Types of Charging Stations at the Workplace

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Nay Chehab, Allegheny Science and Technology
Margaret Smith, Energetics
Britta Gross, General Motors
Eric Ganther, Coca-Cola
Michael Huggins, Portland International Airport
Goal: 500 U.S. employers committed to employee charging by 2018

380+ Partner employers committed to provide charging at...

600+ Worksites where employees have access to...

5,500+ Installed or planned charging stations
Voluntary Model to Promote & Support Charging

DOE Support
- Provide technical assistance
- Recognize success
- Convene employer network

Partner Actions
- Pledge commitment to employee charging
- Communicate by announcing Challenge pledge and posting a profile to DOE website
- Share workplace charging plan and provide updates by responding to annual survey

Join the Workplace Charging Challenge at electricvehicles.energy.gov
How is DOE providing partner recognition?

Profile Badges

@Energy

@eeregov

Join the Workplace Charging Challenge at electricvehicles.energy.gov
How is DOE providing technical assistance?

- EV 101
- Employer Resources
- Employee Outreach Toolkit
- Case Studies
- Webinars
- Workshops
- Quarterly Newsletters
- One-on-One Technical Assistance
Key Resource Highlights

Install & Manage Workplace Charging

✓ Vehicle and charging station basics
✓ Assess demand with sample employee survey
✓ EVSE incentive database and equipment guides
✓ Workplace-focused guidance on ADA and signage
✓ Employer-informed resources on program administration, registration, liability, pricing and station-sharing policy

Promote Workplace Charging

✓ Employee outreach toolkit
✓ Workplace Ride & Drive guide
✓ Vehicle cost and emissions calculators and Find a Car tool

http://energy.gov/eere/vehicles/ev-everywhere-workplace-charging-challenge

Join the Workplace Charging Challenge at electricvehicles.energy.gov
• Level 1 Charging at Work
• Challenge Partner Examples
• Estimated Costs
• Management Policies
• Comparing Level 1 and Level 2 EVSE
## Electric Vehicle (EV) Charging Station Types

<table>
<thead>
<tr>
<th>Charging Level</th>
<th>Vehicle Range Added per Charging Time and Power</th>
<th>Supply Power</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AC Level 1</strong></td>
<td>4 mi/hour @ 1.4kW</td>
<td>120VAC/20A (12-16A continuous)</td>
</tr>
<tr>
<td></td>
<td>6 mi/hour @ 1.9kW</td>
<td></td>
</tr>
<tr>
<td><strong>AC Level 2</strong></td>
<td>10 mi/hour @ 3.4kW</td>
<td>208/240VAC/20-100A (16-80A continuous)</td>
</tr>
<tr>
<td></td>
<td>20 mi/hour @ 6.6kW</td>
<td></td>
</tr>
<tr>
<td></td>
<td>60 mi/hour @ 19.2 kW</td>
<td></td>
</tr>
<tr>
<td><strong>DC Fast Charging</strong></td>
<td>24 mi/20minutes @24kW</td>
<td>208/480VAC 3-phase</td>
</tr>
<tr>
<td></td>
<td>50 mi/20minutes @50kW</td>
<td>(input current proportional to output power; ~20-400A AC)</td>
</tr>
<tr>
<td></td>
<td>90 mi/20minutes @90kW</td>
<td></td>
</tr>
</tbody>
</table>

**Electric Vehicle Supply Equipment (EVSE)** consists of all the equipment needed to deliver electrical energy from an electricity source to a plug-in electric vehicle battery.
Level 1 Charging at the Workplace

Scenario A: Make a Level 1 Electrical Outlet Available

- NEMA commercial grade outlet
- NEC requirements
- Dedicated circuit
- If outside - ground fault circuit interrupter outlet with outlet cover

Scenario B: Provide Level 1 Charging Equipment (EVSE)

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# Level 1 Costs

<table>
<thead>
<tr>
<th>Level 1 EVSE</th>
<th>$300-$1,800</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cordset or basic wall mounted EVSE</td>
<td>$300-$600</td>
</tr>
<tr>
<td>Pedestal EVSE with access control and cable management</td>
<td>$1,500-$1,800</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Level 1 Installation</th>
<th>$0-$3,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Offer an existing electrical outlet for drivers to plug in cordset</td>
<td>$0</td>
</tr>
<tr>
<td>Install an electrical outlet or a wall mounted Level 1 EVSE</td>
<td>$300-$1,000</td>
</tr>
<tr>
<td>Install a pedestal Level 1 EVSE (assuming no major electrical work needed)</td>
<td>$1,000-$3,000</td>
</tr>
</tbody>
</table>
## Examples of Recovering Level 1 Charging Costs

<table>
<thead>
<tr>
<th>Provide Level 1 Electrical Outlet</th>
<th>Provide Wall-Mounted Level 1 EVSE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Electricity Consumption Cost</strong></td>
<td><strong>$110/yr.</strong></td>
</tr>
<tr>
<td>(1,039 kWh/yr*)</td>
<td></td>
</tr>
<tr>
<td><strong>Equipment</strong></td>
<td><strong>No Equipment</strong></td>
</tr>
<tr>
<td>(wall mounted Level 1 charging equipment with cord and connector $300–$600 over 10 years)</td>
<td></td>
</tr>
<tr>
<td><strong>Installation</strong></td>
<td><strong>$30–$100/yr.</strong></td>
</tr>
<tr>
<td>($300–$1,000** over 10 years)</td>
<td></td>
</tr>
<tr>
<td><strong>PEV Driver Fee to Cover All Costs</strong></td>
<td><strong>$140–$210/yr.</strong></td>
</tr>
<tr>
<td></td>
<td><strong>$12–$18/mo.</strong></td>
</tr>
</tbody>
</table>


Level 2 Charging at the Workplace

INL

New York Power Authority

Alliant Energy

Utildata
Network vs Non-Networked

For an additional cost, networked EVSE offer additional features:
• Station Availability
• Energy Monitoring
• Station Usage Analysis
• Payment Systems
• Automatic Diagnostics
• Access Control
• Customer Support
Level 2 Charging Station Costs

**EVSE Unit Cost:** $400-$6,500  
**Installation Cost Range:** $600-$12,700  
**Average Workplace Charging Installation:** $2,223

Main factors that increase installation cost
- Trenching/boring
- Electrical work (panel, new/upgraded service)
- Meeting Americans with Disability Act requirements

Image from Kristina Rivenbark
DC Fast Charging at the Workplace

DCFC Unit Cost: $10,000-$40,000
Installation Cost Range: $4,000-$51,000

Photo from Don Karner

Photo from Margaret Smith

Join the Workplace Charging Challenge at electricvehicles.energy.gov
## Comparing Charging Types

<table>
<thead>
<tr>
<th></th>
<th>Level 1</th>
<th>Level 2</th>
<th>DCFC</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Charging Speed</strong></td>
<td>2–5 miles of range in 1 hr.</td>
<td>10–20 miles of range in 1 hr.</td>
<td>24 or 50 miles of range in 20 min.</td>
</tr>
<tr>
<td><strong>Costs</strong></td>
<td>Generally lower</td>
<td>Generally higher</td>
<td>Much higher</td>
</tr>
<tr>
<td><strong># Vehicle Using EVSE/Workday</strong></td>
<td>1</td>
<td>2 or more</td>
<td>Many</td>
</tr>
<tr>
<td><strong>Access Control</strong></td>
<td>Available</td>
<td>Available</td>
<td>Available</td>
</tr>
<tr>
<td><strong>Energy Monitoring</strong></td>
<td>Not available on unit, but available on secondary system</td>
<td>Available</td>
<td>Available</td>
</tr>
<tr>
<td><strong>Payment System</strong></td>
<td>Not available on unit, but available on secondary system</td>
<td>Available</td>
<td>Available</td>
</tr>
</tbody>
</table>
How Do I Choose?

- How many employees currently drive PEVs?
- What type of PEVs do employees drive?
- How much electrical load is available near my parking lot?
- How far do PEV drivers commute to work?
- How much will employees depend on WPC?
- Payment System?
- Access control?
- How many employees would buy a PEV if WPC were available?
- Budget?
- Do I want drivers to move cars/cords mid-day?
- Track energy consumption?
- Long term plan?
Britta K. Gross
GM, Director Advanced Vehicle Commercialization Policy

Join the Workplace Charging Challenge at electricvehicles.energy.gov
533 GM WORKPLACE CHARGING STATIONS
Including 25 Assembly Plants
(19% Solar; 2 ADA friendly; 400 add’l private; 31% 120V and 69% 240V)

Also: Chevrolet and Cadillac dealers have installed approximately 5,900 charge stations at their locations for owner use – 17 of these dealerships use solar charging canopies.

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GM’s Developing L2 and L1 Strategy

• **Why Level 2 EVSE**
  – Wanted to better understand new supplied hardware/software systems
  – It is more convenient (satisfying) for EV drivers
    • Knowing you are fully charged by noon (just in case)
    • Not having to use your own charge cord (especially in the winter)
  – Rule of thumb projected cost: $10,000 per charge spot (assuming a bank of EVSE)

• **Why Level 1 Outlets**
  – Needed to find a more cost-effective charging option (as the larger initial “special budgets” were depleted)
    • Outlets are reliable (simple)
    • Realization that more than a few employees just can’t move their vehicles by noon, thus would have benefited equally from the slower L1 charging
    • Can easily include “a few outlets” into other ongoing electrical projects in our parking lots and garages
  – Rule of thumb projected cost: $1,000 per charge spot
GM’s L2 and L1 Timeline (approximate)

History of GM’s L2 and L1 Workplace installations

– 2010-2012: Initially all L2 EVSE installations
– 2013-2015: Followed by a phase of L1 outlet installations
– 2015-2016: Currently consider both L1 and L2 options and decide best fit for each site based on
  • Site electrical service/capacity constraints (if any)
  • Budgets
  • For example, from 2015-2016 we installed 25 L1 and 61 L2 EVSE to expand workplace charging at 4 sites and add charging at 9 sites
GM Workplace Charging Etiquette: Ten Rules of Electric Vehicle Charging

1. Safety First
2. EV Spots are for EVs
3. EV Drivers must Adhere to Posted Signs
4. Charge Only When Necessary
5. First Come, First Served
6. All Electric Vehicles are Created Equal
7. It's Okay to Ask for a Charge
8. Don't Unplug Someone Else's EV... Except When They Are Done Charging
9. Charge Up and Move On ... Or Expect to be Cord-Swapped
10. Workplace Charging is a Privilege, not a Right

Making the most of this GM-Employee initiative – happy to share

Acknowledgement: model based on Brad Berman's, "Eight Rules of Electric Vehicle Charging Etiquette"
Join the Workplace Charging Challenge at electricvehicles.energy.gov

Eric Ganther
Coca-Cola, Transportation Planner
Power Sharing:
Maximizing Coca-Cola’s EV Investment
What We Have

Headquarters has largest single-site EV charging program in Georgia

- 81 Level 1 spaces – 50% charge in 8 hours
  - 10 TEC Garage
  - 33 USA Garage 3rd
  - 36 USA Garage 5th
  - 2 CRB – S2
- 14 Level 2 spaces – 50% charge in 3 hours
  - 4 USA Garage 3rd
  - 4 USA Garage 5th
  - 2 CRB – S1 (visitors only)
  - 2 Executive – S2
  - 2 EDC – outdoor (by appointment only)
- 1 Level 3 “Fast charger” – 80% charge in 30 minutes or less
  - USA Garage 3rd
User Feedback

Focus Groups
- 3rd annual FG was held in February 140 from our email list were invited
- Theme = “power sharing” of existing resources

Input
- Strong desire for additional infrastructure
- Willing to pay for charging if money were pooled for more chargers
- Prefer more careful communication to new EV drivers about how to use
- Prefer formal management over informal
- Concern about having to move car in middle of day (parking, time lost)
EV Driver Survey – January 2015

**Dependence Level**
- Need Every Day
- Need Every Other Day*
- Very Nice to Have
- Not Strictly Needed
- Don’t Use
- Use More in Winter or Extra After Work Trips

* But strongly prefer daily access

**Home Facilities**
- L1 (16 hours)
- L2 (6 hours)
- L3 (30 minutes)
- Nothing

**Daily 1-Way Drive Distance**
- < 5
- 6 - 10
- 11 - 15
- 16 - 20
- 21 - 25
- 26 - 30
- > 30

**Other Data**
- 92% of EV drivers have Leafs
- 70% have the Fast Charge port
- Leafs have ~80 mile range

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Fast Charger

- Machine and installation donated by Nissan ($27K value)
- 80% charge in 30 minutes
- Near existing EV charging stations
- Reserve using Outlook
- Stay with car while charging

Nissan’s DC Fast Charger
Join the Workplace Charging Challenge at electricvehicles.energy.gov

Michael Huggins
Port of Portland, Landside Operations Manager
PDX Airport Parking

Length of Stay

- **Economy Lot**: Highest length of stay with over 120 hours.
- **Long-Term**: Moderate length of stay with around 80 hours.
- **Short-Term** and **Employee Lot**: Lower length of stay with less than 20 hours.
Portland International Airport (PDX)

- Approximately 9,000 employees have Airport ID Badges and work within the terminal and airfield
  - Port Employees
  - Airlines (Alaska, Horizon, Delta, etc.)- above and below wing, including pilots
  - Concessionaires (Nike, Made in Oregon, Henry’s Tavern, etc.)
  - Tenants (Bags Inc., etc.)
  - Federal Agencies (TSA, CBP, etc.)

- Approximately 6,500 have access to the Employee Parking Lot

- Employee Parking Lot has 2,394 parking stalls
EV Charging Stations

42 Level 1 Charging Stations

The L1 PowerPost™ EVSE is ideal for long term parking situations.

A typical Level 1 charge costs less than $1.

At an electric rate of $0.10/kWh and at the maximum Level 1 charge rate of 1.92 kW, it costs $0.19 per hour to charge an EV ($0.10/kWh x 1.92 kW)

4 hours of charging = $0.76

4 hours of charging at a typical charging rate of 1.44 kW = $0.58 ($0.10/kWh x 1.44 kW x 4 hours)

A 20 mile commute can be replenished in 4-6 hours.

<table>
<thead>
<tr>
<th>CHARGER TYPE</th>
<th>CHARGE TO</th>
<th>CHEVY VOLT 16kWh BATTERY</th>
<th>NISSAN LEAF 24kWh BATTERY</th>
<th>COMMERCIAL COST (EST)</th>
<th>INSTALLATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1 AC</td>
<td>HALF</td>
<td>4 Hours</td>
<td>7 Hours</td>
<td>$1,500</td>
<td>$500-$1,500</td>
</tr>
<tr>
<td></td>
<td>FULL</td>
<td>8 Hours</td>
<td>13 Hours</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Existing Level 2 Charging

- 3 dual-plug charging stations in the Short-Term Parking Garage
- 2 dual-plug charging stations in the Port of Portland Fleet Parking Area

Port Fleet includes 56 electric, bi-fuel, flex fuel and hybrid vehicles
Future Installation

- Expand the Short-Term and Long-Term EV Charging
  - Level 1 charging stations
  - 12 adjacent to the existing level 2 in Short-Term
  - 12 new chargers on level 2 of the Long-Term
  - 15 new chargers in new Port employee lot

- Benefit:
  - Provide PDX customers EV Charging Stations in all public facilities
  - Enhance customer service
Questions?

WorkplaceCharging@ee.doe.gov

Learn More: www.electricvehicles.energy.gov
Thank you

WorkplaceCharging@ee.doe.gov

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