Plug-In Electric Vehicles and Infrastructure at GM
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Slides sourced from:
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Electric Vehicle (with a Range-Extender)

Designed for **40 miles**

**BATTERY**

**Electric Drive**

_typically 25-50 mile EV range_

**+**

Designed for over **300 miles**

**EXTENDED RANGE**

Driving on Gasoline

_EPA label: EV @ 98mpge (38 miles) + Gas @ 37mpg comb (344 miles) = Overall 60mpg (382 miles)_
New Plug-in Products …

Chevrolet Spark EV
(with DC fast-charge capability – SAE J1772)
Summer 2013
California and Oregon

Cadillac ELR
(Extended Range EV)
Model Year 2014
Plug-in Electric Vehicles (PEVs):
Includes PHEVs, EREVs and BEVs

- **PHEV**
  - Plug-in Hybrid Electric Vehicle
  - Plug-in Prius
  - Ford C-MAX Energi

- **EREV**
  - Electric Vehicle with “Extended-Range”
  - Chevrolet Volt
  - Cadillac ELR

- **BEV**
  - Battery Electric Vehicle
  - Chevy Spark EV
  - Nissan Leaf
  - Tesla S
  - RAV4 EV
  - Honda Fit
  - Ford Focus

Increasing EV Range (Increasing Charge Times)
Chevrolet Volt Sales (U.S.)
Solid sales growth
Electric drive vehicle sales figures (U.S. Market) - EV sales
Chevrolet Volt Awards

OnStar RemoteLink
Volt Mobile App

Consumer Electronics Show
“TOP PRODUCTS” Award

“Best Engineered Vehicle of 2011” by SAE International’s Automotive Engineering International (AEI)

2011 World Green Car
Ampera - Rallye Monte-Carlo Des Énergies Nouvelles

“EDITOR'S CHOICE AWARD”

“TOP SAFETY PICK”

“BREAKTHROUGH TECHNOLOGY AWARD”

“BEST ENGINE OF 2011” by SAE International's Automotive Engineering International (AEI)
Vehicle Learnings

OnStar Data Collected through January

- Volt Customers are primarily driving electrically
- 2/3 of miles driven are electric
- 133 million electric miles to date
- 7 million gallons of gas saved
- Driving 900 miles between fill ups
- Volt is being used as expected
- Range extender is critical to Volt’s success
CHARGING AND INFRASTRUCTURE
Where are the Cars?

Source of Data - 2001 National Household Travel Survey ; GM Data Analysis (Tate/Savagian) - SAE paper 2009-01-1311
Charging Infrastructure: Home … Work … Public

- **Public charging**
  - High Visibility
  - Destination
  - Public education and outreach

- **Workplace**
  - Corporate Parking Lots, Municipal Parking Lots

- **Residential (majority)**
  - Satisfying consumer-driven home installation process
  - Permits, electricians, inspections, meters, rates
Volt Infrastructure Learnings:

- ~50% of Volt customers charge at 120V ($0)
- 240V grant programs likely driving some 240V demand
- 240V installation costs range from $500 to $6,000 (avg. ~$1500 + h/w)
- 2nd Meters (to access time-of-use rates) = 20% of home installs
  - Average 2nd meter installation adds $900 to the cost (CA, early MI, …)
- 70% of 240V installs are in Single Family Homes
  - Multi-family residences more complex
  - DC fast-charging (SAE compliant) may provide a better “neighborhood” solution
- Little evidence nationally of local grid issues with 3.3kW
  - Some concern, but no data, for >3.3kW charging

- Important role of 120V (level 1) charging
- Workplace charging key to vehicle/technology promotion
  (and more daily electric miles driven)
Key Enabler: Continue to leverage Stakeholders

DOE/EERE Community Readiness Efforts

States (50% of states have an EV incentive)
Municipalities (e.g. Indianapolis)
Advocacy:
- EDTA and EEI (national campaigns)
- Plug-in America (national plug-in day)
- Rocky Mountain Institute (EV-ready city)
GM / EPRI / Utility Collaboration:

- Largest existing auto-utility collaborative effort -- formed in 2007
- Over 50 utility members and the Electric Power Research Institute (EPRI)
- Focus areas: Vehicle-to-Grid Technology, Aligned Messaging and Policy Priorities, New Business Opportunities (EV-to-Grid)
Infrastructure Learning: Engaged Partners

EEI with the Volt at the Congressional Ballgame at Nationals Stadium

PJM CEO Terry Boston - with his Volt

DTE’s Volt

Pres. EEI Tom Kuhn with his Volt

TVA’s Volt license tag

TECO Outreach Event 2011 Tampa, FL

EPRI with Volt at Plug-in 2011

NV Energy Volt charging
Incentive: Up to $2,500 to 2,500 Detroit Edison customers for EVSE & home installation.

Two separately metered PEV rates offered – Flat Rate and Time-of-Use

1,390 Qualified Applications
1,133 L2 EVSEs Installed
1,038 2nd Meters Installed

- YTD 2012 Average installation cost $2,155 ($2,500 incentive covers total cost for majority of customers)
- Flat Rate fully subscribed at 250 customers
- Vehicles enrolled include:
  - Volt: 86.2%
  - Leaf: 2.2%
  - Focus/C-max: 0.5%
  - Prius: 0.5%
  - Other: 10.6%
Department of Energy: EV Everywhere Initiative
A Grand Challenge in Plug-In Electric Vehicles

• Goal: to produce plug-in electric vehicles (PEVs) that are as affordable and convenient for the average American family as today’s gasoline-powered vehicles within the next 10 years.

• Announced March 7, 2012

• To enable innovation to rapidly develop and commercialize the next generation of vehicle, component, and charging infrastructure technologies to achieve sufficient PEV cost, range, and charging infrastructure to assure widespread PEV deployment without subsidies.
DOE – Workplace Charging Challenge

- Announced 31 January 2013 at DC Autoshow
- Goal: expand access to workplace charging stations by 10x in 5 years
- The Partners pledge: assess workforce PEV charging demands, and then develop and implement a plan to install workplace charging infrastructure for at least one major worksite location
- Additional Ambassadors: California PEV Collaborative, CALSTART, Electric Drive Transportation Association, Electrification Coalition, International Parking Institute, NextEnergy, Plug In America, and Rocky Mountain Institute.
- Supports the broader DOE EV Everywhere Grand Challenge announced in March 2012
GM Workplace Charging
239 Workplace Charge Spots (plus 400 GM private and 5,200 dealership charge stations nationwide for Chevy customers)

Pontiac
- 32 Workplace (16@240V)
- 8 Private

Milford Proving Grounds:
- 22 Workplace (240V)
  - (18 are Solar)
- 358 Private (incl. 9 DC)

GM California Sites
- Palo Alto
  - 1 Workplace (1@240V)
- Thousand Oaks
  - 4 Workplace (4@240V)
- Torrance
  - 17 Workplace (13@240V)
- N. Hollywood
  - 2 Workplace (120V)
- Glendale
  - 1 Workplace (120V)
- Santa Fe Springs
  - 1 Workplace (240V)

GM Ren Cen
- 33 Workplace (30@240V)
  - 2 “showcase” @240V
  - 8 Private

GM New York Sites
- Ardsley
  - 3 Workplace (2@240V)

Warren Tech Center:
- 113 Workplace (68@240V)
  - (20 are Solar)
- 15 Private (incl. 2 DC)

Hamtramck Plant
- 10 Workplace (all Solar)

Michigan

Torrance
- 1 Workplace (1@240V)

Palo Alto
- 1 Workplace (1@240V)
Incentives

- Federal $7,500 (max) tax credit for PEV purchase
- State incentives promoting EV technology
  - About 50% of the states have some type of EV incentive
- Incentives are both monetary and non-monetary
  - Rebate
  - Income Tax Credit
  - Excise Tax Credit
  - Infrastructure Incentives – EVSE and installations
  - HOV
  - Free Parking
  - Charging
Current State and Local PEV Incentives

- **HOV Lane Access**
  - Nevada
  - California
  - Oregon

- **Rebate $1,500 - $3,000**
  - Washington

- **Free Charging Station**
  - Oregon

- **Waiver**
  - Emission Testing
  - Vehicle Retirement

- **Tax Credit $7,500**
  - Michigan

- **Rebate $4,000**
  - Texas

- **No Regular Session in 2012**
  - West Virginia
  - North Dakota
  - Arkansas
  - Kansas
  - Nebraska
  - South Dakota
  - Minnesota
  - Iowa
  - Missouri
  - Wisconsin
  - Ohio
  - Pennsylvania

- **No Session in 2012**
  - Wyoming
  - Montana
  - New Mexico
  - Utah
  - Arizona
  - Idaho
  - Nevada
  - Colorado
  - New Hampshire
  - Maine
  - New York
  - Connecticut
  - Rhode Island
  - Delaware
  - Vermont
  - Mississippi
  - Alabama
  - North Carolina
  - South Carolina
  - Virginia
  - West Virginia
  - Kentucky
  - Tennessee
  - Illinois
  - Michigan
  - Indiana
  - Ohio
  - Pennsylvania
  - New Jersey
  - Maryland
  - District of Columbia

- **Some State or Local Incentives In Place Applicable to the Volt**

Updated: 3/9/2012
DOE: NREL's Public Charging Locator Database

Alternative Fuels Data Center

Alternative Fueling Station Locator

Find alternative fueling stations near an address or ZIP code or along a route in the United States. Enter a state to see a station count.

5,184 electric stations in the United States

Excluding private stations

Source: www.afdc.energy.gov
## Plug-in Ready Communities

### Required Stakeholders
- Dedicated project leader
- State, city, county
- Clean Cities Orgs/AQMD
- DOT
- Utilities (municipal and regional)
- Regulators/public utility commissions
- Permitting and code officials
- Local employers
- Local universities

### Desired Enablers

#### Game Plan
- Infrastructure/Incentives/Educational Outreach

#### Vehicle Purchase Incentives

#### Charging Installation Incentives
- (Home, Work, Public)

#### Low Off-Peak Charging Rates
- (e.g. to encourage nighttime charging)

#### Green/Renewable Charging Options

#### Government Fleet Purchases

#### Building Codes to Include Home Charging Enablers

#### HOV Lane Access

#### Free Parking

#### Free Charging
PEV Stakeholder Efforts

**Michigan PEV Task Force:**
- Michigan Public Service Commission (incl. the chairman)
- Utilities (Lansing Board of Water & Light, DTE, Consumers Energy, AEP, Wisconsin Public Service)
- EEI (investor owned utility association)
- Automakers (GM, Ford, Chrysler)
- MI Economic Development
- MI Counties
- MI Townships
- MI DOT
- MI Legislature
- MI NECA (National Electrical Contractors Assoc)
- MI Clean Energy Commission
- Detroit EITC
- Infrastructure (Eaton, GE, Clipper Creek)
- Others (Next Energy, Country Lines, MML, ECOcenter, Green Earth MI, Integrys Group)

**Central Florida PEV Ready:**
- Orange County (incl Convention Ctr)
- Orlando Mayor’s Office
- Orlando Visitors Bureau
- I-Drive Chamber of Commerce
- DOE Clean Cities – Central Florida
- Utilities (Progress, TECO, FPL, OUC)
- Automakers and Dealers
- Florida DOT
- Orlando International Airport
- Infrastructure (Siemens)
- Universities (UCF, Seminole,…)
- Cities (Tampa Bay, Sarasota,…)
- Counties (Seminole, Brevard,…)
- Stakeholders (AAA, Enterprise, NASA/KSC, Disney, Sea World, IKEA, Marriott, Florida Hospital, Hotels,…)
- Others (Solar Energy Center,…)
Key Enablers

- **Vehicles and growing product offerings**
- **Charging Infrastructure**
  - Home (single-family home)
  - Multi-dwelling units, Workplace … Public
- **Education and Awareness**
  
  If we’re getting these questions, we have a problem…
  - “Can I drive it on the highway?”
  - “Do I have to get out of the car and do something to switch it from battery to gas?”
  - “Will it cause my electric bill at home to skyrocket?”

- **Must raise awareness and educate consumers**
  - Focus on cars, visibility of the cars, and butts-in-seats
Coming Soon: National Education & Awareness Campaign

**ACCELERATE THE GOOD.**

**Seed Funders:**
Communications & Public Policy

Industry Leaders
Auto companies, utilities, EVSE suppliers, fleets

Non-Governmental Organizations
Environment, conservation, urban renewal

Consumer Advocates
Opinion leaders and early adopters of electric vehicles

The critical path to consumer knowledge
Powered by

Enthusiasts & Spokespeople
Celebrities, high-profile philanthropists, media-savvy early adopters

Government Influencers
DOD, DOE, DOT, iconic government officials, municipalities

Pioneers
Technology/infrastructure innovators & early advocates
Outreach and Education: Resources

Chevrolet Volt Websites

Chevrolet.com/volt  ChevroletVoltage.com

Chevrolet.com/volt  ChevroletVoltage.com

Electrician Training/EVITP

NECAnet.org
(Multi-day certification training)

State Task Force

GMstc.com
(GM First Responder website)

EvSafetyTraining.org
(GM and NFPA partnership)

EV-Ready Cities!

PluginMichigan.org
(State task force website)

ProjectGetReady.org
(EV-readiness guidelines)

GoElectricDrive.com
(collaborative industry website)