



Types of Charging Stations at the Workplace

October 4, 2016

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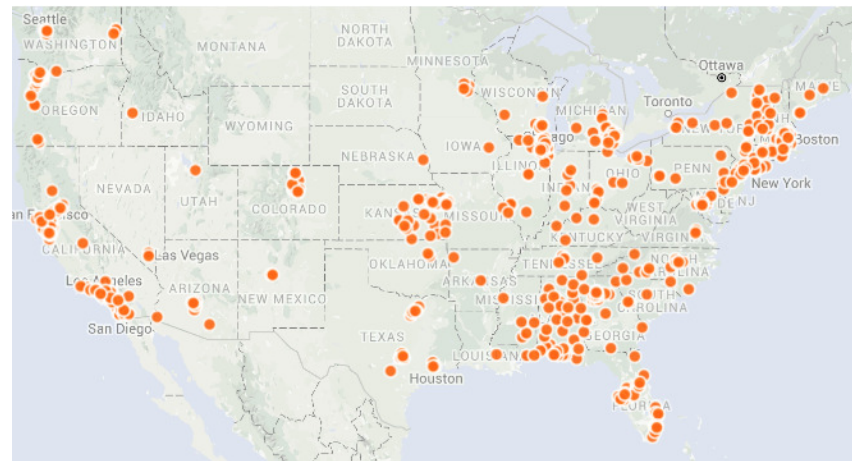
Eric Ganther, Coca-Cola

Michael Huggins, Portland International Airport



U.S. DOE Workplace Charging Challenge

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

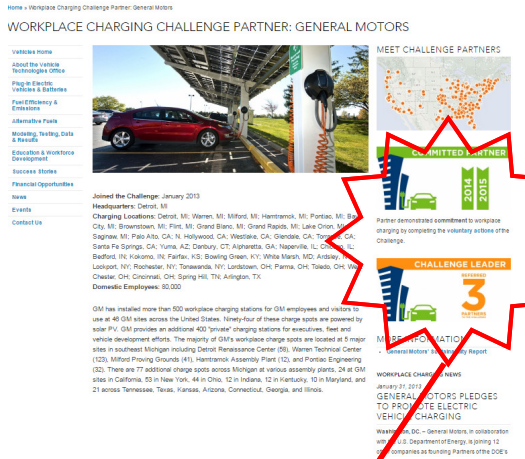
DOE Support

- 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

How is DOE providing partner recognition?



Profile Badges



Greeting card #biz sending a message of sustainability through #EV charging: 1.usa.gov/21r0D44 @PostyCards



@Energy



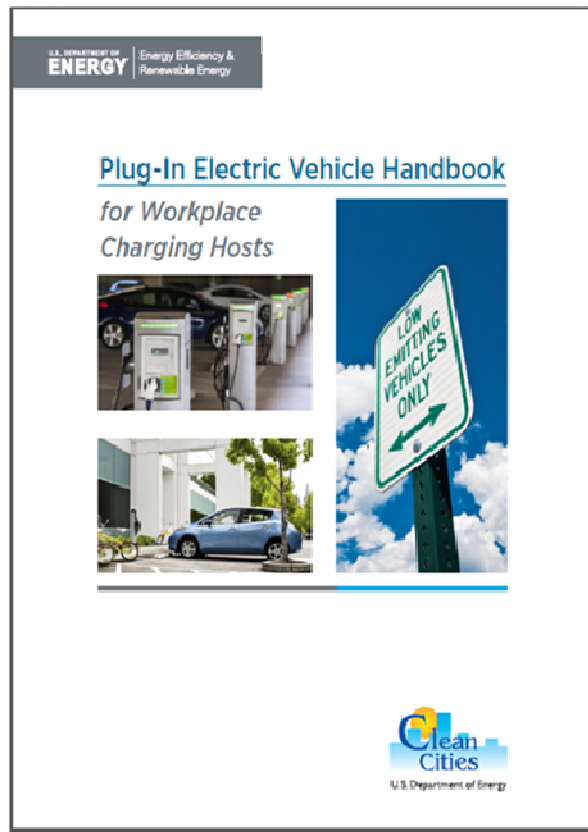
Sustainability is built right into the business model for many of our 280+ #WorkplaceChargingChallenge partners. The Challenge is working to increase the number of #US employers offering electric vehicle charging, with the goal of having 500 partners by 2018. MOM's Organic Market, an organic grocery chain in the #WashingtonDC area, sees its core purpose as protecting and restoring the #environment. Along with offering free charging stations at its headquarters, MOM's also offers employees a 15% subsidy towards the purchase of a hybrid or plug-in electric vehicle as part of its Green Benefits program. Learn more about how MOM's supports the use of plug-in electric vehicles: <http://go.usa.gov/cuZRP>.



@eeregov



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>

- Level 1 Charging at Work
- Challenge Partner Examples
- Estimated Costs
- Management Policies
- Comparing Level 1 and Level 2 EVSE




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

Electric Vehicle (EV) Charging Station Types



Photo from GM



Photo from WSDOT

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

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



Photo from GM

- 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)



Photo from Telefonix



Photo from Clipper Creek

Level 1 Costs

Level 1 EVSE	\$300-\$1,800
Cordset or basic wall mounted EVSE	\$300-\$600
Pedestal EVSE with access control and cable management	\$1,500-\$1,800
Level 1 Installation	\$0-\$3,000
Offer an existing electrical outlet for drivers to plug in cordset	\$0
Install an electrical outlet or a wall mounted Level 1 EVSE	\$300-\$1,000
Install a pedestal Level 1 EVSE (assuming no major electrical work needed)	\$1,000-\$3,000



Photo from Steve Russell, Massachusetts Clean Cities



Photo from AeroVironment



Examples of Recovering Level 1 Charging Costs

	Provide Level 1 Electrical Outlet	Provide Wall-Mounted Level 1 EVSE
Electricity Consumption Cost (1,039 kWh/yr*)	\$110/yr.	\$110/yr.
Equipment (wall mounted Level 1 charging equipment with cord and connector \$300–\$600 over 10 years)	No Equipment	\$30–\$60/yr.
Installation (\$300–\$1,000** over 10 years)	\$30–\$100/yr.	\$30–\$100/yr.
PEV Driver Fee to Cover All Costs	\$140–\$210/yr. \$12–\$18/mo.	\$170–\$270/yr. \$14–\$23/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/epr.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.

Level 2 Charging at the Workplace



INL



New York Power Authority



Alliant Energy



Utilidata

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

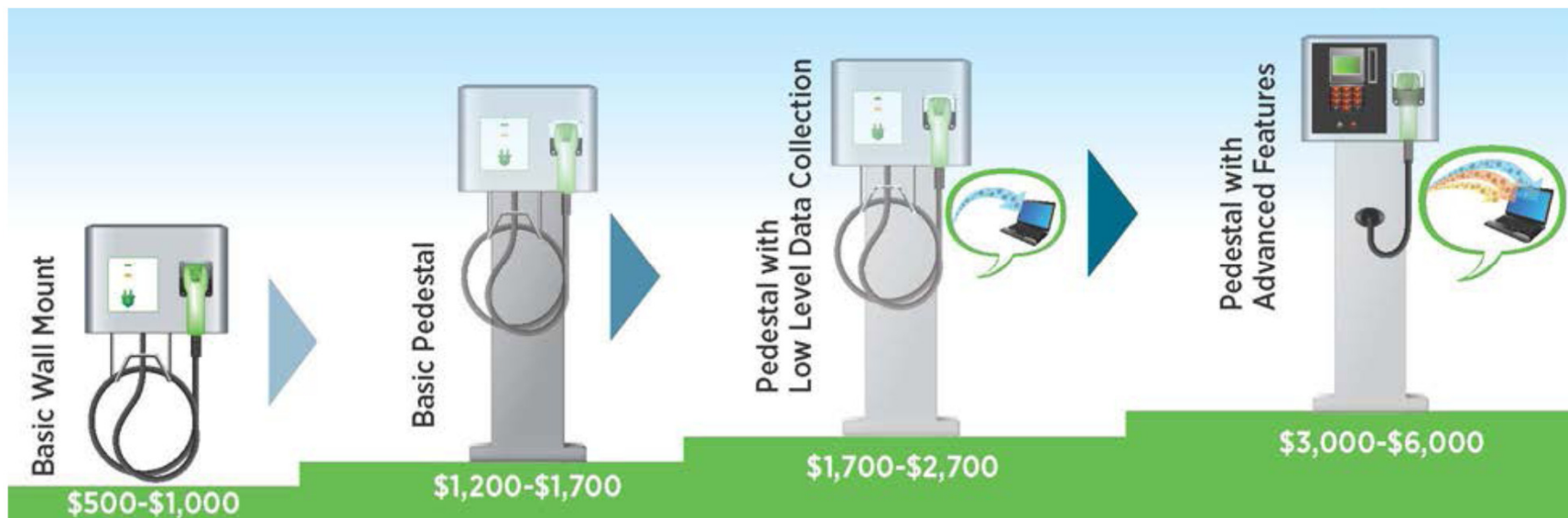


Image from Kristina Rivenbark

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



Photo from Margaret Smith

Comparing Charging Types

	Level 1	Level 2	DCFC
Charging Speed	2–5 miles of range in 1 hr.	10–20 miles of range in 1 hr.	24 or 50 miles of range in 20 min.
Costs	Generally lower	Generally higher	Much higher
# Vehicle Using EVSE/Workday	1	2 or more	Many
Access Control	Available	Available	Available
Energy Monitoring	Not available on unit, but available on secondary system	Available	Available
Payment System	Not available on unit, but available on secondary system	Available	Available

How Do I Choose?

How many employees currently drive PEVs?

What type of PEVs do employees drive?

Budget?

How many employees would buy a PEV if WPC were available?

How far do PEV drivers commute to work?

Do I want drivers to move cars/cords mid-day?

How much electrical load is available near my parking lot?

Access control?

Track energy consumption?

Payment System?

How much will employees depend on WPC?

Long term plan?



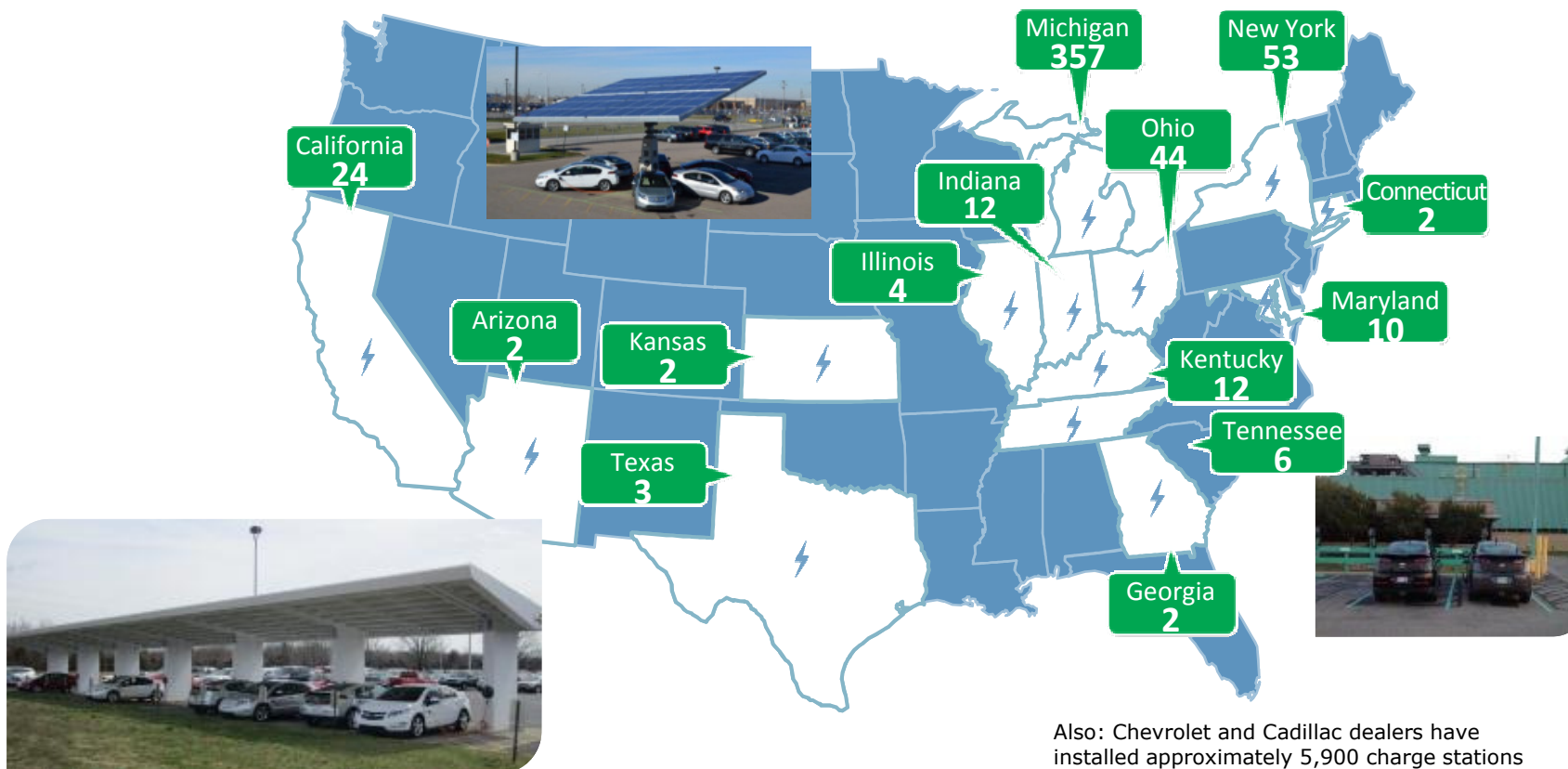
Britta K. Gross
GM, Director Advanced Vehicle
Commercialization Policy



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.

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



21 April, 2014

GM Workplace Charging Etiquette: Ten Rules of Electric Vehicle Charging

Thank you for using the vehicle charge stations at GM locations. We support your decision to drive electrically and ask that you follow a few simple rules while charging in order to make the most of this GM-employee initiative.

1. Safety First

Practice safe charging. This means properly managing the cord during and after charging. During charging tuck the cord under your car so people will not trip on any excess length, or drive over it. After charging, neatly wind the cord on its holder and tuck in any excess length. Avoid overstretching the cord to help ensure it can be used for years to come and do not place the cord such that it comes in contact with the paint of another vehicle.

2. EV Spots are for EVs

It's not acceptable for an internal combustion car to park in a spot designated for a plug-in car. That's a firm rule, no matter how crowded a parking lot is, and no matter how infrequently the charging location is used. Contact security if such a situation occurs.

3. EV Drivers must Adhere to Posted Signs

It is never acceptable for an electric vehicle to park in a designated handicapped parking space—even if the handicapped parking space is next to the charger. Additionally, spots reserved for "Spark EV CIP" were installed to support specific vehicle testing and development and need to be available for these drivers. EREVs and PHEVs should not park in these spots. The signs will be removed if/when testing is deemed completed.

4. Charge Only When Necessary

Don't charge if you don't need a charge. Leave the spot free for another EV driver who might need the charge to complete his or her daily travels without gasoline. GM is providing workplace charging to employees and campus visitors to promote the early growth of an EV market. To make the most of GM's investment, please utilize your home as your primary charging location and use workplace charging as needed to augment your home charge.

5. First Come, First Served

Company vehicles and personal vehicles have the same right to access workplace chargers - there is no special treatment for either.

6. All Electric Vehicles are Created Equal

An owner of a pure battery electric vehicle (BEV) does not have the right to unplug an extended-range electric vehicle (EREV), such as a Chevy Volt, or a plug-in hybrid electric vehicle (PHEV) just because that car has a back-up gas engine. Our goal is for every EV driver to maximize his/her daily electric commute.

7. It's Okay to Ask for a Charge

If a charging spot you need is being used, and you are able to park next to the car that is currently charging, open your charge port door as a signal to the other EV driver to plug you in when he/she is finished charging.

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"

Coca-Cola

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

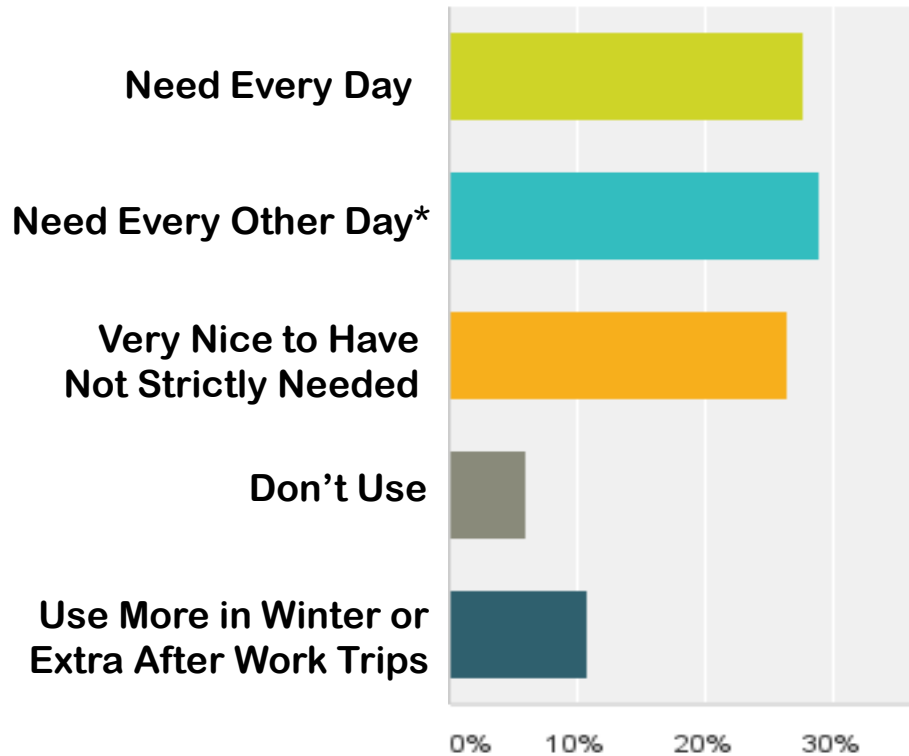
Input

- 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

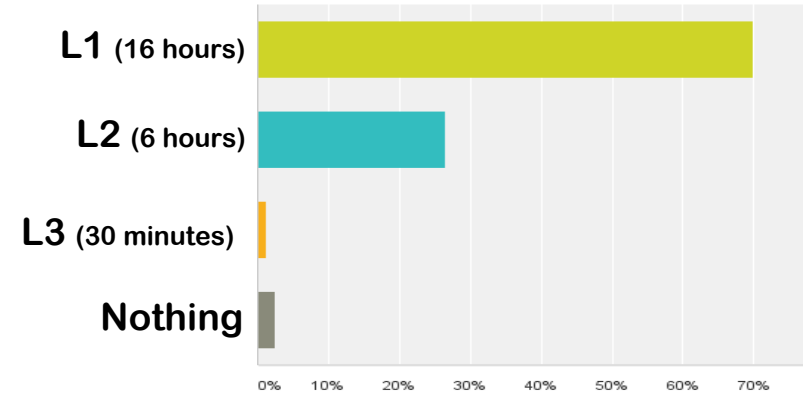


* But strongly prefer daily access

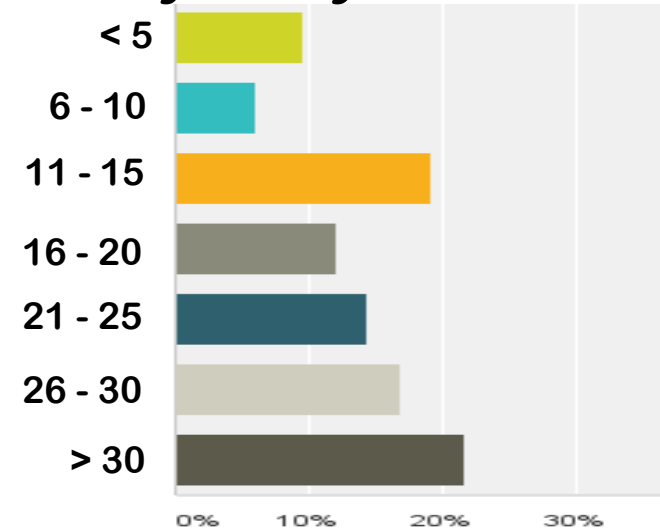
Other Data

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

Home Facilities



Daily 1-Way Drive Distance



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



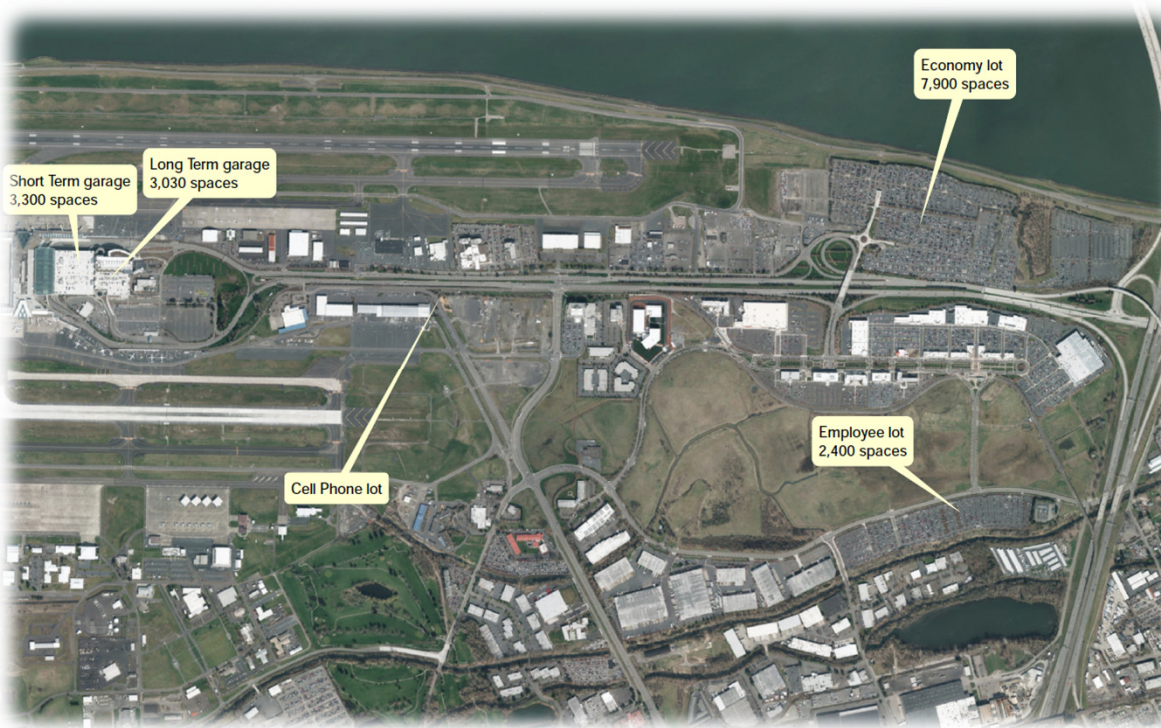


Michael Huggins

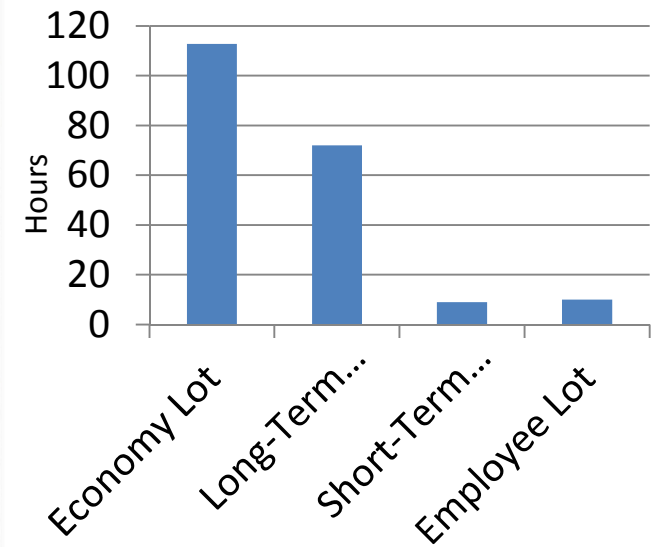
Port of Portland, Landside Operations
Manager



PDX Airport Parking



Length of Stay



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 ($\$0.10/\text{kWh} \times 1.92 \text{ kW}$)

4 hours of charging = \$0.76

4 hours of charging at a typical charging rate of 1.44 kW = \$0.58 ($\$0.10/\text{kWh} \times 1.44 \text{ kW} \times 4 \text{ hours}$)

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

CHARGER TYPE	CHARGE TO	CHEVY VOLT 16kWh BATTERY	NISSAN LEAF 24kWh BATTERY	COMMERCIAL COST (EST) CHARGER	INSTALLATION
Level 1 AC 120 Volt 16 Amp	HALF	4 Hours	7 Hours	\$1,500	\$500- \$1,500
	FULL	8 Hours	13 Hours		

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



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