Plug-In Electric Vehicles and Infrastructure at GM

CASPA Presentation, 3 April 2013

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Slides sourced from:
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VOLT

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	EREV	BEV
Plug-in Hybrid Electric Vehicle	Electric Vehicle with "Extended-Range"	Battery Electric Vehicle

Plug-in Prius

Chevrolet Volt

Chevy Spark EV

Nissan Leaf

Tesla S

RAV4 EV

Ford C-MAX Energi

Cadillac ELR

Honda Fit

Ford Focus

Increasing EV Range

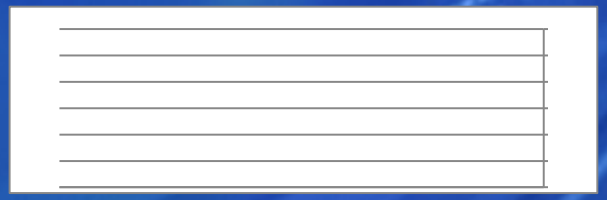
(Increasing Charge Times)

Chevrolet Volt Sales (U.S.)

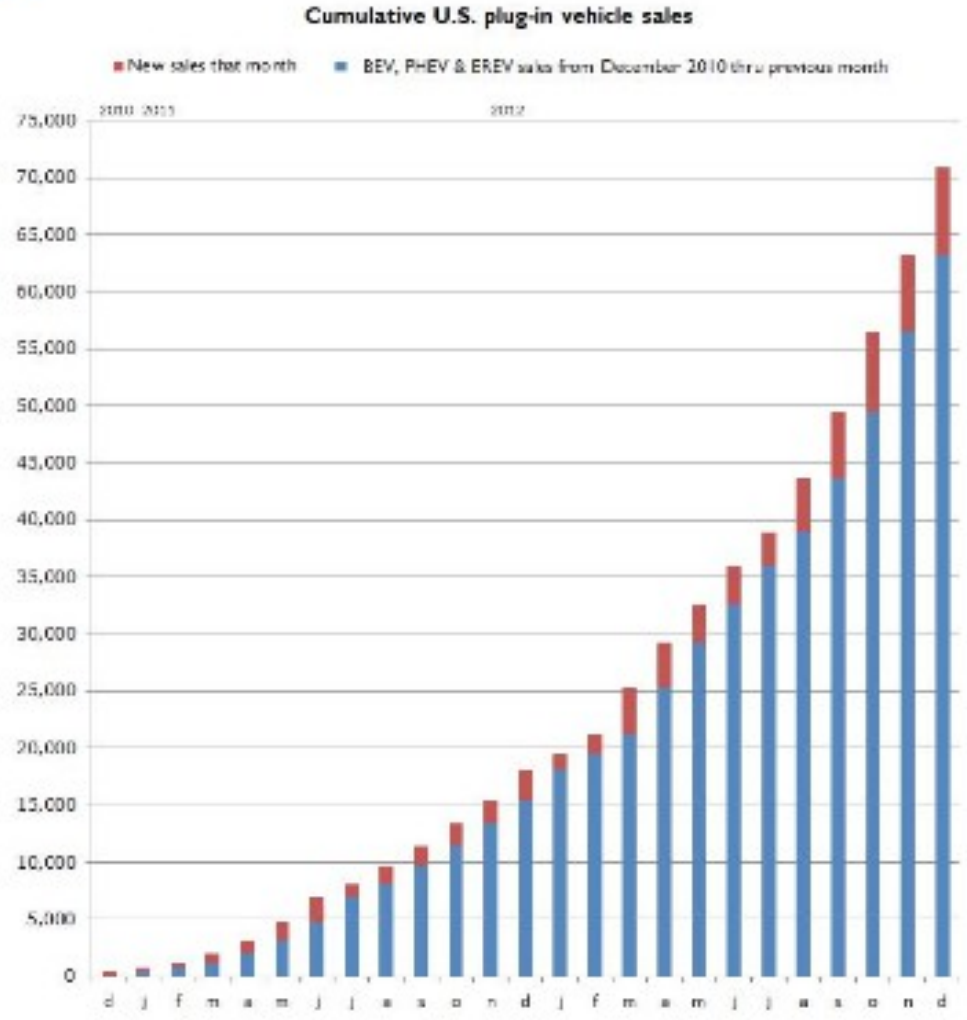
Solid sales growth

Monthly

Launch to date



Electric drive vehicle sales figures (U.S. Market) - EV sales



Chevrolet Volt Awards

North American Car of the Year

2011 Motor Trend Car of the Year

2011 Edison Awards – Innovations & Innovators

Popular Mechanics
TOP 10 VEHICLES AWARD
TECHNOLOGY

"Best Engineered Vehicle of 2011" by SAE International's Automotive Engineering International (AEI)

Consumer Reports Best Products of the Year

Car of the Year 2012

2011 Green Car of the Year – GreenCar

Car and Driver 10 best

Ampera - Rallye Monte-Carlo Des Énergies Nouvelles

OnStar RemoteLink Volt Mobile App

Ward's 10 Best Engines 2010

2011 World Green Car

Popular Science Best of What's New Winner 2010

CEA Consumer Electronics Show

"TOP PRODUCTS" Award

J.D. Power Customer Satisfaction Since 1968 – The Voice of the Customer

Popular Mechanics
EDITOR'S CHOICE AWARD

Popular Mechanics
Breakthrough Technology Award

cnet Tech Car of the Year

VOLT

Energy Star Award 2012 – Partner of the Year

Strategic Vision Total Value Award

2012 Kelley Blue Book Total Cost of Ownership Awards

NHTSA
www.nhtsa.gov

Insurance Institute for Highway Safety
TOP SAFETY PICK

Automobile of the Year 2011

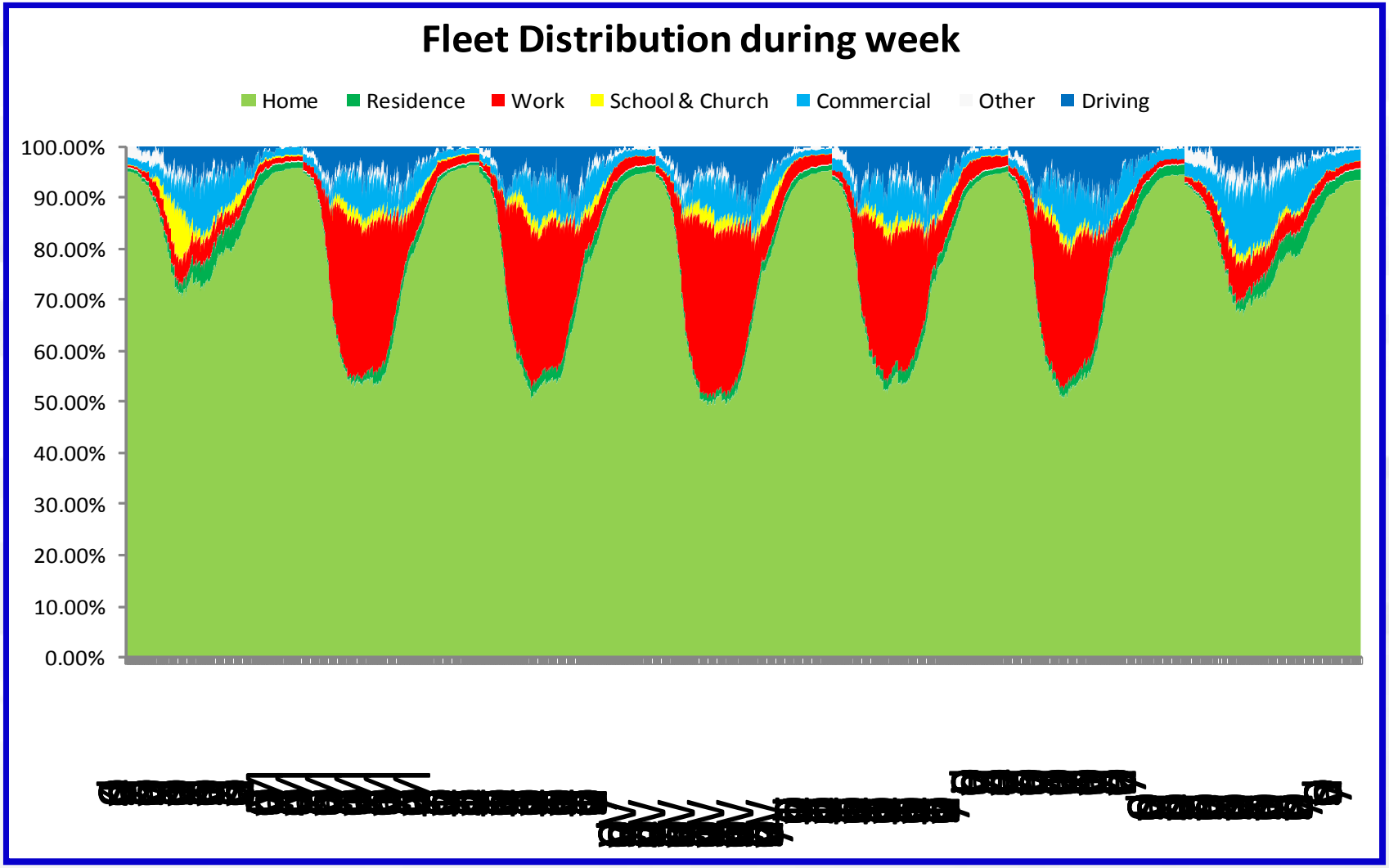
Vehicle Learnings

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

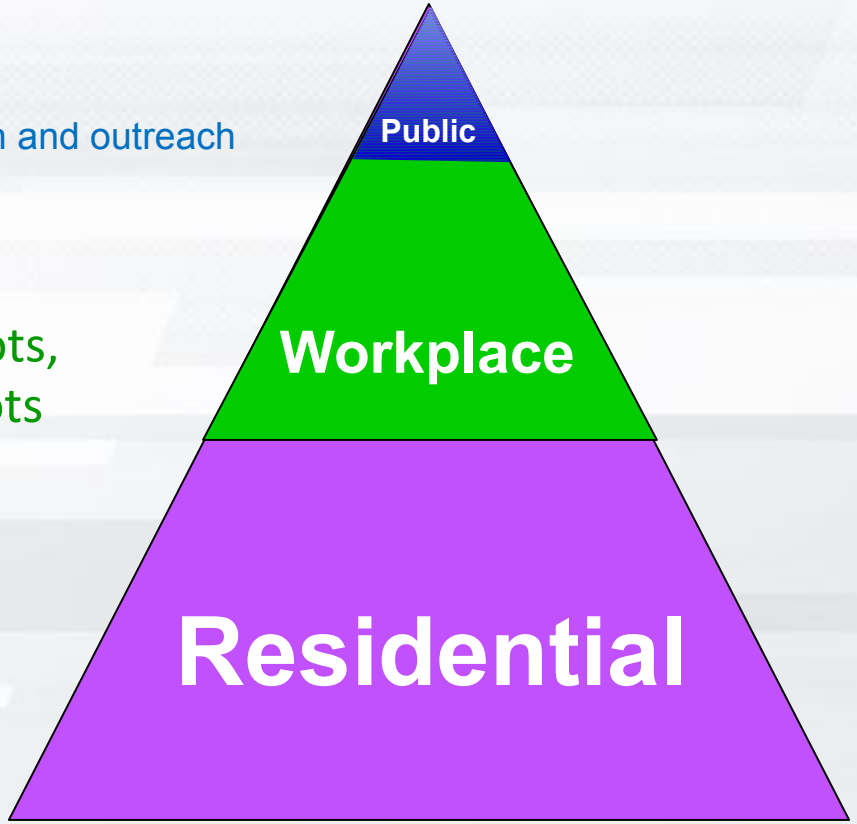
Charging Infrastructure: Home … Work … Public

- 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

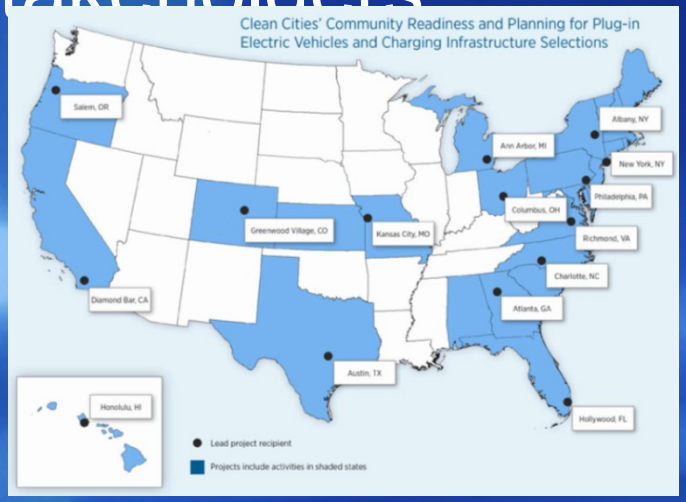


Volt Infrastructure Learnings:

- **~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

Utilities

DOE/EERE Clean Cities

- States (50% of states have an EV incentive)
- Municipalities (e.g. Indianapolis)
- Advocacy:
  - EDTA and EEI (national campaigns)
  - Plug-in America (nat'l 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

DTE Residential Program

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

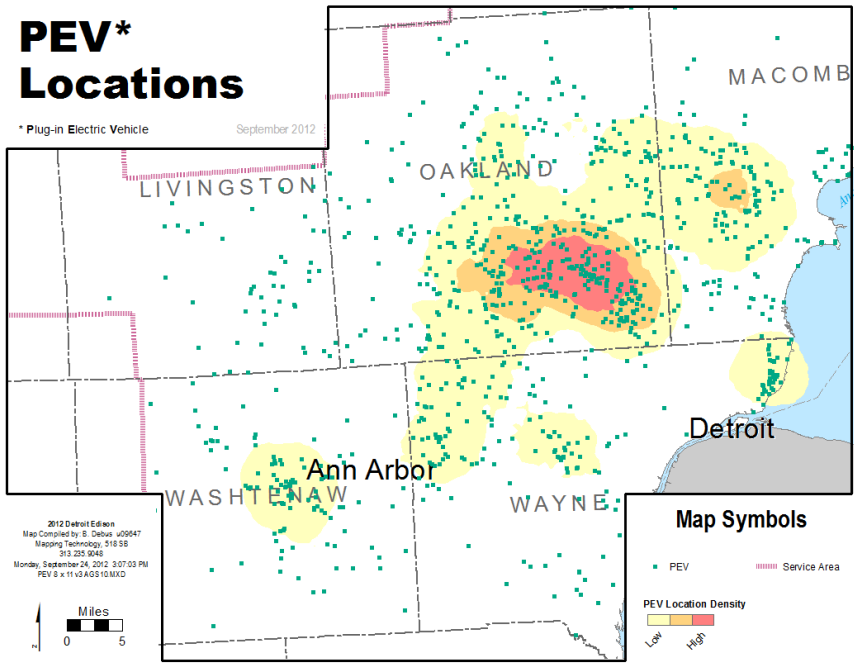
Two separately metered PEV rates offered – Flat Rate and Time-of-Use

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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Home » Thirteen Major Companies Join Energy Department's Workplace Charging Challenge

Thirteen Major Companies Join Energy Department's Workplace Charging Challenge

January 31, 2013 - 11:38am

NEWS MEDIA CONTACT

• (202) 586-4940

WASHINGTON -- Energy Secretary Steven Chu announced 13 major U.S. employers and eight stakeholder groups have joined the new Workplace Charging Challenge to help expand access to workplace charging stations for American workers across the country. In a speech at the Washington Auto Show, Secretary Chu outlined the new initiative, which aims to expand the availability of workplace charging, increasing the convenience of plug-in electric vehicles (PEVs) and providing drivers with more options.

- Announced 31 January 2013 at DC Autoshow
- Goal: expand access to workplace charging stations by 10x in 5 years
- First 13 Partners: 3M, Chrysler Group, Duke Energy, Eli Lilly and Company, Ford, GE, GM, Google, Nissan, San Diego Gas & Electric, Siemens, Tesla, and Verizon
- 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)

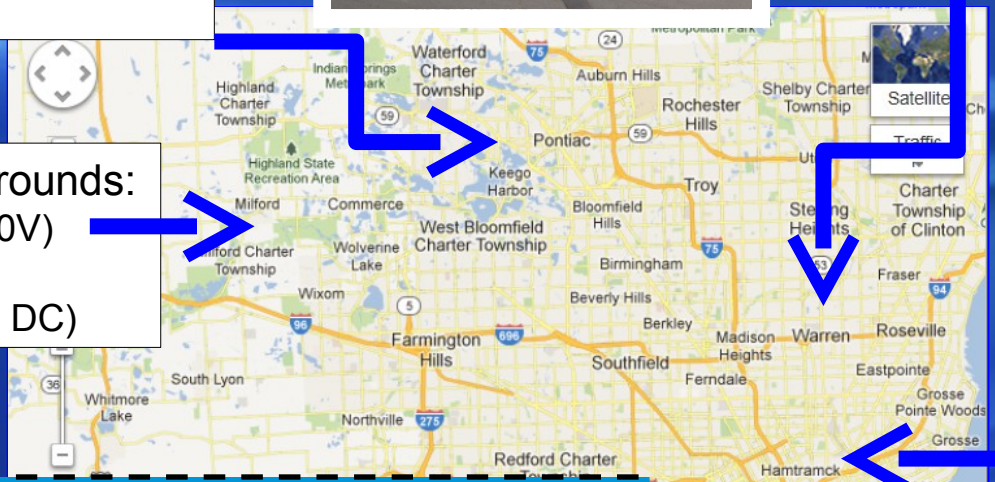
GM New York Sites

Ardsley
- **3 Workplace** (2 @240V)

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

Michigan

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



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

Hamtramck Plant
- **10 Workplace** (all Solar)

GM California Sites

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

N. Hollywood
- **2 Workplace** (120V)

Thousand Oaks
- **4 Workplace** (4@240V)

Glendale
- **1 Workplace** (120V)

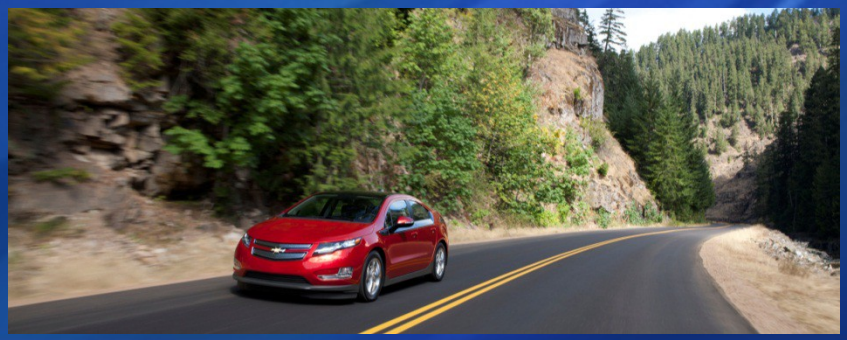
Torrance
- **17 Workplace** (13@240V)

Santa Fe Springs
- **1 Workplace** (240V)

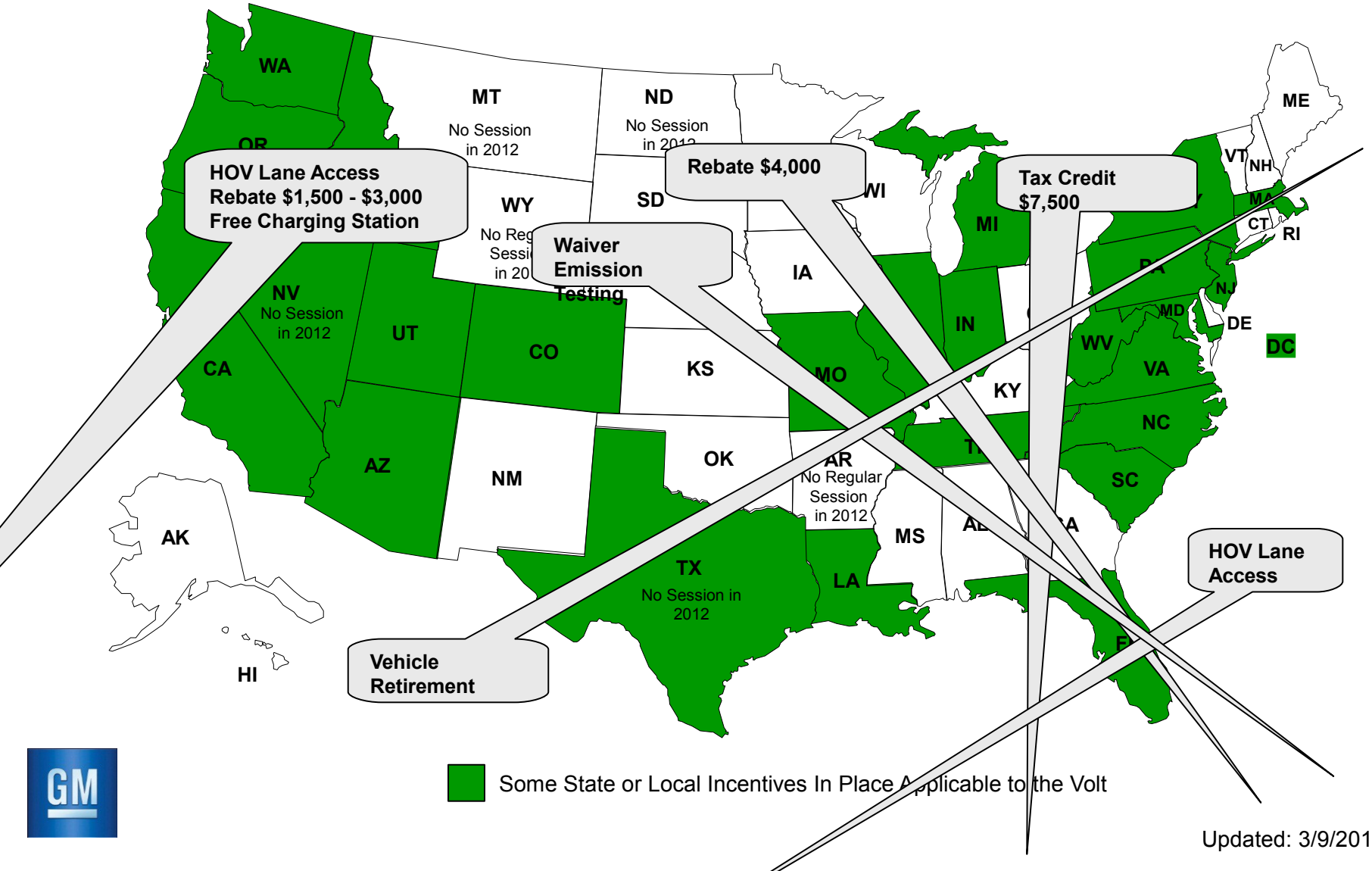
GM Ren Cen
- **33 Workplace** (30@240V)
- 2 “showcase” @240V
- 8 Private

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

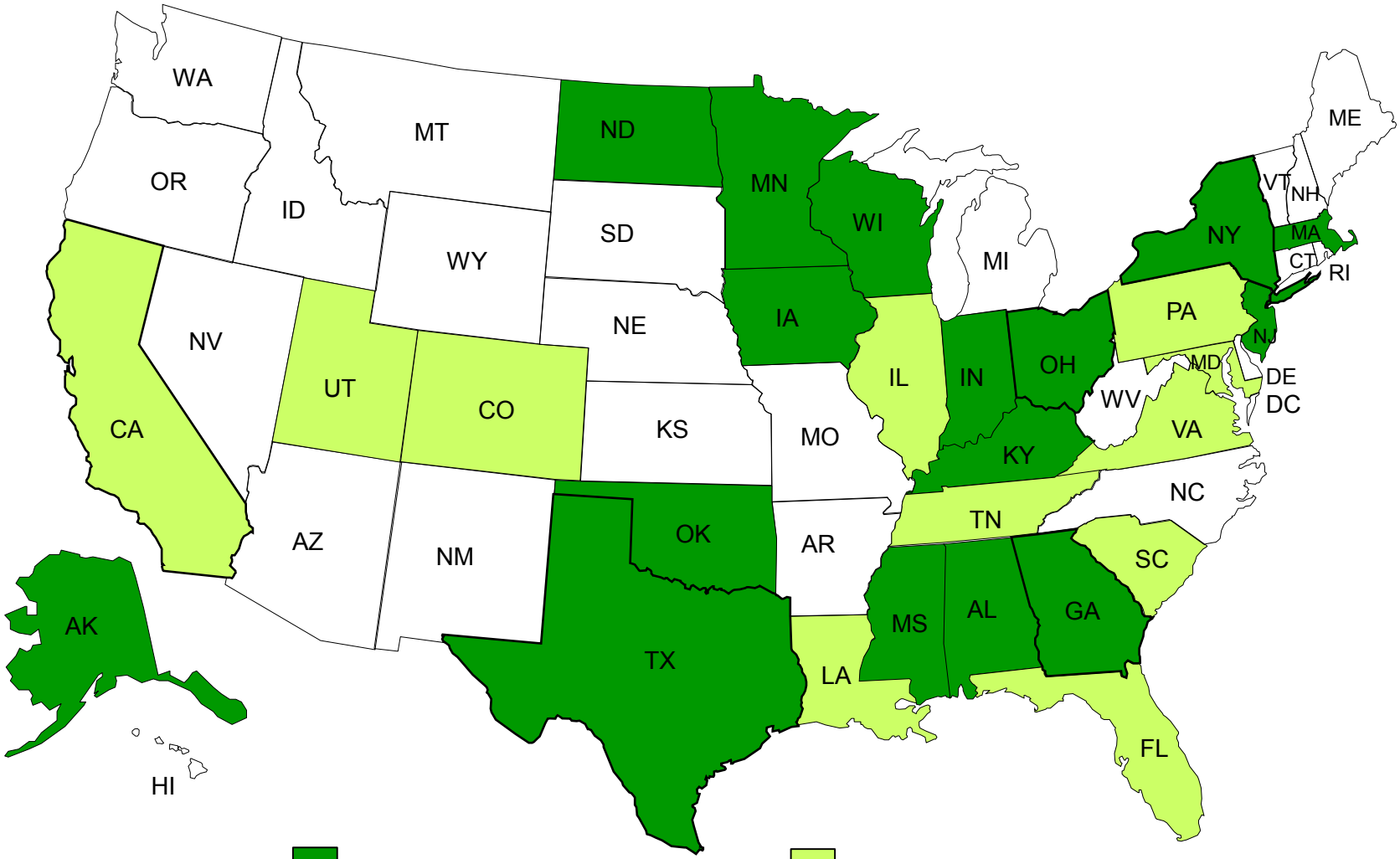


Current State and Local PEV Incentives

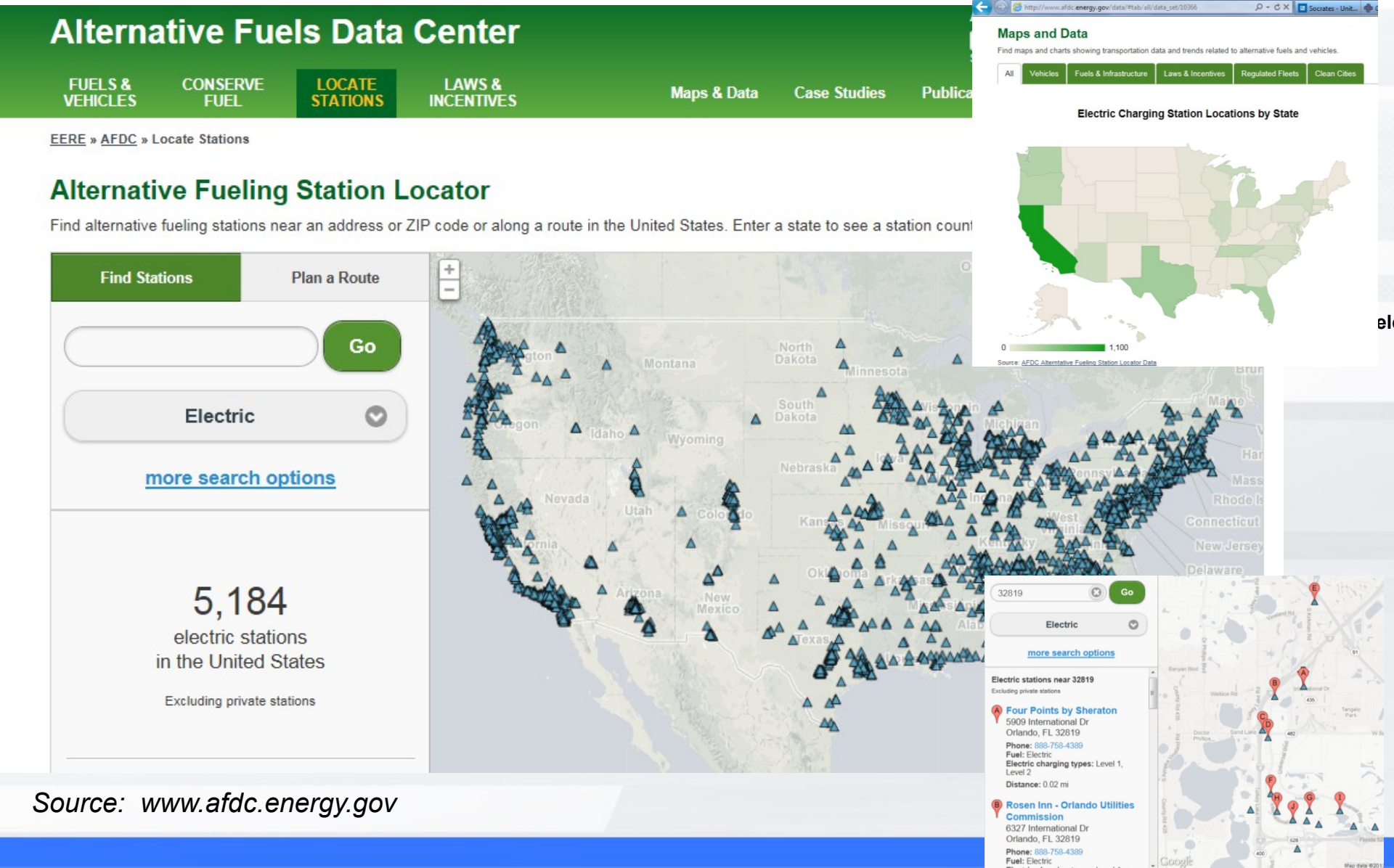


Updated: 3/9/2012

Draft 2013 Potential Incentives



DOE: NREL's Public Charging Locator Database



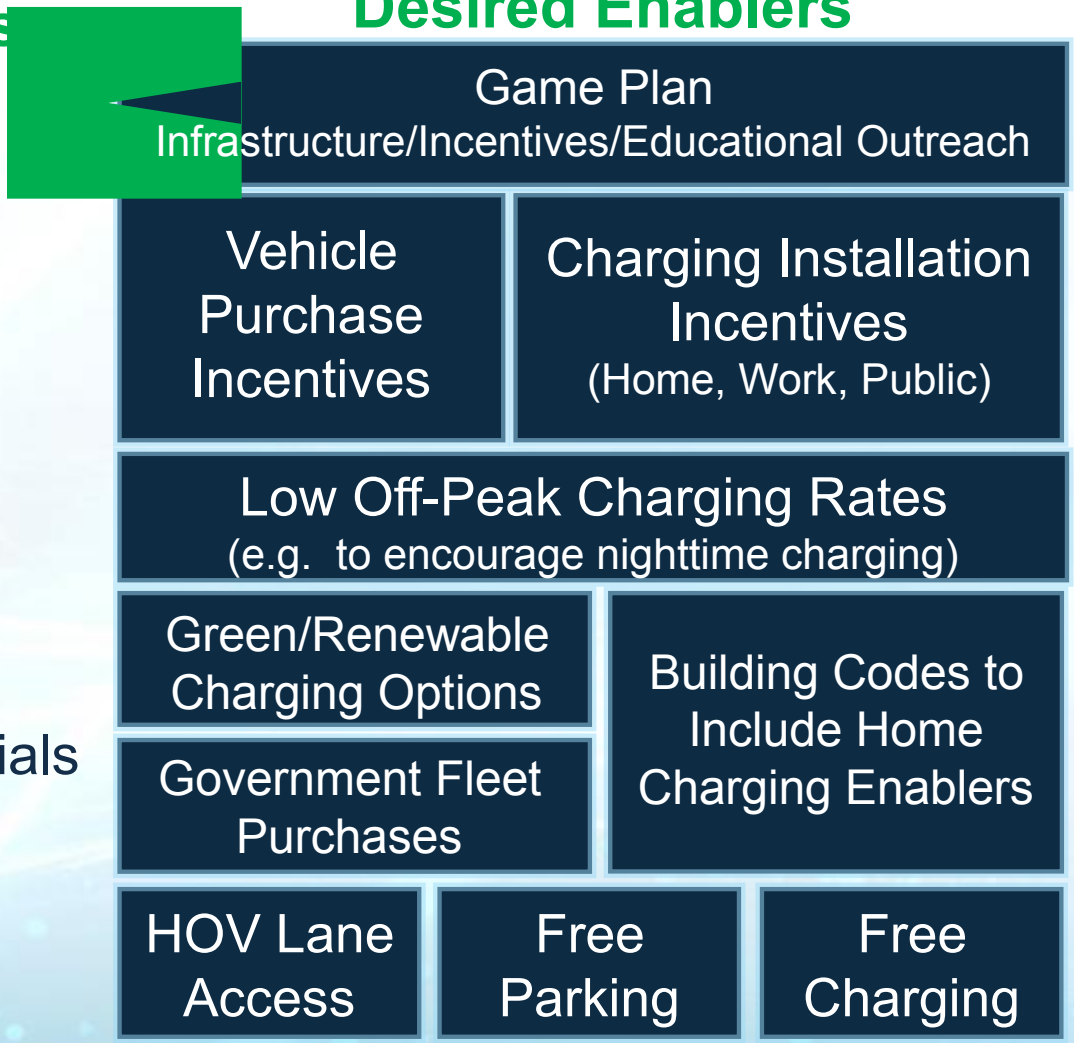
Source: www.afdc.energy.gov

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



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

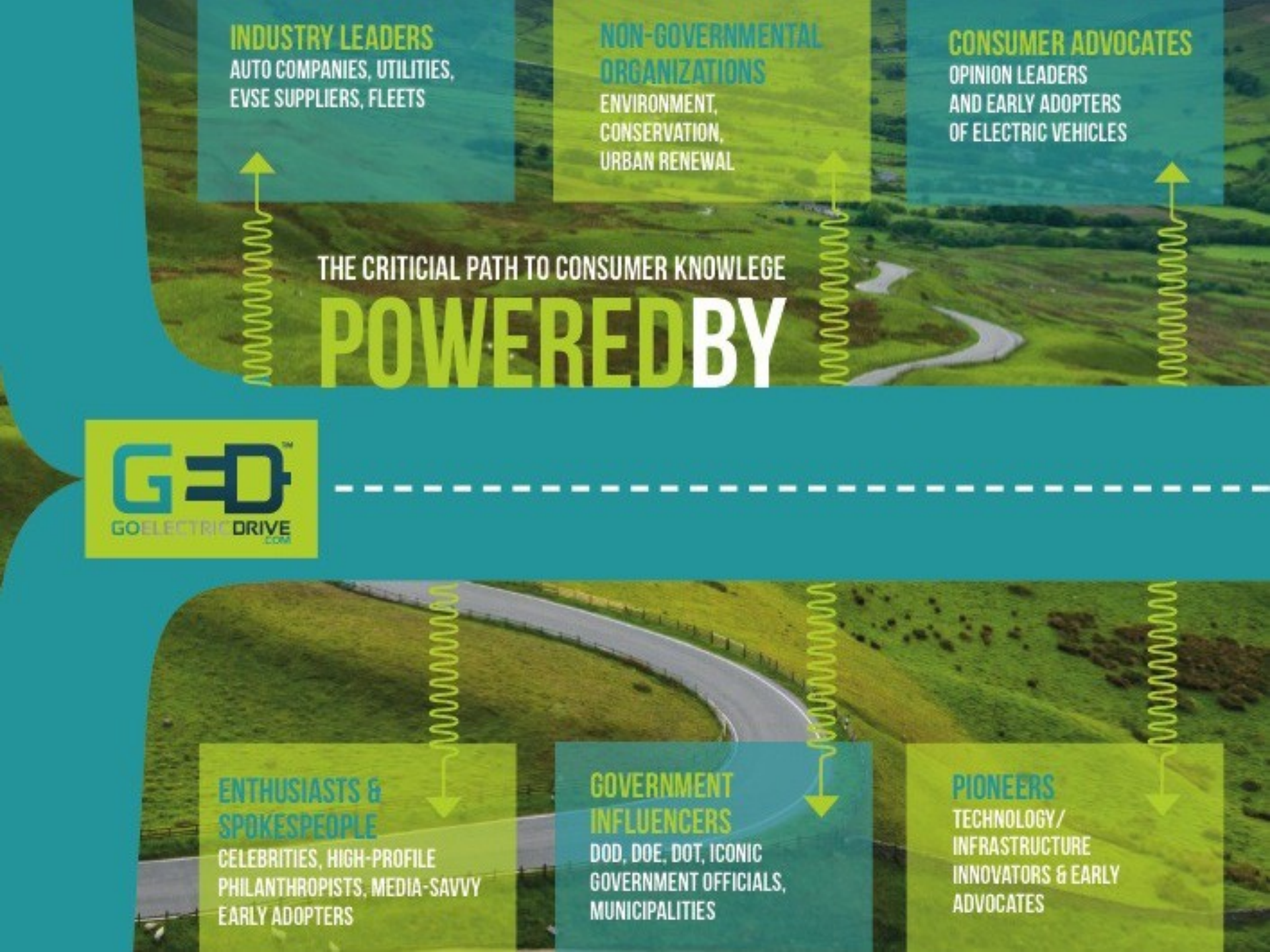
- **Vehicles and growing product offerings**
- **Charging Infrastructure**
  - **Home (single-family home)**
  - **Multi-dwelling units, Workplace … Public**
- **Education and Awareness**

  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:
Dow Chemical, Duke Energy, Edison Electric Institute, EDTA, The Energy Foundation, EPRI, Florida Power & Light, General Electric, General Motors, Johnson Controls, Nissan, Pacific Gas & Electric, Progress Energy, Rockwood Lithium, San Diego Gas & Electric, Siemens, South Coast AQMD, Southern California Edison, and Southern Company.


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 CRITICIAL PATH TO CONSUMER KNOWLEGE
POWERED BY
GED
GOELECTRICDRIVE.COM
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

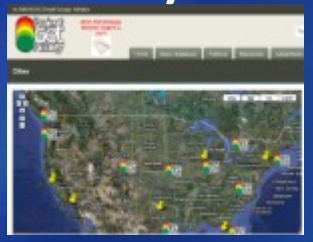
Chevrolet.com/volt

ChevroletVoltage.com

Electrician Training/EVITP

NECAnet.org
(Multi-day certification training)

EV-Ready Cities!



ProjectGetReady.org
(EV-readiness guidelines)

GoElectricDrive.com
(collaborative industry website)

First Responder Training with NFPA

GMstc.com
(GM First Responder website)
EVSafetyTraining.org
(GM and NFPA partnership)

State Task Force

PluginMichigan.org
(State task force website)


VOLT