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
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

[Logo of U.S. Department of Energy]

Primary Partners

[Logo of ECOtality North America]  [Logo of Nissan North America]  [Logo of Chevrolet]  [Logo of 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:

- American Lung Association in California
- City of Phoenix
- Oak Ridge National Laboratory
- Snohomish County PUD
- City of Knoxville
- Knoxville Utilities Board
- APS
- City of Seattle
- Ohio State University
- State of Oregon
- Nashville Davidson County
- King County
- ATX / Cross Country Automotive
- City of Tucson
- PacifiCorp
- State of Tennessee
- Nashville Electric Service
- Maricopa Association of Governments (AZ)
- Bovis Land Leases
- Eaton Corporation
- Pima Association of Governments (AZ)
- State of Washington
- Qualcomm
- Best Buy
- BP America
- Electric Power Research Institute
- Portland General Electric
- Tacoma Power
- San Diego Clean Fuels Coalition
- UC Davis
- Center for Sustainable Energy (CA)
- GridPoint
- Puget Sound Energy
- Tennessee Valley Authority
- San Diego Gas & Electric
- Vanderbilt University Medical Center
- City of Chattanooga
- Hamilton County, TN
- Salt River Project
- Tucson Electric Power
- San Diego Miramar College
- Yazaki North America
- Chattanooga EFH
- Johnston Marklee
- San Diego Association of Governments (CA)
- Underwriters Laboratories, Inc.
- Seattle City Light
- Zipcar
- SAE
- Ecotality
- INL
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

ECOtality Blink

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

![Electricity Consumed Pie Chart]

- 57% Electrical
- 25% Residential Level 2
- 17% Private Nonresidential Level 2
- 1% Publicly Available Level 2
- 1% Publicly Available DC Fast

![Aggregate Electricity Demand Graph]

- Time of Day
- Aggregate Electricity Demand
- Sun
- Mon
- Tue
- Wed
- Thu
- Fri
- Sat

Electricity Demand (AC MkW)
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)
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