 1 option.

Photo 8. Steve Melink holding the connector of a Level 1 PowerPost part of Melink's workplace charging program.
Photo from Melink.

Most Level 1 EVSE units are designed to simply charge a vehicle; they are not networked and do not have additional software features that track energy use, process payment for a charging session, or determine which drivers are authorized to use the EVSE. Secondary systems that provide these features can be installed to supplement the Level 1 EVSE. Employers that want to track EVSE energy use can install a monitoring product that tracks power consumption. A secondary system is available that can provide access control and payment features for Level 1 charging.

Workplace Charging Challenge Partner Examples

Melink – Milford, OH

Melink Corporation, a Workplace Charging Challenge Partner, is committed to reducing vehicle emissions and reliance on petroleum fuels. In an effort to share Melink's vision for sustainable transportation, it provides free charging for employees and visitors as well as an incentive for employees to purchase a PEV. Wanting to offer a variety of charging methods, the company installed ten Level 1 PowerPost EVSE and four Level 2 EVSE on its campus in December 2014. Testing a new product on

campus had some challenges, but everything has been working smoothly after the electrical sub panel was upgraded in January 2015. As of April 2016, 80% of the charging stations were occupied on a daily basis and Melink intends to install additional EVSE in the near future. The Melink headquarters is a Net-Zero Energy and LEED Platinum building. Melink uses a custom building monitoring system to track the energy used throughout the building down to the individual breaker. This monitoring system helps identify excessive energy consumption in the building and track the energy used by the free PEV charging.

SAP – Palo Alto, CA

When SAP, a Workplace Charging Challenge Partner, began planning its workplace charging program, managers conducted an employee survey to identify how many employees were interested in charging their vehicle at work. Based on the survey responses, SAP determined that PEV drivers would have sufficient time during the work day to replenish their batteries using Level 1 EVSE. Since the equipment and installation for Level 1 EVSE cost less than Level 2 EVSE, SAP installed 20 ChargePoint Level 1 EVSE (15 of them can charge two vehicles at the same time). Each parking space next to an EVSE is marked as EV charging only and signage is on the ground. Drivers have to sign up for an access card, but there is no fee for using the workplace charging. SAP's PEV community uses a wiki page to maintain a calendar for who will need to use the EVSE or when an EVSE unit will be down for maintenance.

SAP has 160 employees registered to use these 35 charging ports and the demand is increasing. This growing demand has been a challenge for SAP and is the reason the company may choose to install Level 2 EVSE in the future. With Level 2 EVSE, SAP could implement a system in which two employees can take turns using one EVSE. When discussing additional EVSE installations, SAP faced some internal management challenges – including whether future EVSE installation costs should come from the facilities budget or represent an amenity that could be paid from the human resources budget. It has also faced challenges from employees who do not drive PEVs and think that it is an unequitable practice to provide PEV drivers with front row parking and free fuel.

Estimated Costs for Scenario B (Providing Level 1 EVSE)

Equipment Hardware

Simple wall-mounted Level 1 EVSE units that plug into an outlet or can be hardwired to the electrical system cost around $300–$600. On the higher end of the Level 1 EVSE price range, a pedestal unit with access control costs about $1,500.

Installation

Charging station installation costs vary significantly and are influenced by how much electrical work is needed, how much trenching or boring is needed, and ancillary considerations like permitting, labor rates, and ADA requirements. Little data is available on the costs of installing Level 1 charging equipment. As an example, in North Carolina, an upgrade to a 120 V circuit is needed may cost $200–$500, assuming no unusual construction is needed.[11] Installing a wall-mounted Level 1 EVSE hardwired to the electrical service would also cost around $300–$1,000 assuming the unit is located within 50 feet of the electrical service and no trenching or complex electrical work is needed. The installation cost for pedestal-mounted Level 1 EVSE will greatly depend on the selected location. Trenching or boring parking pavement to connect the EVSE to the electrical service can add a significant cost to the installation process. A ballpark cost range for a pedestal mounted Level 1 EVSE installation is $1,000–$3,000, assuming the unit is located within 50 feet of the electrical service and no major electrical upgrades are needed. If a site requires electrical service upgrades to accommodate the power used by PEV charging stations or extensive trenching, there may be a significant increase to installation costs. While there is little data on costs for installing pedestal-mounted Level 1 EVSE, the pedestal-mounted Level 2 EVSE units installed during the Department of Energy's EV Project had an average installation cost of $2,305 with some installations costing over $4,000.[12] To obtain estimates for a specific project, contact electricians and charging station manufacturers.

Photo 9. At AeroVironment's Monrovia office, they offer workplace charging using TurboDocks which can be used for Level 1 or Level 2 charging.
Photo from AeroVironment

As noted above, employers can minimize charging station installation costs by choosing a location that is close existing electrical service. See the Costs for Scenario A section above for more information about signage. Visit the Workplace Charging Challenge website (http://www.energy.gov/eere/vehicles/workplace-charging-challenge-signage-guidance) to find signage templates and learn how proper signage can optimize charging station usage.

[11] *Plug-In Electric Vehicle (PEV)* Roadmap *for North Carolina*, North Carolina Plug-in Electric Vehicle Taskforce. February 2013
[12] *What were the Cost Drivers for Workplace Charging Installations?*. https://avt.inl.gov/sites/default/files/pdf/EVProj/WhatWereTheCostDriversForWorkplaceInstallations.pdf

Electricity Consumption and Demand

For information about electricity consumption and demands, see the Costs for Scenario A section above.

Maintenance

Since the PEV market is relatively new, little information is available about the maintenance costs or lifespan of EVSE. Regular maintenance is generally not required for Level 1 EVSE. If the EVSE is damaged due to vandalism or driving over a cord, it is more common to replace the damaged component than to try to repair it.

Sample Employee Fee for Scenario B (Providing Wall-Mounted Level 1 EVSE)

An employer may want to charge a fee to recover the costs of electricity, EVSE, and installation. In the example below, drivers would pay $14.17–$22.50 per month (equivalent to $0.65–$1.04 per workday) to offset the costs of electricity consumption and the EVSE. Actual costs will depend on which EVSE is selected, installation costs, and the electricity consumption.

Table 2. Example for Recovering Level 1 Charging Costs when Providing Wall-Mounted Level 1 EVSE.

SCENARIO B Example for Recovering Level 1 Charging Costs	Annual Cost	Monthly Cost
Electricity Consumption Cost for 1,039 kWh/yr*	$110/yr	$9.17/mo.
Wall mounted Level 1 charging equipment with cord and connector $300–$600 over 10 years	$30–$60	$2.50–$5.00/mo.
Installation for wall mounted Level 1 charging equipment $300–$1,000** over 10 years	$30–$100/yr	$2.50–$8.33/mo.
PEV Driver Fee to Cover All Costs	**$170–$270/yr**	**$14.17–$22.50/mo.**

* Average one-way commute (12 miles, 2009 National Highway Transportation Survey, nhts.ornl.gov), Average PEV efficiency (3 miles per kilowatt-hour, U.S. Department of Energy, 2014 PEV Models, www.fueleconomy.gov), Average commercial customer electricity price (10.59 cents per kilowatt-hour, Energy Information Administration, 2015 Table 5.3 at http://www.eia.gov/electricity/monthly/pdf/epm.pdf).
** U.S. Department of Energy, November 2015, Costs Associated with Non-Residential Electric Vehicle Supply Equipment http://www.afdc.energy.gov/uploads/publication/evse_cost_report_2015.pdf.

Management Policies

A clear and consistent management policy is important for any workplace charging program. It is especially important for Level 1 charging since employees often use their own cordsets and a lack of networked features such as communications capabilities places more reliance on management policy. Having an official written policy in place can make a difference between a successful workplace charging program and one that faces many problems. For instance, if an employer informally lets employees plug-in their vehicles to a wall outlet without a written policy, that system could be disrupted if someone in authority objects to providing free electricity. Workplace Charging Challenge Partners have found the suggestions below helpful for managing a successful Level 1 workplace charging program.

Administration

Designate a responsible individual or group for ongoing charging station operation and maintenance issues, use clear and consistent signage and stall paint to indicate PEV parking designation, and identify which drivers have access to charging. Provide clear guidance on how workplace charging policy will be enforced. Read about laying the groundwork for a well-managed program on the Workplace Charging Challenge website: http://www.energy.gov/eere/vehicles/workplace-charging-management-policies-administration

Registration and Liability

Have PEV-driving employees register their vehicles with the employer to participate in the workplace charging program. Consider adding liability language to the registration form to address employer and employee responsibilities when using the charging stations. Examples include prohibiting the use of extension cords and implementing other safety measures to avoid tripping hazards that may be associated with Level 1 outlets. Once registered, provide employees with rearview mirror hangtags or window stickers that signal they have permission to charge. Read simple sign-up procedures for helping employees get plugged in to workplace charging on the Workplace Charging Challenge website: http://www.energy.gov/eere/vehicles/workplace-charging-management-policies-registration-liability

Photo 10. This signage makes it clear that the parking spot is reserved for electric vehicle charging.
Photo from City of Auburn Hills, NREL 27653.

Charging Sharing

A key reason why employers provide Level 1 charging is to avoid the need for employees to move their vehicles in order for others to charge over the course of the workday. In this case, the employer may find it helpful to either assign PEV drivers to a specific charging-capable parking stall or issue only a certain number of Level 1 charging permits. Read about charging sharing practices that mitigate problems when the number of employee-driven PEVs exceeds charging station availability on the Workplace Charging Challenge website: http://www.energy.gov/eere/vehicles/workplace-charging-management-policies-sharing

Photo 11. This energy monitor installed next to the control panel tracks energy consumption on up to 12 EVSE and provides access to the data through an online interface.
Photo from Evolution Electric Vehicle Systems, LLC.

Pricing

Many existing workplace charging programs are free for employees. As the number of PEVs expands, employers may implement a fee to discourage employees who do not truly need to charge at work from occupying the stations. Additionally, an employer may require a fee to recover some or all of the costs of offering workplace charging (electricity, installation, and hardware). Since Level 1 options often lack a fee-collection feature, the employer may choose to set a certain biweekly, monthly, or annual fee that can be collected in the employee's paycheck, alongside submission of their parking fee or at the time of PEV registration. Example fee structure can be found in the "Sample Employee Fee" sections above. Read about the advantages and disadvantages of fee-based and free employee charging on the Workplace Charging Challenge website: http://www.energy.gov/eere/vehicles/workplace-charging-management-policies-pricing

States are considering implementing a regulation (NIST HB44) that will require transaction reporting any time a driver is charged a fee for PEV charging (Level 1, Level 2, and DC fast charging). The EVSE would need to measure the energy used during the charging session and provide a kWh receipt via web, SMS text, QR code, etc. As of May 2016, this requirement is being implemented in California on an interim basis and other states are considering adopting it. Since this type of transaction reporting is not available for Level 1 charging, it is unclear how it will affect situations in which employers want to charge a fee for Level 1 charging.

Comparing Level 1 and Level 2 EVSE

The main difference between Level 1 and Level 2 EVSE is the charging speed. Since Level 2 EVSE uses higher power, it can replenish 10–20 miles of range in one hour of charging, with PHEVs typically on the lower end of the range.[13] If a driver relies on workplace charging for the return commute and is at work

[13] Alternative Fuels Data Center - http://www.afdc.energy.gov/fuels/electricity_infrastructure.html

for a shorter period of time than anticipated, having access to Level 2 EVSE may meet his or her needs, whereas Level 1 EVSE would not. An employer could consider a mixture of charging options with the Level 1 EVSE for those with typical work schedules and Level 2 EVSE available for emergency situations that require faster charging.

Although slower than Level 2 charging, there are many advantages to choosing Level 1 charging. The cost to install a charging station depends on many site-specific factors, but generally, installing a Level 1 station costs less than installing a Level 2 station. Some employers that offer Level 2 charging arrange for vehicles or connectors to be moved during the day to charge multiple vehicles on the same Level 2 EVSE. While this may be good fit for some organizations, others may prefer a workplace charging program that does not involve employees visiting the parking facility mid-day to tend to their vehicles. Each Level 1 station can be paired with one vehicle so there is no need to design and enforce a policy for moving cars or equipment during the day.

With an annual networking fee, networked Level 2 EVSE provide additional features such as communications capabilities, access control, point of sale, energy monitoring, and energy management. These features are not available on the lowest-cost tier of Level 1 EVSE. Some Level 1 EVSE on the higher end of the cost range do have access control systems. Secondary systems can be purchased to incorporate additional features such as access control, payment systems, and energy monitoring into a non-networked EVSE. These secondary systems can be useful if an employer wants to use Level 1 charging but also wants to have additional features that do not come with the EVSE. Since they have a one-time purchase cost instead of an annual fee, these products can be more cost effective than paying annual networking fees. An employer that is considering Level 1 charging and would like additional features should ask the EVSE manufacturer for recommended companies that offer secondary systems.

Table 3. Comparing Level 1 and Level 2 Charging

	Level 1	Level 2
Charging Speed	2–5 miles of range in 1 hr.	10–20 miles of range in 1 hr.
Costs	Generally lower	Generally higher
# Vehicle Using EVSE/Workday	1	2 or more
Access Control	Available on some units	Available on some units
Energy Monitoring	Not available on unit*, but available on secondary system	Available on some units
Point of Sale	Not available on unit*, but available on secondary system	Available on some units

**Based on Level 1 EVSE units available in April 2016.*

The site's overall electricity consumption, demand fee structure, and time of use rates may contribute to choosing between Level 1 and Level 2 charging. In some situations, a workplace may prefer to choose Level 1 over Level 2 EVSE since charging can be provided to more vehicles without pushing the site's peak electricity usage above the utility's threshold for demand fees. In other situations, a workplace may prefer Level 2 over Level 1 EVSE since the vehicles can complete charging in the morning and not increase the site's afternoon peak demand, assuming a management policy that prohibits beginning a second round of charging mid-day. Time of use rates may also factor

into the decision. Contact the electric utility to discuss demand fee rate structures and understand how different charging scenarios can affect your utility bill.

Contact the electric utility to discuss demand fee rate structures and understand how different charging scenarios can affect your utility bill.

The site must have sufficient electrical capacity at the appropriate voltage flowing from the utility to the site's electrical panel to meet the charging stations' power needs. If the site does not meet these requirements, it will need electrical service upgrades. In some cases, electrical service upgrades have cost $10,000–$25,000, including installing a new transformer and significant trenching. To avoid electrical service upgrades, employers are encouraged to choose the EVSE type and quantity that fit within the available electrical capacity. Since Level 1 EVSE draws less power than Level 2 EVSE, a site could install more Level 1 than Level 2 EVSE before meeting the limit of the electrical capacity. For example, a site that has 20 kW of available electrical capacity could install two 7.2 kW Level 2 EVSE or ten 1.9 kW Level 1 charging stations. Keeping in mind that most PEVs charge at a rate of 3.3 kW or 6.6 kW when using a Level 2 EVSE, installing 7.2 kW Level 2 EVSE may not be the ideal design. Lower power Level 2 EVSE are available, which could enable a company to install more EVSE without needing electrical upgrades. Since offering workplace charging encourages more employees to obtain PEVs for their work commute, employers should make decisions about the level and quantity of charging stations based on their expected long term need.

Photo 12. Atlantic Station offers ten Level 1 outlets in a parking garage underneath one of their office towers. These spaces are reserved for the office workers in the building.
Photo from Don Francis, Clean Cities-Georgia.

Successful workplace charging programs choose the charging station design that best fits the needs of the employer and employees. Taking into account the available budget, program goals, employee interest, and site specific requirements, Level 1 charging can be a great workplace charging solution. The low-cost option of simply providing a Level 1 outlet for employees to plug in their own cordset is a viable scenario

for organizations that have minimal available capital and prioritize recouping all costs associated with workplace charging through relatively low employee fees. An employer may be able to cover the costs of offering a Level 1 outlet by charging employees $11.67–$17.50 per month. For increased convenience, installing Level 1 EVSE at the workplace can allow PEV drivers to replenish their batteries during the work day without needing to use a personal charging cordset. An employer may be able to cover the costs of offering a Level 1 EVSE by charging employees $14.17–$22.50 per month.

Well-thought-out and documented management policies are crucial for a workplace charging program to operate smoothly. Information about administration, registration and liability, charging sharing, and pricing can be found on the Workplace Charging Challenge website.

In addition to retaining talented employees, offering the option to charge PEVs during the workday can incentivize more employees to purchase PEVs. Replacing conventional vehicles with PEVs can reduce greenhouse gas and other emissions that contribute to climate change and smog while also saving drivers money and reducing the nation’s dependence on petroleum.

NOTICE

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U.S. Department of Energy's Workplace Charging Challenge

In March 2011, President Obama announced the *EV Everywhere Grand Challenge*, which is a Clean Energy Grand Challenge to PEVs that are as affordable and convenient for the American family as gasoline-powered vehicles by 2022. To help accomplish this goal, the Workplace Charging Challenge encourages U.S. employers in all sectors of the economy to provide PEV charging access at their worksites.

The Workplace Charging Challenge provides resources, tools, and technical assistance to implement and manage workplace charging programs, and Challenge partners are nationally recognized for their sustainability efforts. For more information on workplace charging or becoming a partner, contact the Challenge at *workplacecharging@ee.doe.gov*.

Workplace Charging Challenge
U.S. DEPARTMENT OF ENERGY

EV Everywhere
U.S. DEPARTMENT OF ENERGY

U.S. DEPARTMENT OF ENERGY
Energy Efficiency & Renewable Energy

For more information, visit: energy.gov/eere

DOE/EE-1399 • July 2016

Cover photos:
Lamppost with outlets photo from John Smart, INL; wall-mounted EVSE photo from ClipperCreek; and pedestal-mounted EVSE photo from Telefonix

EV Charging Installation Guide for Business

Welcome

Ameren Missouri is your EV charging resource. EVs are increasingly showing up at workplace and community parking lots throughout our region. Ameren Missouri will help ensure you are prepared when your employees and/or customers begin asking to charge their cars at your location.

As part of our commitment to making this transition as easy as possible for our valued customers, Ameren Missouri has created this QuickStart Guide to help you understand what you need to know about charging equipment, the steps to plan for installation, and the benefits of providing this service.

For more information about vehicles, fleet options, incentives, and additional resources visit AmerenMissouri.com/EV.

Introduction

Over 1.5 million electric vehicles (EV)[1] are now on the road across the United States and sales of EVs are growing here in Missouri. With more than 40 models now available and many more poised for release over the next several years - including fleet, medium, and heavy-duty options - the demand for charging options to power the vehicles is also anticipated to continue growing. Business owners across our region have the opportunity to join this rapidly growing sector by installing EV charging infrastructure at workplace, multi-family dwelling, or other consumer destination locations. Offering charging can provide many benefits including attracting and retaining top workforce talent, establishing your company as a leader in sustainability, and increasing customer satisfaction and time spent at your establishment.

This guide will help you understand the different kinds of charging equipment, how to choose the best location to install chargers, the benefits to offering charging at your business, and potential installation costs. A project checklist is also included to help you get started.

1 https://www.eei.org/issuesandpolicy/electrictransportation/Pages/default.aspx

Charging Overview

Defining EVSE (Electric Vehicle Supply Equipment)

Electric Vehicle Supply Equipment (EVSE), colloquially known as "charging stations," is the equipment used to safely supply electricity to an EV from a power source. EVSE communicates with the EV to ensure safety for the user, vehicle, and power grid. EVSE can be installed at residences, workplaces, retail, public places, and fleet facilities. How quickly a battery charges depends on multiple factors including the type of battery, vehicle considerations, and the type of the EVSE.

Types of Charging Equipment

Level 1: Easy

Level 1 charging uses a standard 120-V AC plug and typically provides about 4-5 miles of range per hour. Most EVs come with a cord for level 1 charging. If desired, a dedicated level 1 charger can be installed at workplaces or community locations, though for at-home charging, access to a standard wall outlet is adequate.

Level 2: Faster

Level 2 charging uses a 240-V or 208-V electrical connection and typically provides about 25 miles of range per hour or a full charge in 4-8 hours. Level 2 EVSE requires a dedicated circuit of 20-80 Amps depending on the specific requirements of the chosen EVSE. It is common for workplaces, retail, public places, and homes to have Level 2 charging. Level 2 chargers are essentially a universal connector that will be described in the Connectors and Plugs section below.

DC Fast Charging: Fastest

A DC fast charger can typically add up to 80% charge in 30 minutes. DC Fast Charging is fundamentally different from Level 1 and Level 2 charging. It requires a higher power supply, typically 480V and 100+ Amps. The charging rate depends on the battery design of the EV and the maximum rate of the charger. Today's EVs can accept DC charging rates ranging from 50kW to 150kW, while some near-future EVs will have charging rates above 300kW. DC fast chargers today have the capability of delivering power at a rate of 50kW to 350kW. Before a DC charging session begins, the EV and the charger communicate to determine the appropriate charging rate for the EV batteries. DC Fast charging uses several types of connectors as described below that vary depending upon make and model of the vehicle. DC fast charging infrastructure is essential for enabling long-distance EV travel and is being developed throughout the country to connect cities.

Level 1 Example

Level 2 Example

DC Fast Charging Example

Connectors and Plugs

Any vehicle with a standard SAE J1772 receptacle will be able to use Level 1 and Level 2 charging. Since all major manufacturers support this standard (Tesla provides adapters), there's no need for drivers to be concerned about compatibility with the charging infrastructure. Different manufacturers use different adapters for fast charging including the CHAdeMO (used by Nissan) and Combined Charging System (CCS) (used by most automakers).

Note, because Tesla has a proprietary connector type, other EVs are not able to connect to Tesla charging stations. However, Tesla owners have access to accessory adapters and can utilize SAE J1772 and CHAdeMO plugs.

Summary Table

Level	Voltage	Charge Rate	Connector	Auto Makers
Level 1				
	120-V	~5 miles per hour	SAE J1772 	All
Level 2				
	208-V or 240-V	~up to 25 miles per hour	SAE J1772 	All (Tesla with adapter)

Level	Voltage	Charge Rate	Connector	Auto Makers
DC Fast Charger				
	480-V	~up to 80% in 30 minutes	CHAdeMo 	Nissan Mitsubishi
	480-V	~up to 80% in 30 minutes	CCS (Combined Charging System) 	Most automakers including: BMW Jaguar Chevrolet Audi/VW Ford
	480-V	~up to 80% in 30 minutes	Tesla 	Tesla

Recommendations

When thinking about what kind of EVSE to install, consider your goals, how it is most likely to be used, and how to bring the most benefit to both your intended users and your organization. Assuming you want to encourage use of EVs, convenience for drivers is a key consideration.

Workplace

Workplaces and homes are ideal for EV charging given the long dwell times. The energy needed for Missouri's average daily commute of 40 miles can easily be recovered using a level 1 or level 2 charger during the workday. While dedicated workplace charging is recommended, there are two approaches to consider.

- For smaller campuses that make moving vehicles or charging connectors relatively easy, 32 Amp level 2 chargers may be shared and allow multiple users in one day. Another consideration is length of employee commutes.
- For larger campuses with hundreds of employees when moving vehicles is inconvenient and a distraction from core work and sharing chargers is not practical, 16 Amp Level 2 chargers can be used to provide an ample 12 miles of range per hour of charge. This also may allow more stations to be installed due to lower power requirements for each charging plug. Some charging stations have the ability to split a single electrical feed into two 16 Amp stations as well to provide this type of charging while only having to wire one circuit to the unit. This can also save on installation costs as well as electrical panel requirements.

Employees view workplace charging as a great benefit. It also helps to create a stronger culture of sustainability and encourages the growth of electric vehicle adoption.

Additional workplace considerations include fleet vehicles such as security and campus use vehicles. For vehicles with a range of 200 or more miles, an overnight level 2 charge will provide the vehicle a full charge at the start of each day.

Multi-Family Dwellings

A multi-family dwelling like a large apartment building is another place where charging station installation can be a great benefit. Dedicated 32 Amp level 2 charging stations are preferred for residents who drive EVs to ensure they have the peace of mind to access charging whenever needed without the difficulty of coordinating with neighbors.

There are several ways to offset the cost of the energy such as implementing a small EV parking fee or including usage in the rent payment. Increasingly, multi-family property owners are choosing to offer EV charging as an amenity to differentiate their property and attract new residents or retain clients.

Public Locations

Retail

Retail destinations like malls, restaurants, grocery stores, hotels, and more can often benefit from level 2 charging. Visitors are able to top off their vehicle while at these locations utilizing services, shopping, or staying overnight. This approach can also attract new customers for these businesses by offering charging as an amenity.

Parking Facilities

Another great location for EVSE installation are public parking garages and lots. These lots, depending on the rate of traffic, can benefit from the installation of both level 1 and level 2 charging. A parking garage or lot with long dwell times is a great opportunity to offer the benefit of level 1 charging. Similarly, a surface parking lot averaging two to three hour dwell times is a great candidate for level 2 charging.

Retail and public locations adjacent to highways or major routes through and between cities can be good candidates for DC fast charger installations where drivers on long-distance trips can refuel their EVs for 30-60 minutes while taking a break and patronizing local businesses.

Summary Table

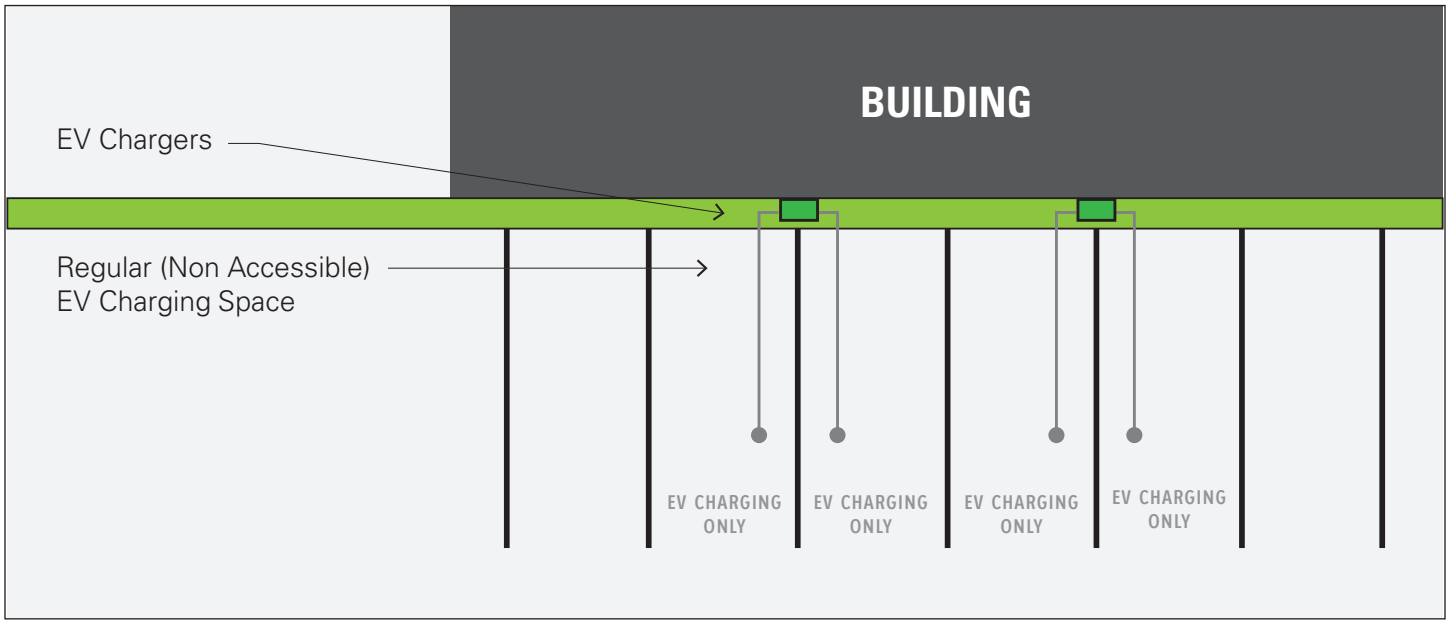
Location	EVSE Recommendation
Workplace	Level 2
Multi-Family Dwelling	Level 2
Public/Around Town	Level 2, DC Fast Charger

Workplace Charging

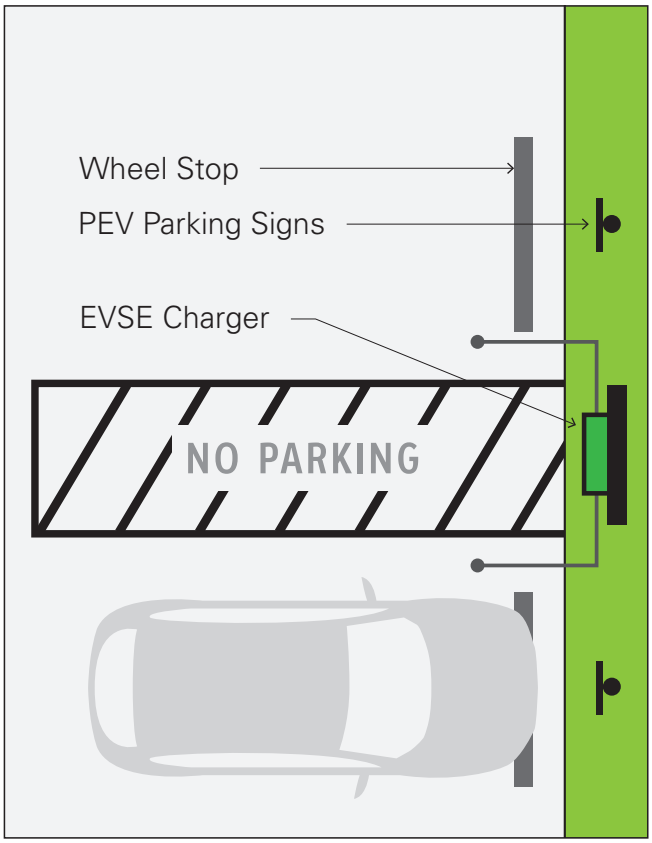
Multi-Family Dwelling Charging

Public/Around Town Charging

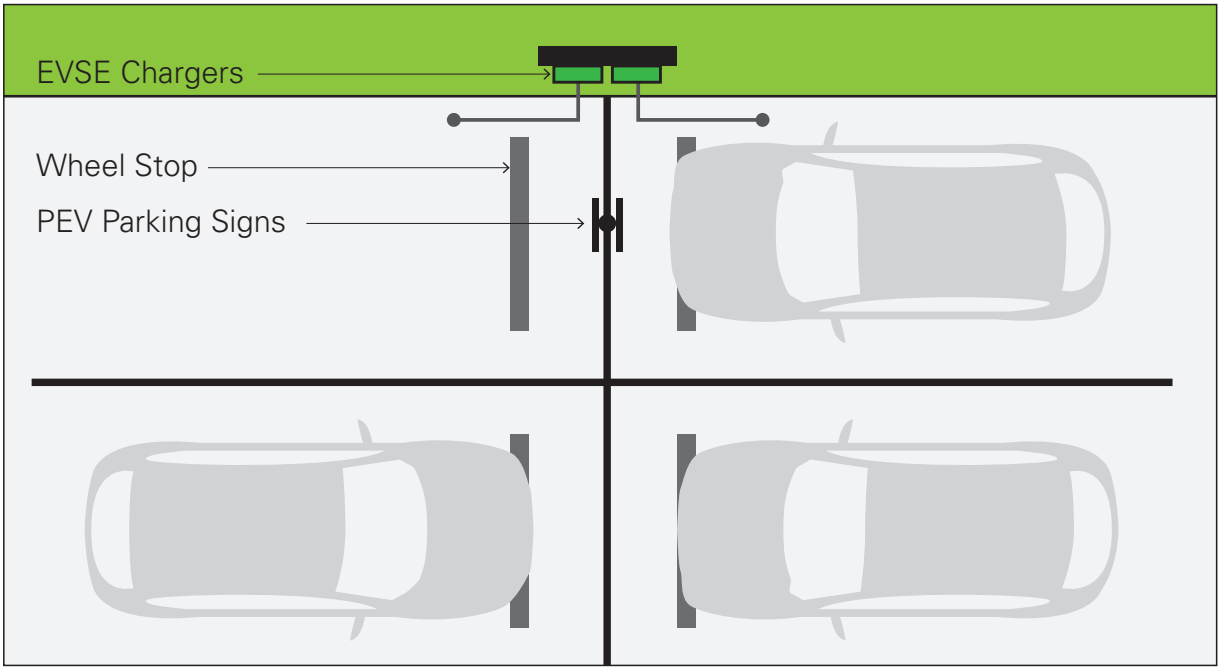
Diagrams of parking configurations with ports/cars.



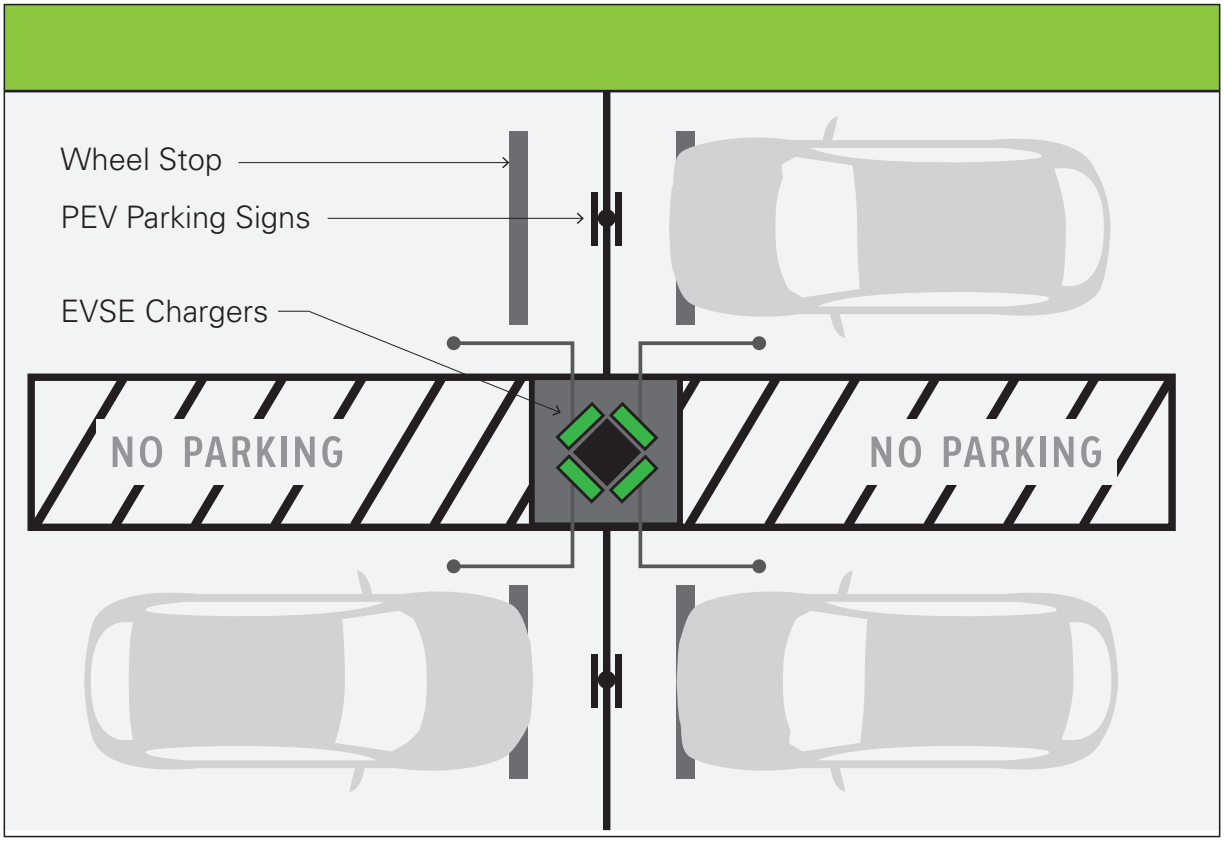
Example Wall-Mounted EVSE Configuration



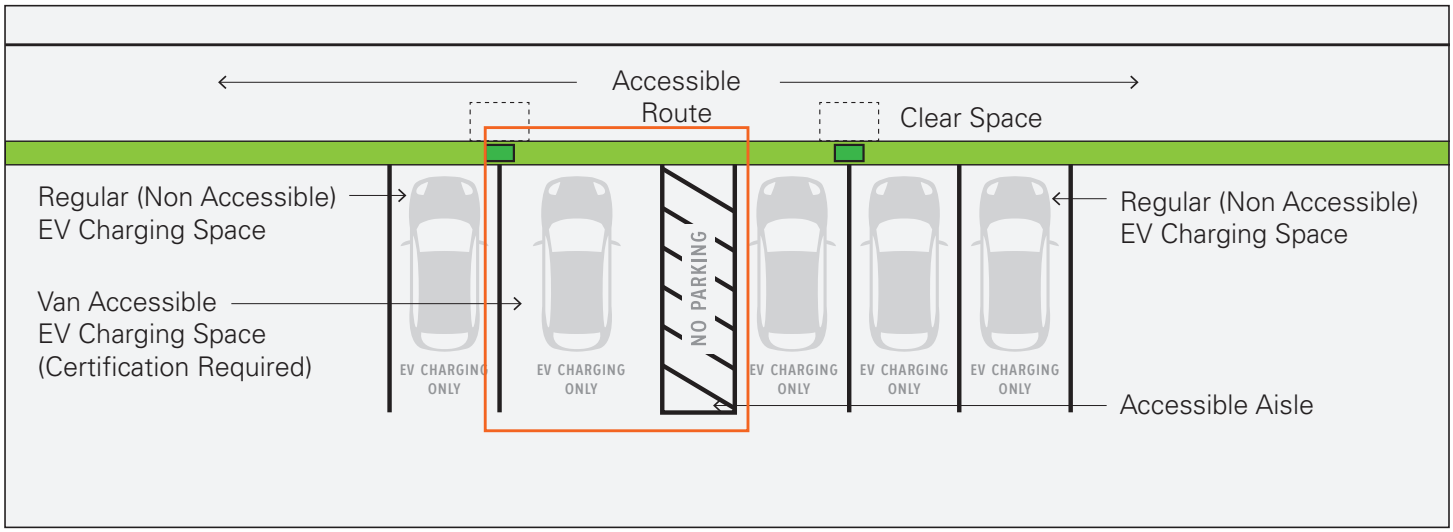
Example Single Unit Dual Port EVSE Configuration



Example Dual Unit EVSE Configuration



Example Multi-port EVSE Configuration



Example ADA Accessible EVSE Configuration

'Smart' or Basic Charging?

A key factor when planning to install EVSE is to determine if smart or basic EVSE will best fit your needs. The distinction between smart and basic systems is the ability to actively control the charging stations, collect charging information to get insights about utilization, and charge fees. This can include monitoring time and electricity use for the unit overall or a single charge session to determine peak usage, the ability to modulate the output of electricity provided to the unit during peak times and track users. A smart system connects to Wi-Fi or other available platforms like LTE wireless to share the information - thus a "smart" network.

Alternatively, a basic charger does not allow for user payments, capture and report out information on usage, or provide the owner control over the output of the unit beyond on and off. Basic charging is the simplest and least expensive option, however, provides the same charging capability as a smart charger without all the additional features.

While the initial cost can be higher than using a basic system, smart charging provides many benefits. For some organizations making the choice to utilize a smart charging system will make the most sense, especially when managing a fleet of all electric vehicles.

If you are unsure if networked equipment is necessary, consider choosing equipment with the Open Charge Port Protocol which will allow the station to be more easily and cost-effectively upgraded if needed/desired.

Payment Options

While offering access to free charging may be beneficial in particular settings, it is not practical in all instances. Most operators of public-facing DC fast chargers do offer this as a paid service. Smart systems enable the operator to collect fees via the network - several payment models are available including providing a monthly subscription service or structuring payment by use. By use payment structures offer flexibility to accommodate peak rates, total usage rates, and more. Depending on the network provider, payment structures may be customized. In addition to various payment structures, there are several ways to collect payment from users as well. Some models feature credit card readers for payment, others use smart phone enabled apps or RFID cards to enable the charging station. There are various costs associated with offering these options which will be discussed later in this guide.

EXAMPLE:

A retail center may choose to offer the first hour of charging free to customers. Every hour thereafter will be charged by kWh.

Monitoring and Reporting

Smart charging stations optimize the charging infrastructure by allowing the operator to manage the use of electricity. Smart chargers can also generate reports to help site hosts better understand demand which in turn can help them plan for future capacity, avoid peak demand charges that can cause higher electric bills, and design policies to better balance station usage. The ability to monitor and in turn regulate the system is a top consideration when determining which type of EVSE to install. Many businesses may find this data useful in determining how long people are using the chargers and can also help determine if there are certain times/days which are prime use hours. This can also be helpful when planning future expansion with more EVSE.

Visit AmerenMissouri.com/EV to connect with providers, through Ameren Missouri's EV Partner Network, that can assist with determining the right EVSE to fit your needs.

Considerations

There are many important considerations to take into account when determining if an EVSE installation is right for your organization and then, if so, how to plan for the project.

Location

When evaluating available parking, the ideal location to install EV charging is near existing electrical infrastructure to reduce installation costs. The farther away chargers are installed from this infrastructure the more complicated the installation process and, ultimately, the higher the costs. During initial construction is an ideal time to run conduit under parking areas to remote spaces to enable future EVSE installs. When installing conduit it is recommended to plan for additional spaces to be electrified in the future as many more EVs are expected on the roads in the years to come.

Convenience

Keep in mind that you'll want to locate the chargers in a convenient location with easy access to walkways and buildings if possible. Many operators choose to locate EV charging in optimal parking locations to raise awareness and encourage use of the chargers. If the chargers are difficult to access or burden the driver unnecessarily, they may choose not to charge. Locating chargers near prime parking locations can also help to encourage people to drive EVs. Another consideration would be the length of cables for the charging connector. Different EVs locate their charge ports in different locations so longer cables are recommended to not require vehicles to park a certain direction. Longer cables also allow EVs in two different parking rows to share the cable, when appropriate, to allow more access to the same station.

Driver Safety

Employee, tenant, and customer safety should be a top priority when designing your installation. The chosen area should be well lit to allow drivers to easily read all signs and instructions. Most charging stations are fully outdoor rated and safe to be used outside in the elements however it is recommended to verify this for your selected model. If a lot of chargers will be located along the same parking row it may be good to use cable management to keep cables up off the ground and help to mitigate any tripping hazards. Cable management will be covered below.

Mounting Type

Different configurations are available for mounting chargers, depending on your needs and available space. Wall mounts and pedestals are common options to consider when trying to choose the right equipment for your available space. In parking lots, typically pedestal mount chargers are used and for parking garages, wall mount chargers help to simplify installation. There are several other mounting styles as shown below:

Example Pedestal

Example Wall Mount

Internet Connection

Check the chosen chargers to see if they need Ethernet, Wi-Fi, or LTE wireless access to handle certain functions, including basic operation, usage data, or collecting payments. Keep this in mind as the installation process moves forward. Many chargers are capable of several connection types to make this process simpler for the user. Verify that the location chosen has the appropriate communications signal access, as appropriate, as some parking areas may be too distant from Wi-Fi to connect to the chargers.

Protecting Chargers

Curbs, wheel stops, bollards, and other mounting methods can be used to protect the charging equipment from potential collisions with cars.

Example Wheel Stop

Example Bollards

Aesthetics

If the aesthetics of the charging infrastructure is important, consider how it fits into the existing landscape. Screens or walls can be used to keep the chargers from public view. Additionally, if desired, many chargers can be branded using company logos or other graphics to customize aesthetics.

Signage and Marking

Call attention to all charging stations clearly with visible signs over the parking areas. Standard "EV Charging Only" signs are available through most signage companies that offer common road and parking signs. Also, consider adding clear markings on the ground to indicate the area is reserved for charging. It is recommended to paint the entire parking space if possible a bright green to highlight the spaces are reserved for EV charging.

Example Signage

Example Markings

Accessibility

While there is not yet the widespread application of the Americans with Disabilities Act (ADA) compliance requirements in Missouri, your organization or community may want to consider this. If so, ensure charging infrastructure complies with the ADA and other applicable local accessibility requirements. Considerations include the height of the curb, connectors, or providing accessible charging spaces. For these types of spaces wheel stops and curbs are not recommended so that users can easily access the charger from all sides. Bollards can be used to protect the charger from vehicles when they are parking.

Potential for Growth

When planning the installation location, consider how needs might increase as electric vehicles become more popular. A key question to consider is if you will want to add more charging capacity in the future. Planning for increased need from the start will help to save costs on design and construction for the longer term for items such as running conduit or adding electrical capacity for future EVSE installs.

Cable Management

Charging equipment comes with cords and keeping them organized and neat is important for the safety of the users and overall maintenance of the equipment and surrounding landscape. Many charging cords are loose, requiring the user to wrap the cord around a holder after each use. While this is simple and low cost, it can result in cables being left on the ground and subject them to unnecessary wear and cause an obstacle for landscape care. Planning for cable management is an important step when choosing the correct EVSE. Many charging stations are designed with cable management functions to ensure that cables are properly put away after each use as well as kept up off the ground during use. Options include pole or wall-mounted cable management reels as well as overhead cord management built into the charger.

Example Cable Management

Benefits of Offering Charging

Installing EV charging stations can provide an important benefit to your customers, employees, and community while helping establish your leadership in sustainability and innovation. Fleet operators can save on the total cost of vehicle ownership through fuel and maintenance savings while reducing emissions. Workplaces and businesses can provide vehicle charging options to employees and/or customers as an incentive while enhancing employee and customer recruitment and retention efforts, among other benefits.

	Workplace	Fleet	Multi-Family Dwelling	Public Locations
Attract and retain top talent	✓			
Attract new and repeat customers	✓		✓	
Create an advantage over your competitors	✓	✓	✓	✓
Increase employee satisfaction and productivity	✓	✓		
Increase customer satisfaction and shopping dwell time				✓
Potentially add a new revenue stream			✓	✓
Potentially increase rent and occupancy rate			✓	✓
Potentially Increase Property Value	✓	✓	✓	✓

Associated Costs

When considering an EV charging installation, there are a few cost areas to take into consideration. Equipment, installation, network, maintenance, and energy use are all costs to factor into the overall budget. There are, however, several ways to lower costs, including incentives offered by Ameren Missouri* as well as a federal tax incentive.

Equipment

The first consideration is the charging equipment itself - the cost of EVSE varies by brand, number of charging port connectors, networking capabilities, and more. When selecting the right equipment for your building, consider the features you most need or desire, and that fit your budget. For example, many higher end units feature data collection and require networking which will also add to overall cost considerations. Other questions to consider include:

- Do you need theft deterrent features?
- How many changing port connectors do you need?
- Do you wish to collect data?
- Would you like the ability to remotely manage the units?
- Is cable management preferred at your location?

Summary Table

Level 1	Level 2	DC fast charging
$300 (wall mounted) – $1,500 (pedestal unit)	$400 (non-networked) – $7,200 (smart)	$10,000 – $40,000+

For more detailed EVSE pricing information, please refer to the Ameren Missouri EV Partner Network. Our partners will be happy to help identify the correct EVSE for you and provide a quote.

*Incentives offered by Ameren Missouri are available to current Ameren Missouri business customers.

Installation

Installation costs can vary widely and are dependent on what electrical infrastructure exists, what upgrades are required, and local fees and permits. A few ways to reduce installation costs include choosing an installation location with existing electrical access, pairing the project with other needed construction, or installing multiple units. Locating new charging installations as close to existing electrical service as possible, when practical, will help to keep conduit and cable runs shorter. Also, selecting the proper mounting type of EVSE can help to reduce costs. For example, consider a wall mount unit in a parking garage or mounted to the side of a building near parking so that concrete work is not required when installing the units. If pedestal mount chargers are preferred however, perhaps pair installation with routine parking lot resurfacing so that boring or trenching costs can be minimized.

Installation Cost Considerations

- Concrete Work
- Electric Panel Work/Requirements
- Trenching
- Boring
- Running Conduit/Expanding Service Reach
- Permitting
- Signage and Markings

Internet Connection

If you have chosen networked or “smart” chargers, establishing a network connection may be an additional cost consideration. Beyond the network connection cost, depending on the vendor, there may also be an additional subscription charge for data collection and transmission. If you choose to collect payment at the chargers, there may also be fees associated with the transaction service. It is recommended to check with the supplier of the equipment to see what fees are required to operate the units when selecting a smart charger.

Maintenance

The type of warranty included with the charger varies by manufacturer and can range from a fixed-term to renewable. Level 1 chargers typically require little maintenance. Basic level 2 chargers typically require little to no maintenance. Level 2 units with additional features may require slightly more maintenance, however, they are frequently modular in design to allow parts to be easily interchanged. DC fast chargers require more regular maintenance as they have more complex systems which include cooling systems, filters, and other components.

Of course the more features the charger includes, the more likely it will be to require service. Additionally, EVSE units come with warranties depending on the manufacturer with some offering extended options as well as on-site maintenance for an additional cost. Cord and plug damage are the most frequently addressed maintenance items for EVSE. Replacing cords and plugs outside of warranty can cost from $60 to $300 depending on the unit. As with any asset, insurance is always recommended.

Energy Use

The electricity cost associated with your stations will depend on two utilization factors - time of use and overall energy use. For example, during peak demand times the cost of electricity may be higher, depending on the type of utility rate - monitoring and regulating the flow of electricity to the station through a network can help reduce this cost. The needs of each location will differ based on expected utilization.

Incentives

Cost-saving incentives are available to entities willing to make charging infrastructure available at their locations. It is recommended that you seek pre-approval before beginning any installation activities.

Ameren Missouri Incentive

Ameren Missouri is offering incentives for businesses seeking to install EV charging stations at workplaces, multi-family dwellings, and publicly accessible locations. The program is open to all Ameren Missouri business customers and includes:

- Up to $5,000 incentive per Level 2 port (40 Amp max);
- Up to $20,000 incentive per DC fast charging port (50kW nominal max); and
- A maximum incentive totaling 50% of the total project cost.

For more information visit AmerenMissouri.com/EV.

Federal

Businesses who purchase and install qualifying charging infrastructure before December 31, 2020 are eligible to receive a tax credit of 30% of the cost up to $30,000 under the Alternative Fuel Infrastructure Tax Credit. The credit is available on both the cost of the equipment and the installation costs, though, does not include permitting and inspection fees. More information can be found on the Department of Energy website.

Checklist

Goals and Scope

☐ Identifying clear goals that will help define a project scope is the most important step in the process. Clear goals and well-defined scope will simplify decision-making as you perform subsequent steps, including research into equipment options, investigating your facility's unique attributes, and speak with EVSE experts that will help your project succeed.

Internal Buy-In

☐ To ensure the success of the charging installation, it's important to identify a project champion who can lead the way and help the team advance the project through each step. A few options include facilities personnel, sustainability representative, or an EV driver/sustainability enthusiast. The project champion(s) should have adequate time to dedicate to the design, planning, and facilitation of the installation.

Budget and Timeline

☐ After identifying goals and scope and establishing the project champion(s), defining the budget and timeline for your installation project is an important step that includes examining the associated costs, conducting research, and obtaining quotes. A detailed project plan including a projected timeline is necessary to ensure success for larger installations. Many contractors can also support this effort to ensure the overall project is successful. Having concise benchmarks in order to achieve goals is a smart way to help ensure the success of the project.

Incentives

☐ Determining what incentives are available to you will help stretch your budget and fulfill or expand the scope. Applying for incentives early will help keep the installation timeline on track.

Installation Contractor

☐ A trustworthy contractor with experience in installing charging infrastructure will be a key member of the team. Visit AmerenMissouri.com/EV to connect with contractors, through Ameren Missouri's EV Partner Network, that can assist with installing and selecting the right EVSE for your needs.

Project Design

Power Assessment

Installations are most cost-effective when placed near an existing power source. A power assessment can help identify the most advantageous locations for the installation. Conducting an audit of your site's energy usage and available power sources early on in the process will ensure only viable locations are considered and help you identify the type of equipment best suited to your location.

Location

This step requires an assessment of available spaces, power sources, safety and much more. Throughout the process it will be important to consult with facilities managers, security, and other individuals with a vested interest.

Equipment

At this step you will determine the type of equipment to be installed. This includes:

- Smart or Basic Charging? You likely need smart charging equipment if:
  - *You want users to pay a fee through the station;*
  - *You want to restrict charging to only specific users;*
  - *You want to get data on how the chargers are being used; and*
  - *You want to control charging to avoid utility peak demand charges.*
- Single or dual connector?
- Cable management? Manual or mechanical assist?

Permitting

Most installations require permits for various aspects of the installation project. Start this process by conducting research and contacting your local permitting office or inquire with your chosen electrical contractor or service provider.

EV Charging Policy

Organizations offering workplace charging can benefit from setting clear guidelines regarding usage and sharing to help ensure a safe and successful charging experience for all. To develop a charging policy, consider engaging the intended users - for example through a survey - in the effort to fully understand their charging needs. When the time comes to develop a policy, an example of a workplace charging policy (PDF) by the U.S. Department of Energy can help you get started.

Promotion

Once you have installed your charging stations, engage with targeted users on how they can take advantage of this benefit. Promoting your charging infrastructure will help make the intended user aware of the offering and provide an opportunity to highlight your company's efforts. Promotional opportunities include a ribbon-cutting/unveiling ceremony, hosting an EV test drive event, educational sessions, and registering on charging station apps if they are publicly available. In addition, internal company communications such as intranet or all company mailing or virtual signs are a great way to promote the amenity of charging stations to employees.

Conclusion

Here at Ameren Missouri, we understand the intricacies an EVSE installation poses to your organization and are here to support your goals and serve as your EV resource. As the demand for charging continues to increase across the region, Ameren Missouri is here to help ensure you are prepared when your community begins asking to charge their cars at your location.

For more information about vehicles, fleet options, incentives, and additional resources visit us at AmerenMissouri.com/EV

You can also ask our experts any questions relating to installing charging stations by sending an email to EVMissouri@ameren.com.

Additional Resources

1. Electric Vehicle Charging for Multi-Unit Dwellings
2. Alternative Fuels Data Center Workplace Charging
3. Lynda.com Case Study

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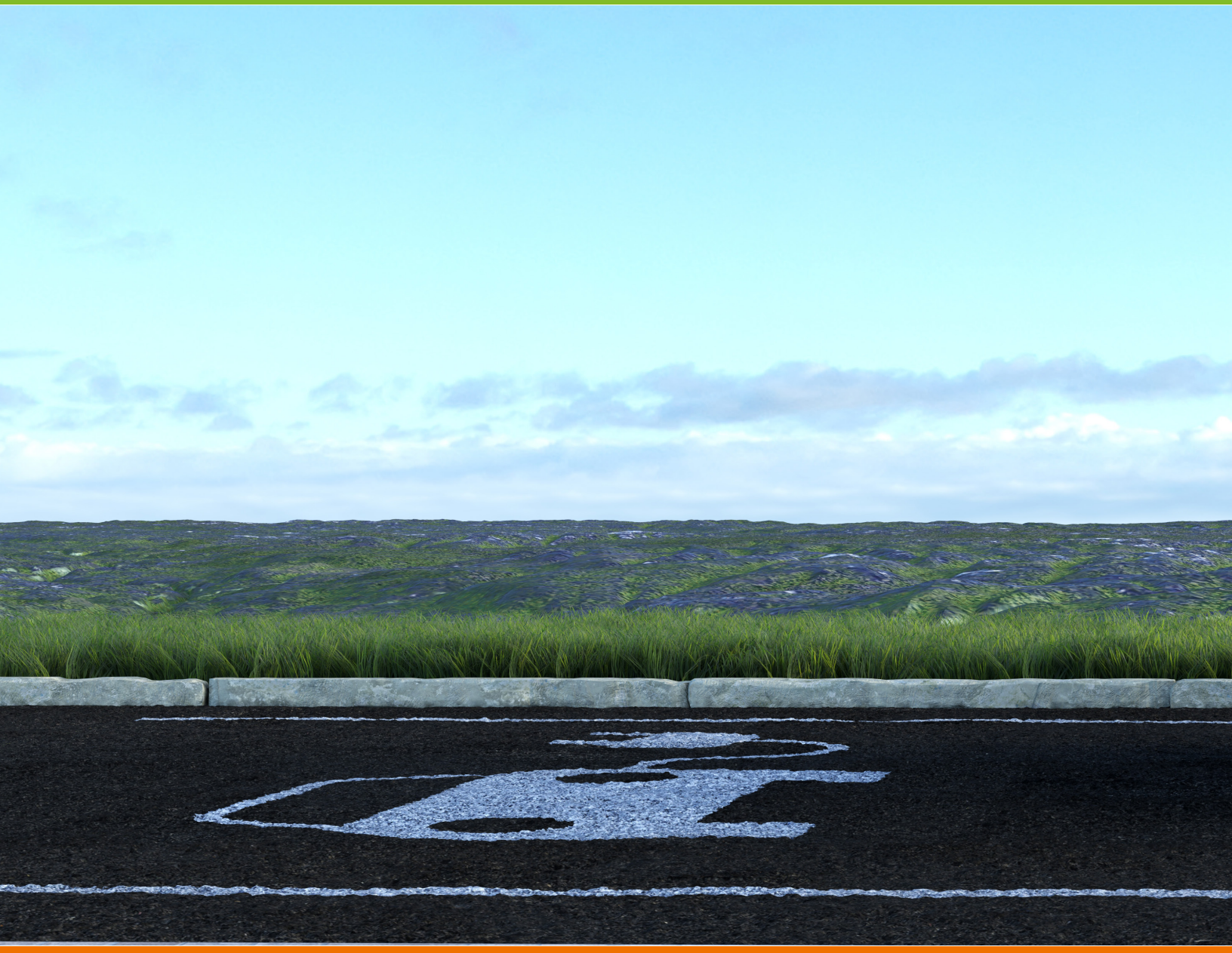

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