REAL-WORLD CHARGING BEHAVIOR OF BATTERY ELECTRIC VEHICLE DRIVERS WITH ACCESS TO WORKPLACE CHARGING

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U.S. Department of Energy (DOE) federal laboratory

890 square mile site with 4,000 staff

Support DOE's strategic goal

Increase U.S. energy security and reduce the nation's dependence on foreign oil

Multi-program DOE laboratory

- Nuclear Energy
- Renewables and Hybrid Energy Systems
- Advanced Vehicles, Batteries, Fuels, and Infrastructure
- Unmanned Aerial Systems and Autonomous Vehicles
- Cyber Security

The EV Project

The world's largest EV infrastructure deployment project

Objectives:

- Build mature EV charging infrastructure in 17 US regions
- Study:
 - Infrastructure deployment process
 - Customer driving and charging behavior
 - Impact on electric grid
- 12,000+ AC level 2 charging units, 100+ DC fast chargers
- 8,000+ electric drive vehicles
- Project partners:



EV Project Infrastructure Deployment



How Are Leaf and Volt Drivers Using Public Charging Infrastructure?

- PEV drivers who charge away from home tend to have 1 or 2 "favorite" charging locations
- For many drivers, a favorite charging location could be work



Workplace Charging Analysis

- 250 work sites identified with workplace charging available
- 700+ Nissan Leafs and ~100 Chevrolet Volts in The EV Project who park at these sites
- Data from 2012 2013

Where do Leaf and Volt drivers with access to workplace charging choose to charge? (Jan 2012 - Dec 2013)





How did Leaf drivers use workplace charging?

- Answer the question:
 - Are there drivers that need workplace charging?
- Address the common assumption:
 - If drivers have access to home and work charging, they will charge at home and "top off" at work

How did Leaf drivers use workplace charging?

- 14% of Leafs studied needed to charge at work in order to complete their daily commute on most days
- On these days, they charged at home and topped off at work as expected



How did Leaf drivers use workplace charging?

 Leaf drivers who did not need workplace charging on most days had varying behavior



Do Leaf drivers need to charge at work sometimes?

- Assumption: if you need it, you need it; if you don't, you don't
- 14% of vehicles needed workplace charging on *most* days, but..
- 43% of vehicles needed workplace charging to complete their daily driving on *some* days



Does workplace charging increase electric vehicle miles traveled?

- On days when Leaf drivers needed to charge at work, workplace charging extended their range by an average of 15 miles
- Round-trip commutes on these days averaged 73 miles
- On days when drivers did not need workplace charging but used it, they averaged 12% more miles than on days when they did not charge at work

How often did drivers charge at work?

- Assumption: if they can charge at work, they will
- A study of Leaf and Volt parking and charging at 6 work sites showed dramatic differences from site to site



Days With and Without Charging

How often did drivers charge at work?

• Differences were also seen from vehicle to vehicle at the same site



Worksite with Paid Charging



Days when charged at work





What determines whether drivers will charge at work?



From 47 Leafs, 5 Volts at 6 worksites

What determines whether drivers will charge at work?



Summary of Factors Influencing Workplace Charging Frequency

Cost	Free	Cost per kWh	Free	Free	Cost per hour	Cost per kWh
Policy	Online reservation system	None	Move after charged (unenforced)	Move after charged (unenforced)	Move after charged (enforced)	None
PEV/EVSE Ratio	4.6	2.6	1.5	2.0	2.5	1.1

For more information, visit

avt.inl.gov/evproject.shtml

Lessons learned white papers related to workplace charging:

- Where do Nissan Leaf drivers in The EV Project charge when they have the opportunity to charge at work?
- Where do Chevrolet Volt Leaf drivers in The EV Project charge when they have the opportunity to charge at work?
- Workplace Charging Case Study: Charging Station Utilization at a Work Site with AC Level 1, AC Level 2, and DC Fast Charging Units
- Workplace Charging Behavior of EV Project Drivers at Six Work Sites (in review)
- Driving and Charging Behavior of Nissan Leaf Drivers in The EV Project With Access to Workplace Charging

INL's funding for this work comes from DOE's Vehicle Technologies Office

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