

Introduction to the EV Project: the Largest Deployment of Electric Vehicles and Electric Vehicle Charging Infrastructure Ever Undertaken

John Smart, Idaho National Laboratory
Stephen Schey, ECOtality North America

INL/CON 10-19271



Presentation Outline

- Overview of the EV Project scope
- Product specs
- Project objectives
- Plan for reporting of results
- Project status and timing

The EV Project

- **Purpose:** Build and study mature EV charging infrastructure in 9 U.S. regions – in 16 cities and on interstate corridors
- \$230 million project funded by U.S. Department of Energy (DOE) Vehicle Technologies Program as part of the American Recovery and Reinvestment Act
- 50% cost share by private sector and nonfederal government partners
- **Outcome:** Use lessons learned to enable efficient mass deployment of charging infrastructure and plug-in electric vehicles

Project Partners

Sponsor



Primary Partners



ECotality North America



Nissan North America



Chevrolet



Idaho National Laboratory



ECOtality North America

- DOE grant recipient and project leader
- Provider of infrastructure solutions for plug-in electric vehicles
- Partner with INL in conducting light duty vehicle testing for DOE's Advanced Vehicle Testing Activity (AVTA)

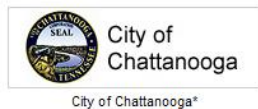
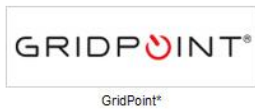
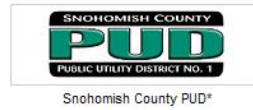
Idaho National Laboratory

- Multi-disciplinary DOE lab
- Responsible for EV Project data collection, analysis, reporting
- Manages light duty vehicle testing for AVTA

Nissan, General Motors

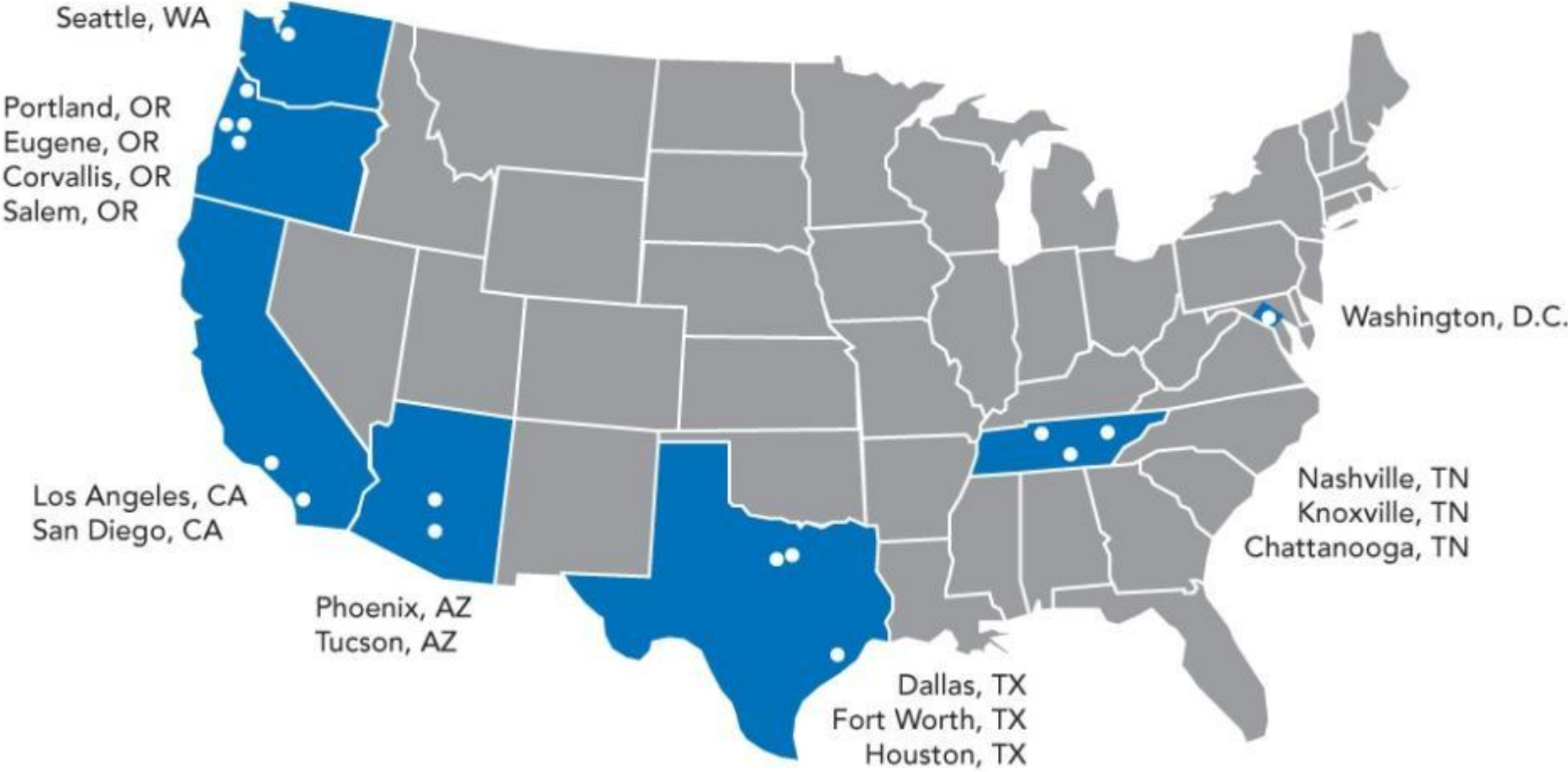
- Integrated processes with ECOtality NA for new customer charging unit installation
- Supporting data collection

EV Project Strategic Partners include:



EV Project Locations

16 cities in 9 market regions



Infrastructure and Vehicle Deployment

Vehicles

- 5,700 Nissan LEAF™ vehicles included in EV Project*
- 2,600 Chevrolet Volts included in EV Project *

Electric vehicle supply equipment (EVSE)

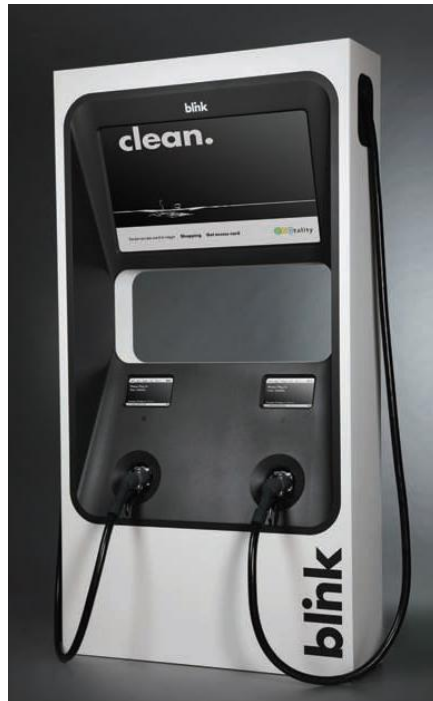
- 8,300 residential AC level 2 EVSE for participating Nissan LEAF and Chevrolet Volt customers
- 6,350 AC Level 2 public-use EVSE
- 125 additional AC Level 2 EVSE in ORNL Solar Project

DC fast chargers

- 310 DC level 2 fast charger ports in cities and on interstate corridors

* Number of vehicles in EV Project only. Does not represent regional or national production volumes

Product Specs



ECOtality Blink™ charging equipment



Nissan LEAF™



Chevrolet Volt

Blink charging equipment



- AC level 2 residential and commercial EVSE
- 240 VAC single phase, 6.6 kW
- Single J1772 connector per EVSE
- Networked, with data collection
- Touch screen user interface, RFID authentication, subscription service



- DC level 2 commercial fast charger
- 480 VAC 3 phase, 60 kW
- Two CHAdeMo connectors per charger
- Networked, with data collection
- Touch screen user interface, RFID authentication, subscription service

Nissan LEAF



- Battery electric vehicle (BEV)
- 24 kWh battery pack
 - J1772 AC level 2 inlet
 - CHAdeMO DC fast inlet on all EV Project LEAFs
 - Event data collected via vehicle telematics

EC



Chevrolet Volt

Product Specs



Chevrolet Volt

Extended-range electric vehicle (EREV)

- 16 kWh battery
- J1772 AC level 2 inlet
- No fast charging
- Event data collected via vehicle telematics





Project Objectives

Build mature EV charging infrastructure in nine regions and study:

- Infrastructure deployment process
- Customer driving and charging behavior
- Impact on electric grid

Infrastructure deployment process

- Systematic selection of public charging locations for maximum benefit to vehicle owners, charger hosts, and community
 - ≡ Targeting where people shop, play, gather for 1 – 3 hrs
 - ≡ Coordinating with electric utilities, local government, and other stakeholders
 - ≡ Marketing to commercial hosts (final decision makers)
- Proving ground for codes, standards, and permitting
 - ≡ ... in their various stages of maturity or development

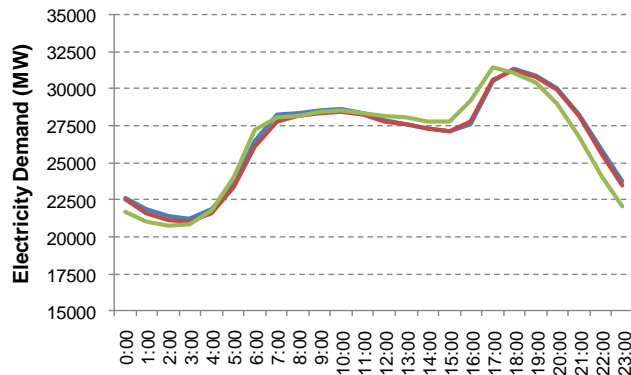
Studying customer behavior

- Vehicle customer driving and charging behavior
 - ≡ Residential vs. public charging station utilization
 - ≡ AC level 2 vs. DC fast charging utilization
 - ≡ Influence of infrastructure availability
- Distinctions in usage of two different vehicle types (BEV and EREV)
- Changes in behavior over time



Studying impact on electric grid

- Vehicle charging demand relative to system peak
- Vehicle charging demand relative to local distribution
- Influence of smart charging and incentives
 - ≡ User interface for charge scheduling
 - ≡ Electric utility time-of-use rates

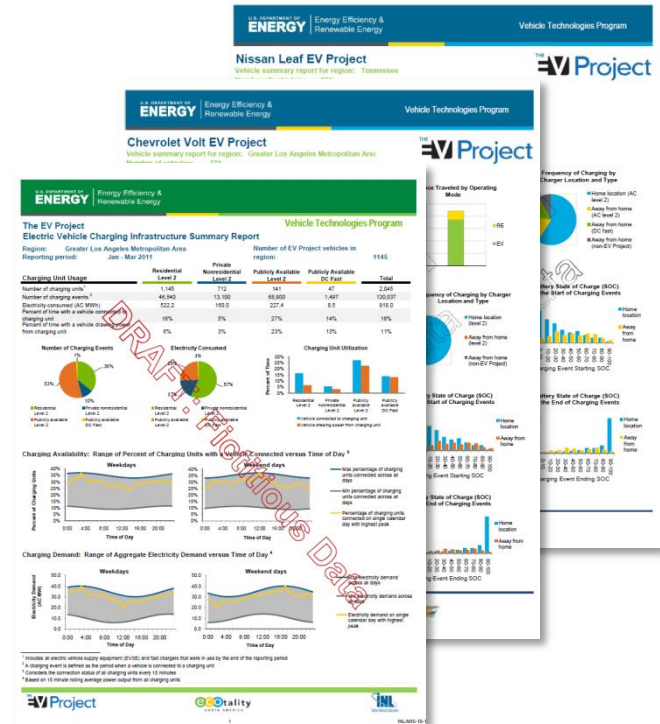


Reporting of results

- Individual participants access their own information on a web portal
 - ≡ Vehicle owners with residential or fleet EVSE
 - ≡ Commercial EVSE/charger hosts
- General public can see project results in quarterly fact sheets on EV Project and INL websites
- Deep-dive studies will be presented in various forums

Quarterly reports to public

- Aggregated reports by project region
- Overview report for at-a-glance project status
- Infrastructure-focused charging report
- Vehicle-focused charging report



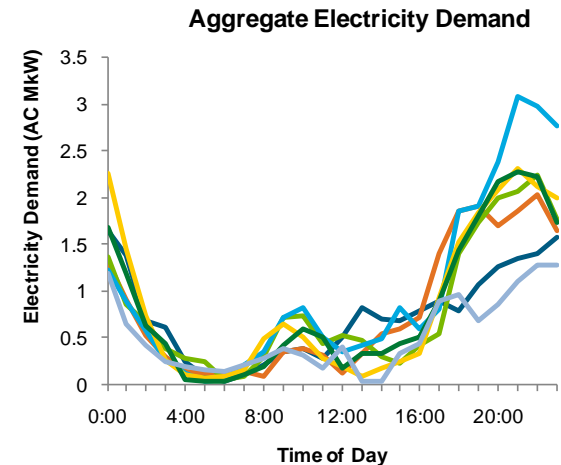
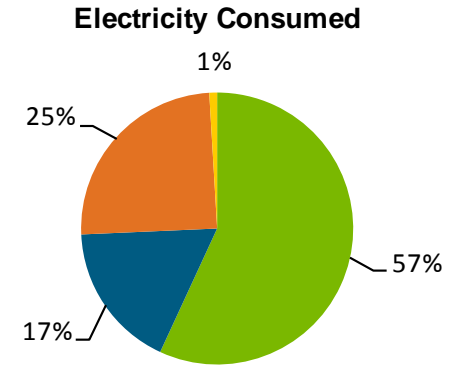
Infrastructure-focused report

- Metrics given for each charging unit type
 - Residential / AC level 2
 - Private nonresidential / AC level 2
 - Publicly available / AC level 2
 - Publicly available / DC fast charger
 - In city
 - On intercity / interstate corridors

Infrastructure-focused report

117 metrics and plots, including:

- Electricity consumed
- Charging unit utilization
- Aggregate charging demand vs. time of day and day of the week
- Individual charging event metrics
 - How often, how long, how empty, how full

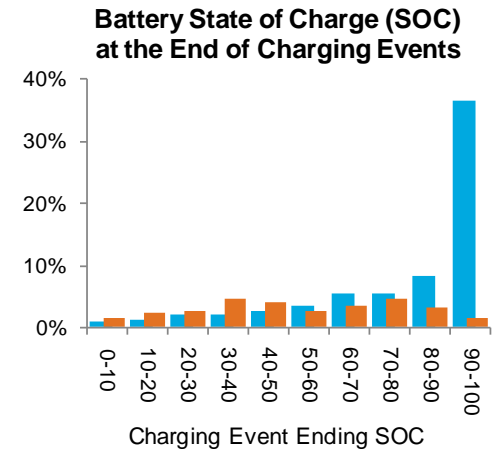


Vehicle-focused reports

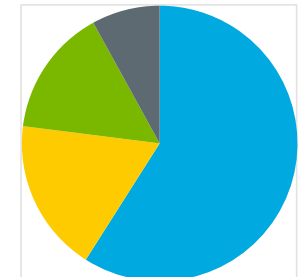
Separate reports for LEAF and Volt

39 (Volt) and 47 (LEAF) metrics and plots, including:

- Distance driven, other trip statistics
- Percent of distance driven in charge depleting vs. charge sustaining mode (Volt only)
- Battery state of charge at the start and end of charge
- Percent of charging events performed at home vs. away from home (LEAF shows line items for DC fast charging)

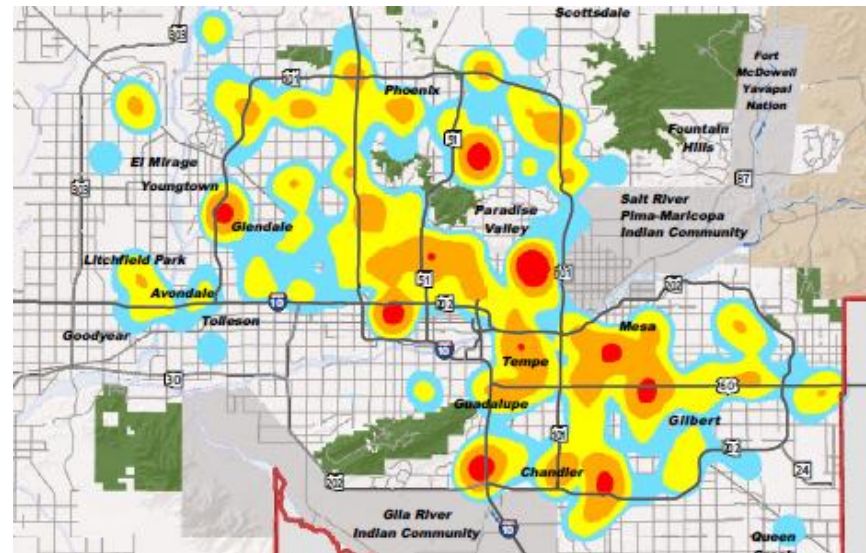


Frequency of Charging by Charging Unit Location and Type



Deep-dive study topics

- Change in BEV customer “used range” over time
- Geospatial Information Systems density analysis
- Charge clustering impact to local distribution
- San Diego Gas & Electric TOU study
- UC Davis human behavior studies
- Studies by other partners



Confidentiality of data

- Raw data is protected by non-disclosure agreements
- Contains customer personal information
- Information is shared, data is not
- Preserving customer confidence that their data will remain secure is paramount to future of connected vehicles

Status

- Systematic planning process for each EV Project region is complete
- Regional stakeholder teams have developed unique deployment plans for each region
- Infrastructure deployment guidelines and long range plans were issued for each region

Infrastructure deployment guidelines

- Outline equipment installation process for various EVSE/charger types and locations
- Stress the need for coordination with
 - Local governments, permitting authorities
 - Auto manufacturers
 - Electric utilities and local electrical contractors
 - Other local groups such as home owner assoc.
- Summarize codes and standards applicable to each project region

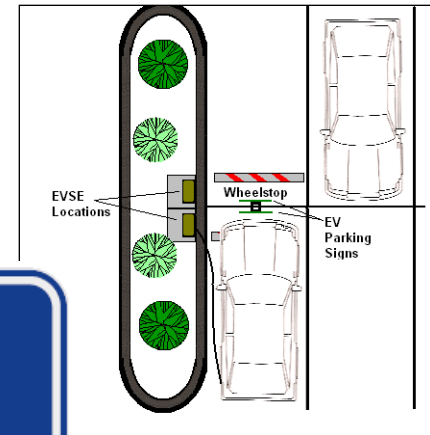
Infrastructure deployment guidelines

Give practical guidelines and recommendations for:

- Site layout
- Protection of equipment
- ADA accessibility
- Site flooding potential
- Ownership, liability
- Load management strategy
- Trouble reporting
- Lighting
- Signage
- etc.

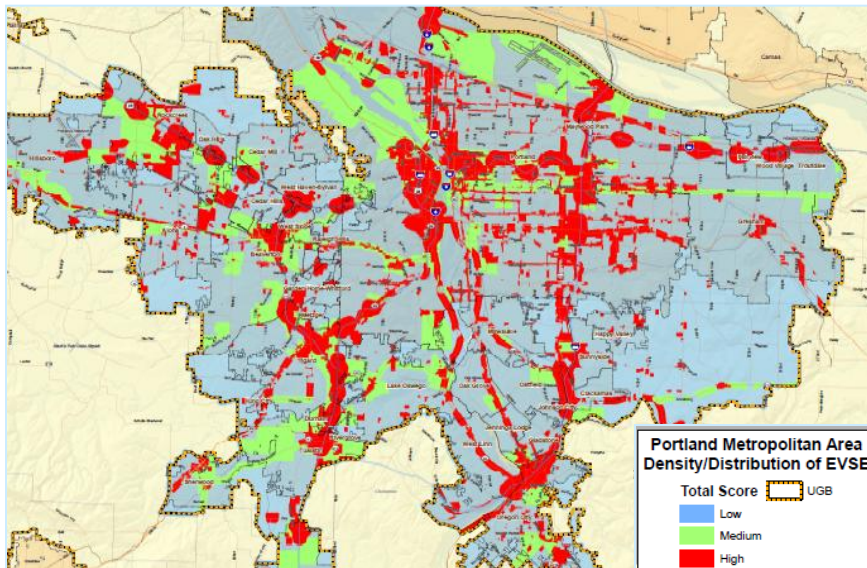
Focus is on customer safety,
security, and convenience.

www.theevproject.com/documents



Status

- Blink AC level 2 wall-mounted EVSE is UL listed
- ECotality NA Stakeholder Services executing regional deployment plans, also signing national accounts



Timing

- Residential EVSE installation underway
- Public EVSE installation starting mid Feb 2011
- First reports issued after Q1 2011
- Launch curve through Sep 2011
 - Just-in-time infrastructure installation – vacant charging stations do not promote EV adoption
- Data collection continues through Dec 2012

There's no substitute for a test drive!



Acknowledgement

This work is supported by the U.S. Department of Energy's Vehicle Technologies Program

For more information

- EV Project: www.theevproject.com
- ECOtality North America: www.ecotalityna.com
- Blink: www.blinknetwork.com
- INL / Advanced Vehicle Testing Activity:
<http://avt.inl.gov>