ELECTRIC DRIVE VEHICLE DEMONSTRATION AND VEHICLE INFRASTRUCTURE EVALUATION

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This presentation does not contain any proprietary, confidential, or otherwise restricted information.
OVERVIEW

TIMELINE
Project Start; 10/1/09
Project End; 4/30/13
Percent Complete; 12%

BUDGET
Total Project; $218,700,268
DOE Share; $100,196,560
Contractor; $118,503,708
ORNL FWP; $6,800,000
INL FWP; $7,803,440

BARRIERS
Infrastructure Deployment
Vehicle Deployment
Standards Development

PARTNERS
Nissan North America
General Motors
18 Cities
10 Electric Utilities
2 Universities
OBJECTIVES

Deploy 8,300 Grid-Connected Electric Vehicles
Establish Mature Charge Infrastructures To Vehicles
Identify And Resolve Barriers To Infrastructure Deployment
Develop An Infrastructure Utilization Data Base
Evaluate Infrastructure Effectiveness
Develop Sustainable Business Models
Develop Models For Future Infrastructure Deployments
MILESTONES

- Project Initiation 10/01/09 (complete)
- Complete 10-Year Plans 06/30/10 (complete)
- Complete EV Micro-Climates 08/30/10 (complete)
- Initial Infrastructure Installation 11/01/10 (complete)
- Initial Vehicles Deployed 12/01/10 (complete)
- Vehicle Deployment Complete 12/31/11
- Initial Lessons Learned 06/30/12
- Data Collection Complete 01/31/13
- Final Reports 04/30/13

Relevance
INFRASTRUCTURE PLANNING

- Organize Regional Stakeholders
  - Government
  - Utilities
  - Employers
- Develop Long-Range Plan
  - Deployment Area
  - Vehicle Penetration
  - Infrastructure Requirements
- Develop EV Micro-Climate
  - Initial Deployment
Approach

18 CITY DEPLOYMENT

- Portland, OR
  - Eugene, OR
  - Corvallis, OR
  - Salem, OR
- Seattle, WA
- San Francisco, CA
- Los Angeles, CA
  - San Diego, CA
- Phoenix, AZ
  - Tucson, AZ
- Nashville, TN
  - Knoxville, TN
  - Chattanooga, TN
  - Memphis, TN
- Dallas, TX
  - Fort Worth, TX
  - Houston, TX
VEHICLE DEPLOYMENT

◆ 4,700 Nissan Leaf Vehicles
◆ 2,600 Chevrolet Volt Vehicles
◆ Residential EVSE Provided By EV Project
◆ ETEC Customer Relations Management System Coordinated With Vehicle Purchase Process
◆ Vehicle Data Collection Via Telematics
◆ Vehicle Data Base Maintained And Analyzed By INL
◆ Residential EVSE Installed By EV Project
INFRASTRUC TURE DEPLOYMENT

- Residential EVSE Installed For All Vehicles
  - SAE J 1772 Compliant
  - Interactive Touch Screen
  - ANSI Certified Energy Meter
  - Data Collected Via Cellular Or WiFi
  - Installed By Certified Contractor Network
INFRASTRUCTURE DEPLOYMENT

◆ Certified Contractor Network
  ◆ Recruited Based On Capability – Including Davis-Bacon
  ◆ Competitively Selected
  ◆ Trained In Health and Safety
  ◆ Trained in Installation
  ◆ Deployed In All Cities
INFRASTRUCTURE DEPLOYMENT

- Commercial EVSE Installed In 12 Cities
  - SAE J1772 Compliant
  - Interactive Touch Screen
  - ANSI Certified Energy Meter
  - RFID Access Control
  - Data Collected Via Cellular Or WiFi
  - Installed By Certified Contractor Network

Approach
INFRASTRUCTURE DEPLOYMENT

- DC Fast Chargers Deployed In 13 Cities
  - Dual CHAdeMO Connectors
  - 42” Advertising Display
    Supporting Business Model
  - Interactive Touch Screens
  - ANSI Certified Energy Meter
  - RFID Access Control
  - Data Collected Ethernet
  - Installed By Certified Contractor Network
Vehicle Data Collection Approach

- Vehicle Data Collected Using Navigation System Telematics
  - Vehicle Data Set On Key On/Key Off Event
  - Vehicle Identification Number
  - Time & Date
  - Location (GPS Coordinates)
  - Indicated Battery State-of-Charge
- Raw Data Transmitted To INL
  - Nissan Global Data Center
  - General Motors OnStar
- Vehicle Data Merged With Charger Data At INL
**CHARGER DATA COLLECTION**

- Charger Data Collected Using Cellular Modem or WiFi
- Charger Data Set Based On Metered Output
  - Power vs. Time
  - Total Energy per Charge
  - Numerous Event Based Times
- RFID Access Control
  - Identifies User Of Charger
  - Allows Development Of Revenue Models
- Web Portals And Mobile Applications For Chargers Users
SMART GRID INTEGRATION

- Charge Control Integration With Utility
  - Demand Reduction
  - Ancillary Services
- Rate Studies
  - Off Peak Price Elasticity Study With SDG & E
  - EV Rate Implementation With CA Utilities
Project Management

- Project Staffing Complete (≈100 New Personnel)
- Project Offices Established
  - Home Office
  - 7 Regional Offices
- Project Management System Installed
  - Project Cost And Schedule
  - Project Reporting And Earned Value
- Customer Relations Management System Established
  - Charger Installation Management
  - Operational System Management
INFRASTRUCTURE PLANNING

- Deployment Guidelines Issued
- Ten-Year Plans Issues
- Micro Climates Complete
- Host Site Selection Ongoing
HARDWARE MANUFACTURING

- Level 2 EVSE Complete
  - Residential And Commercial UL Listed
  - Roush Industries Manufacturing 50 Units/Day
  - Carlton-Bates Distributing Through Wesco
- DC Fast Charger Completing Certification
  - Grid Power Unit Testing Complete
  - Dispenser Unit Testing Underway
  - Carlton-Bates Manufacturing And Distribution
Communications Network Established
Data Collection Underway
Vehicle Data From OEMs
Charger Data From Blink Network
INL Reporting Data
BARRIER IDENTIFICATION

- AHJ Inspector Training
- ADA Requirements
- Charge Station Signage
- Utility Demand Charges
- Utility Notification
- Cluster Overloading
- Fast Charge Connector Standard
SOME EV PROJECT PARTNERS

Collaboration
UL CERTIFICATION

- UL Joined EV Project As Partner
- UL Certification To New Standard 2594
  - Level 2 EVSE
  - DC Fast Charger
- Collaboration On Installer Standards
- Collaboration On Certification Issues
  - Plug-Connected EVSE
  - Meter Certification
DC Fast Charge Connector

- Adopted CHAdeMO (JARI) Standard
  - Physical and Communication Interface
  - Compatible with Nissan, Mitsubishi, and Subaru
- Obtained proprietary release from CHAdeMO
- Presented technical description to SAE J1772 Committee
  - Agreement obtained from other charger suppliers
  - Initial deployment in United States
- SAE Committee action delayed
  - Developing North American variant
Collaboration With San Diego Gas & Electric
- Test Four Different Time-of-Use Rates
- Peak To Off Peak Ratios Vary From 2:1 To 6:1

California Public Utilities Commission Approval
- Implement With EV Project
- Provide Rate Design Data For All California Utilities

Billing Calculated Using EVSE Meter
- Eliminates Separate Meter Installation Cost
- Minimizes Energy Diversion Potential
First Responder Training
- Input From California First Responder Training And NFPA
- Resource Awareness For First Responders
- Input To AAA Motorist Response

AHJ Permit Process
- Involvement In Infrastructure Planning
- Training Of Inspector Personnel
- Early Warning Of Install Schedule

CPUC Participation In Regulatory Process
ADA REQUIREMENTS

- Coordinate Requirements With States
- Working Towards Consensus
  - First EVSE Handicap Accessible
  - Van Accessibility Not Required
  - Building Accessibility Not Required
- Compliant Commercial Hardware
Future Work

EVSE DEPLOYMENT

- Deploy 8,300 Grid-Connected Vehicles
- Deploy 12,000 Level 2 EVSE
- Deploy 200 DC Fast Chargers
**DATA COLLECTION & REPORTING**

- **Vehicle Report**
  - Characterize Vehicle Utilization
  - Establish Owner Range Used

- **Charger Report**
  - Characterize Charger Utilization
  - Time of Day Use
  - Energy Transfer
  - Power Demand
Future Work

DEMAND RESPONSE

- Utility Data Generation
  - Load Duration
  - Energy Use
  - EV Project Data
  - 10-Year Projections
- Demand Response Demonstration
  - EVSE Control
  - User Transparency Evaluation
- GIS Based Data
  - Distribution Effects
  - Clustering
LESSONS LEARNED

- Barriers
  - Signage
  - ADA
  - AHJ Permit process
  - Utility Demand Charges

- Infrastructure Planning
  - Deployment Guidelines
  - Long Range Plans
Future Work

BUSINESS MODEL DEVELOPMENT

- Development of EVSE Cost Models
  - Cost Of Commercial Charging
  - Cost Of Residential Charging
- Development of EVSE Revenue Models
  - Commercial Charging Price Testing
  - Quantification Of Non-Revenue Benefits
- Development Of Business Models
  - Allow Viral Deployment of Commercial EVSE
  - Models For Infrastructure Deployment In The Next 500 Cities
SUMMARY

- EV Project Hardware Developed, Certified, In Production
- Infrastructure Installation Contractors Onboard
- Vehicle and Infrastructure Deployment Underway
- Data Collection Underway
- Barriers Identified – Many Resolved
- Lessons Learned Developing