Air & Waste Management Association
North Texas Chapter
October 26, 2010

The Advancement of Plug-In Vehicles
The Advancement of Plug-In Vehicles

History of Electric Vehicles
The Advancement of Plug-In Vehicles

Vehicle Production

*Indicates Market Launch

- *Chevy Volt ($40,000)
- *Leaf EV ($33,800)
- *PHEV SUV
- Ford Focus EV
- Ford Transit Connect
- Production Ford Escape PHEV
- EV for U.S.
- More OEMs
- More Models

Source: Electric Power Research Institute, Inc. 2010
The Advancement of Plug-In Vehicles
First to Market

**Chevrolet Volt**
- Extended Range Electric Vehicle
- 40 mile electric range
- Charging:
  - 8 to 9 hours at 120V
  - 3 to 4 hours at 240V

**Nissan Leaf**
- Battery Electric Vehicle
- 100 mile electric range
- Charging:
  - 20 hours at 120V
  - 8 hours at 240V
Focus on Residential
- Seamless installations for homeowners
- Permits, electricians, inspections
- Rates and customer programs

Workplace
- Includes fleet and retail

Public Charging – as needed
- Retail, private, public spaces
- Know what drivers need
- What are the viable business models?
Electric Vehicle Supply Equipment (EVSE) is defined in the National Electric Code:

“The conductors, including the ungrounded, grounded, and equipment grounding conductors and the electric vehicle connectors, attachment plugs, and all other fittings, devices, power outlets, or apparatus installed specifically for the purpose of delivering energy form the premises wiring to the electric vehicle”

NEC Article 625.2
The Advancement of Plug-In Vehicles

Recharging Infrastructure

Panel
• Contains circuit breakers

Circuit
• Consists of the wires and interconnects

EVSE
• Supplies power to the vehicle

Charger
• Converts AC to DC
The Advancement of Plug-In Vehicles
U.S. Standards for an EVSE

- Society of Automotive Engineers (SAE)
- Underwriters Labs (UL)
- National Fire Protection Association (NFPA) – National Electric Code
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Recharging Infrastructure

Two levels of AC charging with SAE J1772 Connector

- **Level 1**
  - AC energy to the vehicle’s on-board charger
  - From the most common U.S. grounded receptacle, commonly referred to as a 120 volt outlet

- **Level 2**
  - AC energy to the vehicle’s on-board charger
  - 208-240 volt
  - Maximum current specified is 32 amps

Note that these are maximums – vehicle manufacturers will determine the maximum power level for their vehicle
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Recharging Infrastructure

LEVEL 1
Cord Set

LEVEL 2
EVSE
Level 3 DC Charging

- Connector: Chademo
- DC energy from an off-board charger
- No minimum energy requirement but the maximum current specified is 400 amps
- No DC system standard currently exists except for Japan
- SAE discussing DC fast charging standardization
- Strong interest in DC fast Charging
The Advancement of Plug-In Vehicles
Regional Interest

General Public

<table>
<thead>
<tr>
<th>Technology</th>
<th>Reservations</th>
<th>Hand Raisers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nissan Leaf</td>
<td>250</td>
<td>4,000</td>
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</tbody>
</table>

Source: Nissan

Local Governments and Agencies

<table>
<thead>
<tr>
<th>Technology</th>
<th>Actively Pursuing</th>
<th>Interested, but Not Pursuing</th>
<th>Not Interested</th>
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</thead>
<tbody>
<tr>
<td>Hybrid Vehicles</td>
<td>56%</td>
<td>36%</td>
<td>8%</td>
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<tr>
<td>Electric Vehicles</td>
<td>20%</td>
<td>57%</td>
<td>23%</td>
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</tbody>
</table>

Source: 2009 NCTCOG Survey
The Advancement of Plug-In Vehicles
Recently Funded Projects

North Central Texas Council of Governments
DOE and Texas SECO Recovery Act Funding

- 6 Electric Vehicle Recharging Stations
- 146 Light-Duty Gasoline-Electric Hybrid Vehicles
- 3 Light-Duty Plug-In Gasoline-Electric Hybrid Vehicles
- 1 Light-Duty Plug-In Electric Vehicles
- 25 Neighborhood Electric Vehicles
- 93 Heavy-Duty Diesel-Electric Hybrid Vehicles
- 9 Heavy-Duty Electric Vehicles

The EV Project – DOE and Ecotality

- Home Recharging Stations
  (Number pending sale of vehicles in region)

DOE = U.S. Department of Energy
SECO = Texas State Conservation Energy Office
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Recharging Infrastructure

Legend
- Existing Electric Vehicle Stations
- Funded Electric Vehicle Stations
- Potential Charging Locations at Major Metroplex Intersections
- Area Within 4 Miles of Any Potential Charging Location
- Major Highways

Additional 12 EVSEs Gifted by TXU to Dallas and Fort Worth
The Advancement of Plug-In Vehicles

Electric Vehicles North Texas

- Local Fleets Recharging Infrastructure
- Home Recharging Infrastructure
- Public Recharging Infrastructure
- Education, Outreach and Marketing

Project Plan:
- Introduced Technologies
- Project Goals
- Milestones
- Deliverables

Electric Vehicle Workshop
October 29, 2009

- Implement Infrastructure
- Plug-In Vehicles
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Electric Vehicles North Texas
2010 Program Deliverables

Regional and Statewide Coordination Groups

Needs and Opportunities Identification

Regional Data Products

Electric Vehicle Life Cycle Monitor

Regional Contractor Listing

EVSE Inclusion into Adopted Regional Codes

State Fair of Texas EV Showcase

Initial Vehicle and Infrastructure Deployment
The Advancement of Plug-In Vehicles

Electric Vehicles North Texas
2011 Program Objectives

Education for First Responders

- Workshop early 2011
- Chevrolet and On Star
- National Alternative Fuel Training Consortium

High Voltage Labels & First Responder Tags

The First Responder cable cut tag is wrapped around the low voltage positive battery cable and is located in the rear compartment behind the fuse panel door. To help ensure that low voltage is not holding the high voltage contactors closed, cut the cable before any extrication work is performed.

Source: General Motors
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Electric Vehicles North Texas
2011 Program Objectives

Education for Electrical Contractors

- Workshop early 2011
- SPX Service Solutions

SPX EV Solutions: Electrical Contractor Registration

Welcome to the pre-registration page. By pre-registering, you'll notify us of your interest in joining our elite network of certified licensed electrical contractors. Please take a few moments to provide the information in the form below.

- Company Name
- Business Fax Number
- Contact Name
- Email Address
- Business Address
- Electrical License Number
- Business City
- State(s) Where License is Held
- Business State
- Number of Years in Business
- Business Zip Code
- Number of Full Time Electricians
- Business Phone Number

( * required )

Submit
The Advancement of Plug-In Vehicles

Electric Vehicles North Texas
2011 Program Objectives

Education for Inspectors

- Workshop early 2011
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Electric Vehicles North Texas
2011 Program Objectives

Streamlined Permitting Process

Oncor

Point of Purchase

NCTCOG

City Permitting Offices

Public EVSE

Fleet EVSE
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Electric Vehicles North Texas
2011 Program Objectives

Universal Recharging Station Signage

Preferential Parking Program and Other Incentives

Additional Funding for Regional Projects

Further Vehicle and Infrastructure Deployment

Public Outreach
## The Advancement of Plug-In Vehicles

### Electric Vehicles North Texas Stakeholders & Interested Parties

<table>
<thead>
<tr>
<th>Local Governments</th>
<th>Regional Transportation Authorities</th>
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<tbody>
<tr>
<td>City of Arlington</td>
<td>Dallas Area Rapid Transit (DART)</td>
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<tr>
<td>City of Burleson</td>
<td>North Texas Tollway Authority (NTTA)</td>
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<td>City of Carrollton</td>
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<td>City of Dallas</td>
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<td>City of Forest Hill</td>
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<td>City of Fort Worth</td>
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<td>City of Garland</td>
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<td>City of Kaufman</td>
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<td>City of Mansfield</td>
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<td>City of Plano</td>
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<td>City of Richardson</td>
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<td>City of Rowlett</td>
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<td>Dallas Police Department</td>
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<tr>
<td>Town of Westlake</td>
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<tr>
<td>Dallas Fort Worth International Airport</td>
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<tr>
<td>Rockwall Independent School District</td>
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<td>Metroplan, Little Rock, Arkansas</td>
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<td>General Services Administration</td>
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<tr>
<td>Houston Advanced Research Center</td>
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<tr>
<td>Southern Methodist University</td>
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<td>Texas A&amp;M University</td>
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<td>Texas Christian University</td>
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<th>Nonprofit Organizations</th>
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<tbody>
<tr>
<td>North Texas Clean Air Coalition</td>
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<tr>
<td>Downwinders at Risk</td>
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<tr>
<td>Texas Business for Clean Air</td>
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</tbody>
</table>
# The Advancement of Plug-In Vehicles

## Electric Vehicles North Texas Stakeholders & Interested Parties

### Utilities/Communications
- Duncan Power
- Energy Future Holdings Corp
- Feris Electric Co. IEC
- GE
- NRG
- Oncor Electric Delivery
- Reliant Energy
- TXU Energy

### Industry/Consulting
- 3 Million Renewable Energy
- A123 Systems
- Adventure Golf Cars, LLC
- Aeroviroment
- Better Place
- Boulder Electric Vehicle
- Daffer McDaniel, LLP
- Earth People Co
- EcoGreenHotel
- Ecotality
- Eetrex Incorporated
- Electric Mobile Cars
- Emisstar LLC
- ETEC
- EV Autos Texas
- EV Tech, Inc.
- EVCarco, Inc.
- EVX Labs
- Facility Solutions Group
- Ford Motor Company
- General Motors
- Green Car People
- ICF International
- Navistar Electronics
- Nissan
- Plug Smart
- Plug-In Vehicle Solutions, Inc.
- Positive Energy Resources
- Raytheon
- Shoppas Material Handling
- Smith Electric Vehicles
- TBD America, Inc.
- Texas ESO Inc.
- TNMP
- Vectrix
- Verdex
- Vitron Group
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Additional Partnerships

NCTCOG Statewide Electrification Collaboration
(Dallas-Fort Worth, Houston, Austin, San Antonio)

Center for the Commercialization of Electric Technologies Statewide Collaborative

PHEV/EBVs: Transportation and Electricity Convergence
National Science Foundation Industry/University Cooperative Research Center

Project Get Ready and the Rocky Mountain Institute
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I-35 Corridor Electrification Workgroup

Possible Areas for Interstate Electrification

I-35 Corridor between:
- San Antonio and Austin
- Austin and Waco
- Waco and Dallas
- Dallas and Canada

I-45 Corridor between:
- Dallas and Houston

I-10 Corridor between:
- San Antonio and Houston
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Upcoming Events

Electric Vehicles North Texas Stakeholder Meeting
December 15, 2010 at 10 a.m.
North Central Texas Council of Governments
William J. Pitstick Executive Board Room
616 Six Flags Drive, Centerpoint Two
Arlington, TX 76011
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Resources

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