ELECTRIC DRIVE VEHICLE DEMONSTRATION AND VEHICLE INFRASTRUCTURE EVALUATION

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ECOTALITY NORTH AMERICA

MAY 12, 2011

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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

Approach

INFRASTRUCTURE PLANNING

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

THE EV Project

Approach

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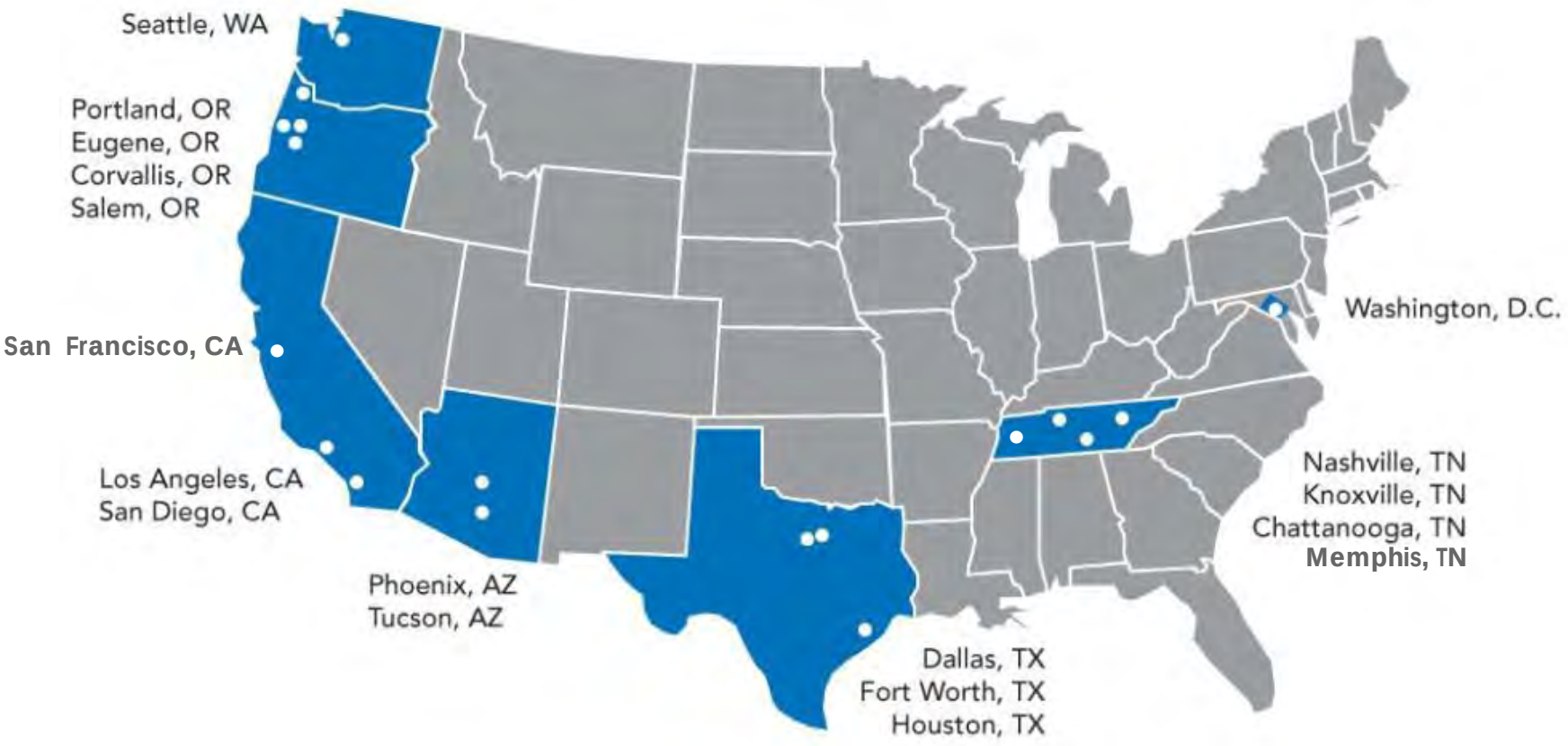
18 CITY DEPLOYMENT

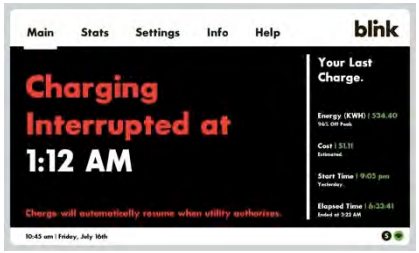


VEHICLE DEPLOYMENT

- 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

INFRASTRUCTURE DEPLOYMENT

- Residential EVSE Installed For All Vehicles
  - SAE J1772 Compliant
  - Interactive Touch Screen
  - ANSI Certified Energy Meter
  - Data Collected Via Cellular Or WiFi
  - Installed By Certified Contractor Network



Approach

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

Approach

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

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

- 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

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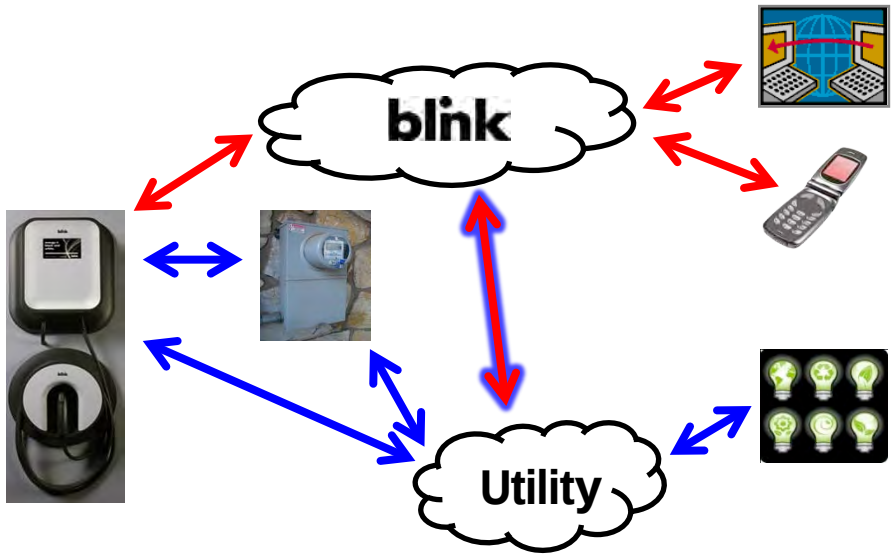
CHARGER DATA COLLECTION

- 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

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Accomplishments

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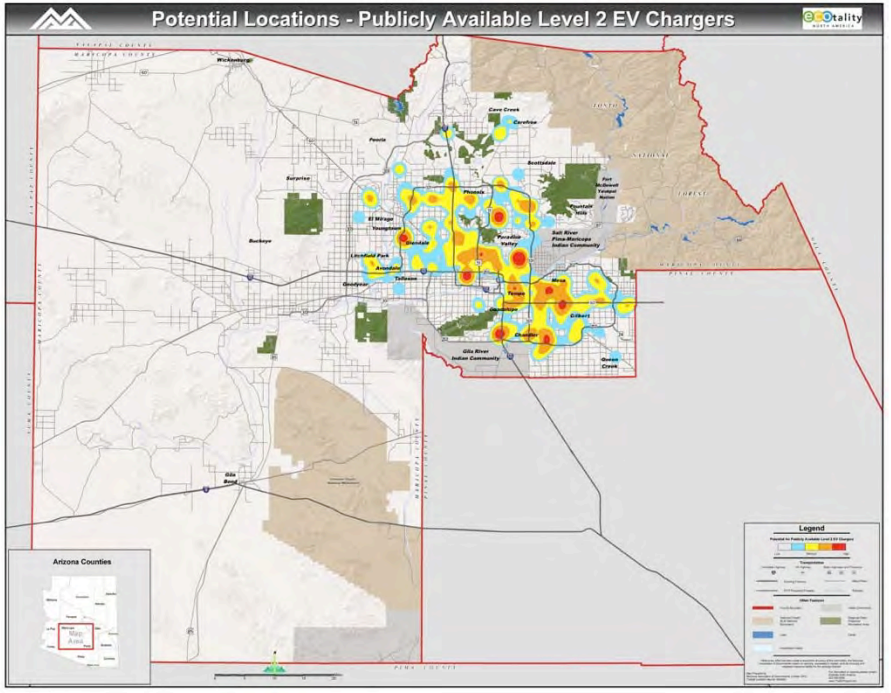
INFRASTRUCTURE PLANNING

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



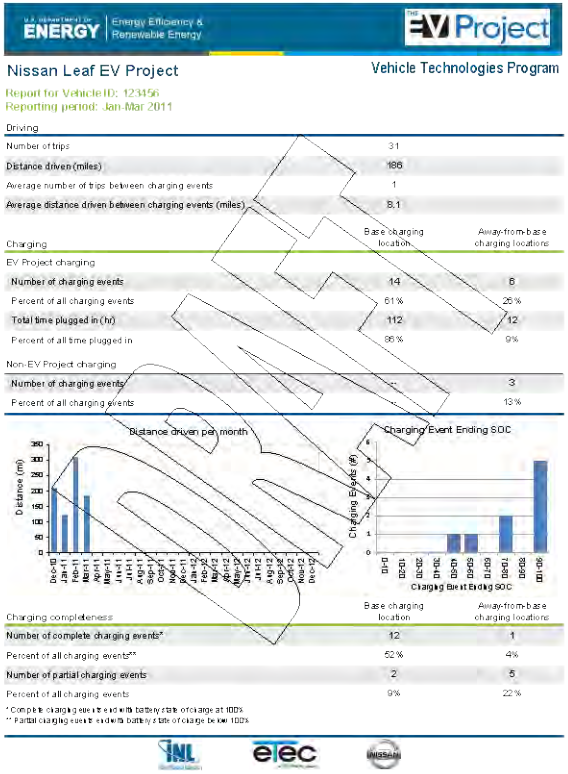
HARDWARE MANUFACTURING

- 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

Accomplishments

NETWORK DEVELOPMENT

- 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

UL Underwriters Laboratories

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Collaboration

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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

SPECIAL EV RATES

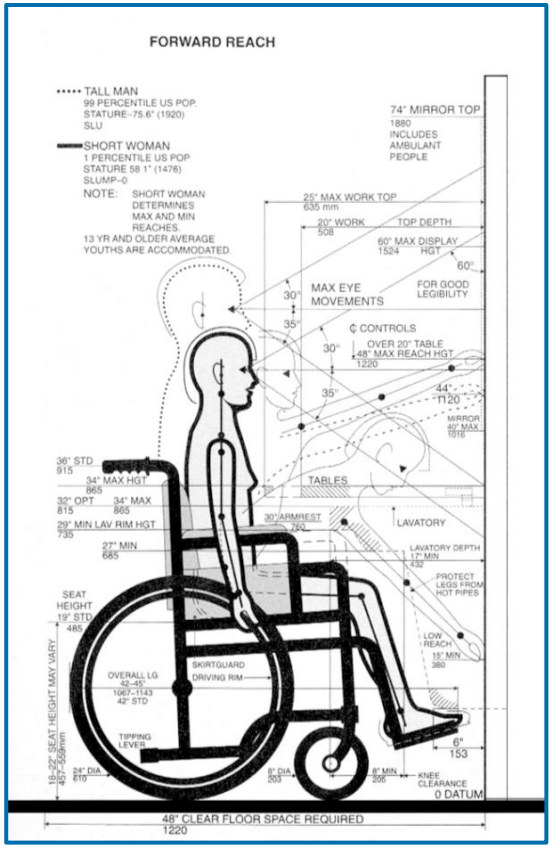
- Collaboration With San Diego Gas & Electric
  - Test Four Different Time-of-Use Rates
  - Peak To Off Peak Ratios Vary From 2:1 To 6:1
- California Public Utilities Commission Approval
  - Implement With EV Project
  - Provide Rate Design Data For All California Utilities
- Billing Calculated Using EVSE Meter
  - Eliminates Separate Meter Installation Cost
  - Minimizes Energy Diversion Potential

SOFT INFRASTRUCUTRE

- 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

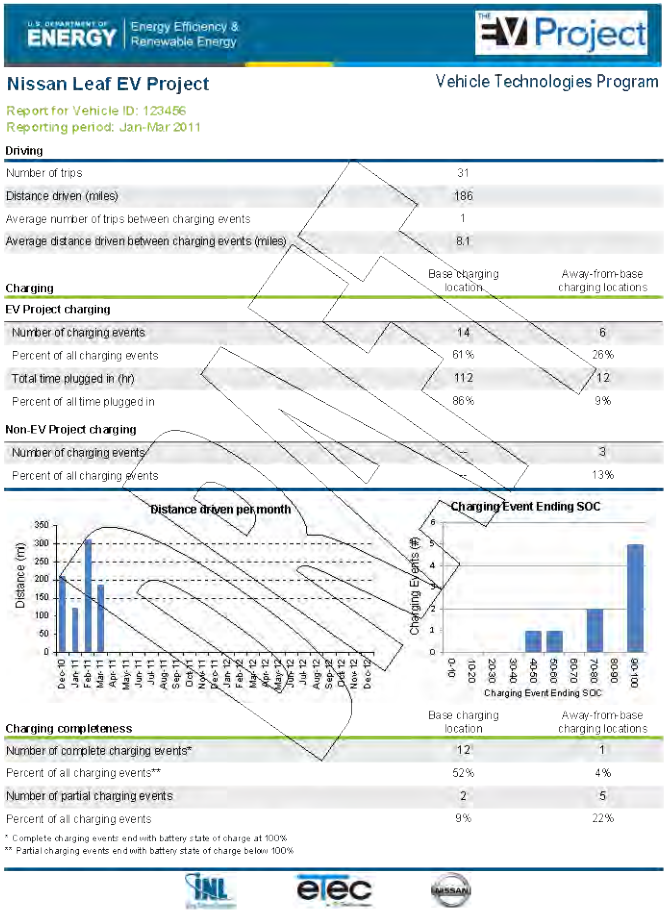


EVSE DEPLOYMENT

- 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



U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy — THE EV Project

Nissan Leaf EV Project — Vehicle Technologies Program

Report for Vehicle ID: 123456
Reporting period: Jan-Mar 2011

Driving

Number of trips	31
Distance driven (miles)	186
Average number of trips between charging events	1
Average distance driven between charging events (miles)	8.1

Charging	Base charging location	Away-from-base charging locations
EV Project charging		
Number of charging events	14	6
Percent of all charging events	61%	26%
Total time plugged in (hr)	112	12
Percent of all time plugged in	86%	9%
Non-EV Project charging		
Number of charging events	--	3
Percent of all charging events	--	13%

Distance driven per month

Charging Event Ending SOC

Charging completeness	Base charging location	Away-from-base charging locations
Number of complete charging events*	12	1
Percent of all charging events**	52%	4%
Number of partial charging events	2	5
Percent of all charging events	9%	22%

* Complete charging events end with battery state of charge at 100%
** Partial charging events end with battery state of charge below 100%

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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

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