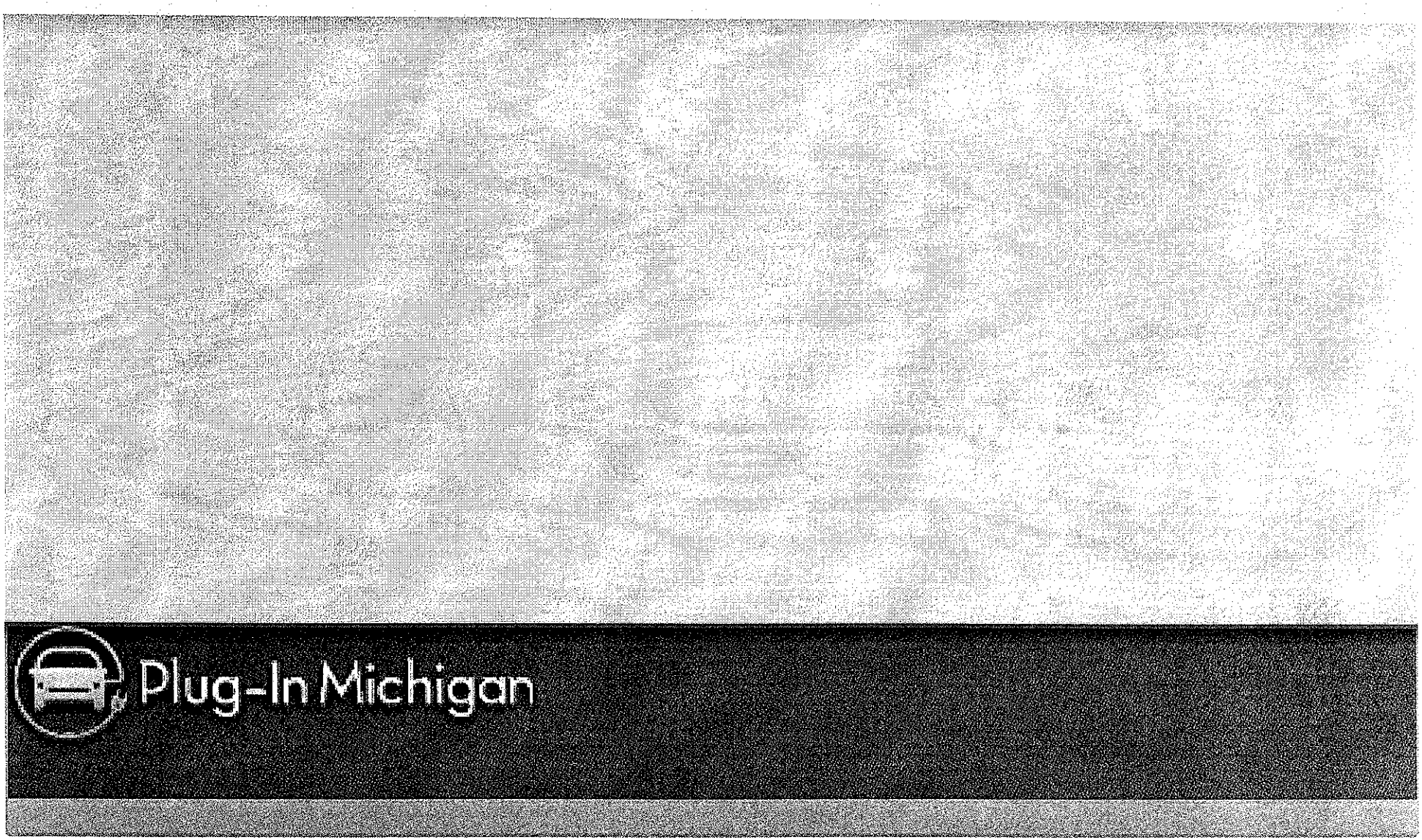
Plug-In Michigan

Michigan Plug-in Vehicle Preparedness Taskforce

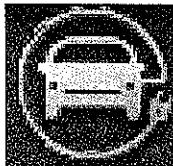
House and Senate Energy & Technology Committees

May 10, 2011



Overview and History

Orjiakor Isiogu, Chairman
Michigan Public Service Commission



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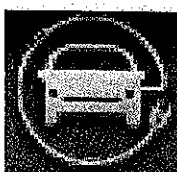
Michigan's Plug-in Preparedness Taskforce

- *Automotive Manufacturers*
- *Clean Cities Coalition*
- *Dept. of Licensing and Regulatory Affairs* *(formerly DELEG)*
- *Electrical Contractors*
- *Environmental Groups*
- *Michigan Public Service Commission*
- *Not for Profit Corporations*
- *Utilities (both regulated and public)*
- *Other Interested Parties*



Plug-In Michigan

Michigan's Plug-in Preparedness Taskforce

- Key Milestones
  - Supported passage of building code rules regulating charging station installations - 2010
  - Hosted Ride and Drive event – 2010
  - Launched www.PlugInMichigan.org website – 2011
  - Transitioned to Taskforce member-led group - 2011

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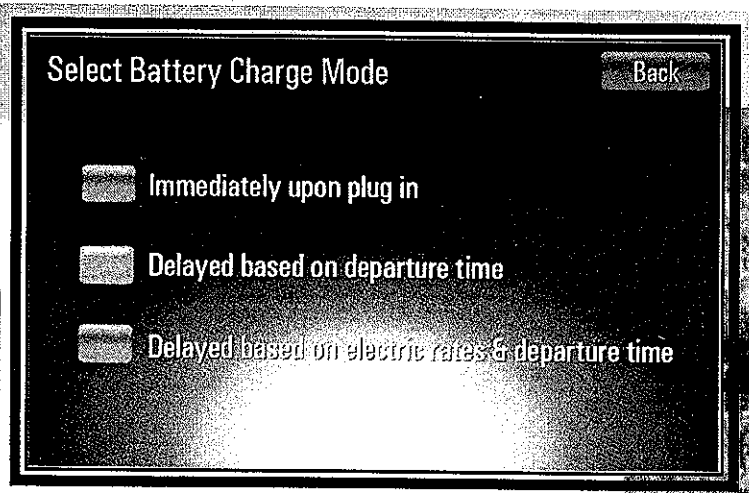
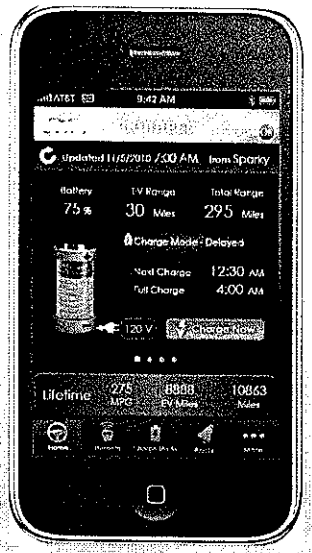
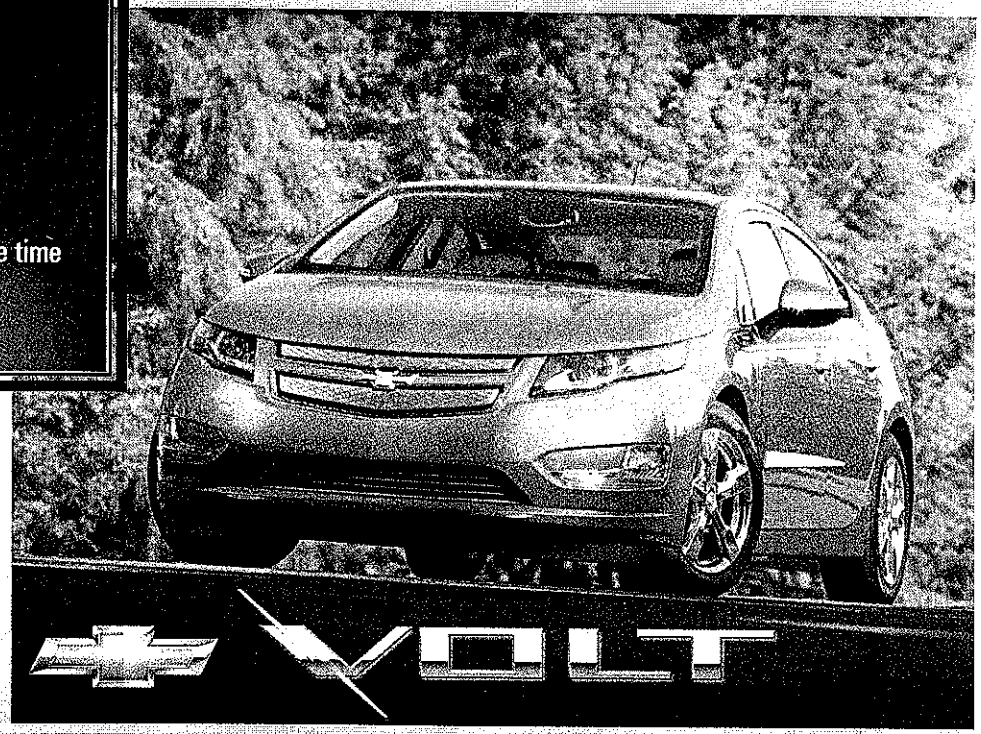
Automotive Perspective

Kristin Zimmerman, General Motors
Charlie Pryde, Ford Motor Company
Jay Iyengar, Chrysler







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Kristin Zimmerman
Advanced Technology Infrastructure – Chevy Volt Program
General Motors

Plug-In Michigan

Definition of PEV & EVSE

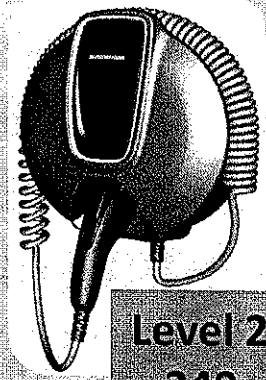
PEV = Plug in Electric Vehicles - All PEV categories are listed below:

- BEV - Battery Electric vehicles (e.g. Nissan Leaf, Tesla Roadster)
- EREV - Extended Range Electric Vehicles (e.g. Chevy Volt) and
- PHEV - Plug-in Hybrid electric vehicles (e.g. Ford Escape Plug in Hybrid)

EVSE = Electric Vehicle Supply Equipment:

- Charging cords and stations are called EVSEs – Mfers include:
  - Lear/Voltec, Coulomb Technologies, Clipper Creek, EcoTality, Eaton, Leviton, GE, PEP…. There are over 40 manufacturers
- The Society of Automotive Engineers (SAE) J1772 developed the common/standard charge coupler for the vehicle
- The actual charger is located on-board the vehicle. Specific vehicle charging requirements vary by each auto OEM
- The Volt charges in 3-4 hours with a level 2 (240v) EVSE and 8-10 hours with a common house plug (120v).

Level 1: 120v



Level 2: 240v

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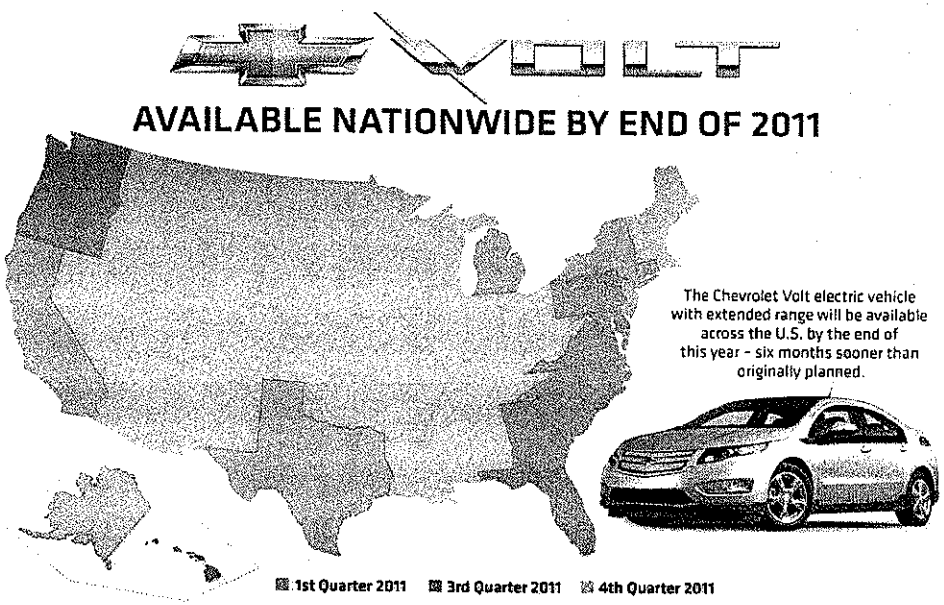
Vehicle Roll-Out Plans for Chevy Volt

- Model year 2011 production is on schedule with strong/growing demand
- Made in Michigan:
  - Detroit-Hamtramck - Vehicle
  - Brownstown - Battery System
- March - Michigan Market opened
- Chevy Volt sales and orders in Michigan continue to grow and are nearing 500 vehicles through April



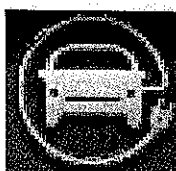
- Model year 2012 production begins in September 2011
- Chevy Volt retail markets will be national by 4th quarter 2011
- Chevy Volt in Canada July 2011
- Chevy Volt - launching in late 2011 in Europe and China

Plug-In Michigan

Early Volt Markets - What are we learning?

Early Adopters Influence and Drive Mainstream Adoption:

- Volt early launch markets targeted early adopter markets
- Many Volt customers are former Prius owners – 90% of current Volt customers previously from outside the brand
- Early Volt customers include:
  - the environmentally/energy security conscious;
  - the electrical contractors/inspectors who play an integral role in safely and cost effectively installing level two charging at the home; and
  - early technology adopters
- Prospective customers are motivated by current customers blogging of experiences with their Volt to date: (5 months of real data)
  - fun to drive;
  - exceeds expectations;
  - experiencing over 1,000 miles per 9 gallon tank of fuel;
  - great ride and handling on snowy roads; and
  - safe (IIHS highest safety pick)



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Challenges/Opportunities

Barriers being removed by the MPSC PEV Taskforce

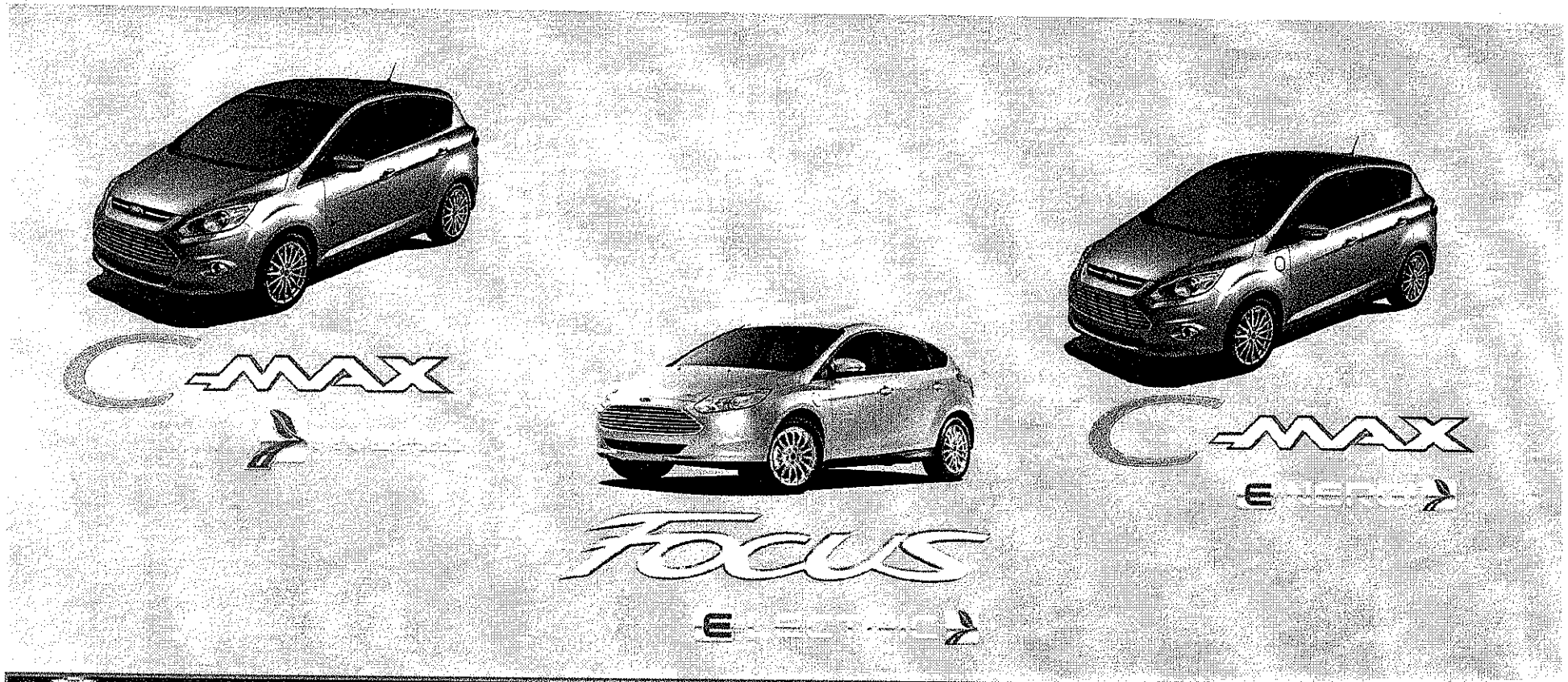
Over 5,000 "free" residential EVSEs for PEV customers in MI

Ongoing Challenges: Continue to …

- Target cost reductions for the customer by removing purchase, ownership and operation barriers:
  - Install residential charging with favorable utility, smart PEV charging options
  - Streamline permitting, inspection and electrical contractor training
- Educate the broader public and policy making entities on the activities of the state/nation regarding PEV/Smart Grid Planning (MI Smart Grid Collaborative)
- Develop on-line tools empowering purchase choice for the customer

Opportunities:

- GM's early notification process – Volt customers opt in to inform utilities where they live – assists future local grid planning
- Vehicle to Grid (V2G) Communications Demonstrations – OnStar
- Secondary Battery Use – Community Energy Storage, power quality/reliability & frequency regulation for the grid, back up storage, etc.



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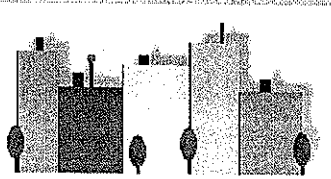
Charlie Pryde
Regional Governmental Affairs Director
Ford Motor Company

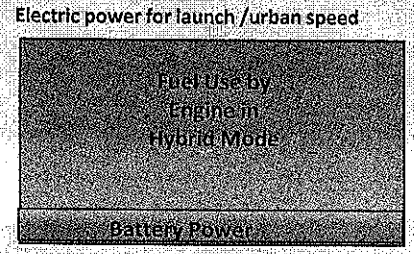
Plug-In Michigan

Electrified Vehicle Alternatives: Customer Driven

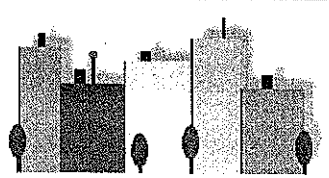
HEV



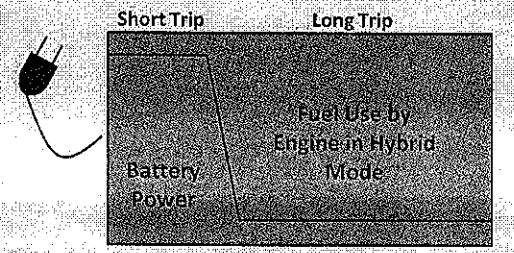
Urban and Highway (highest volume and best FE/$)



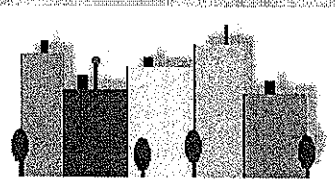
PHEV



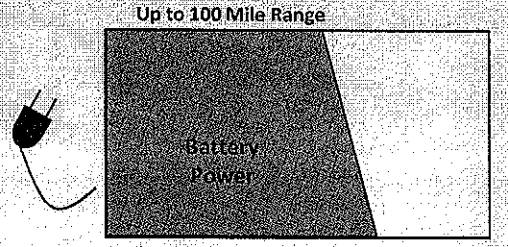
Primarily Urban and Some Highway (promotes energy diversity)



BEV



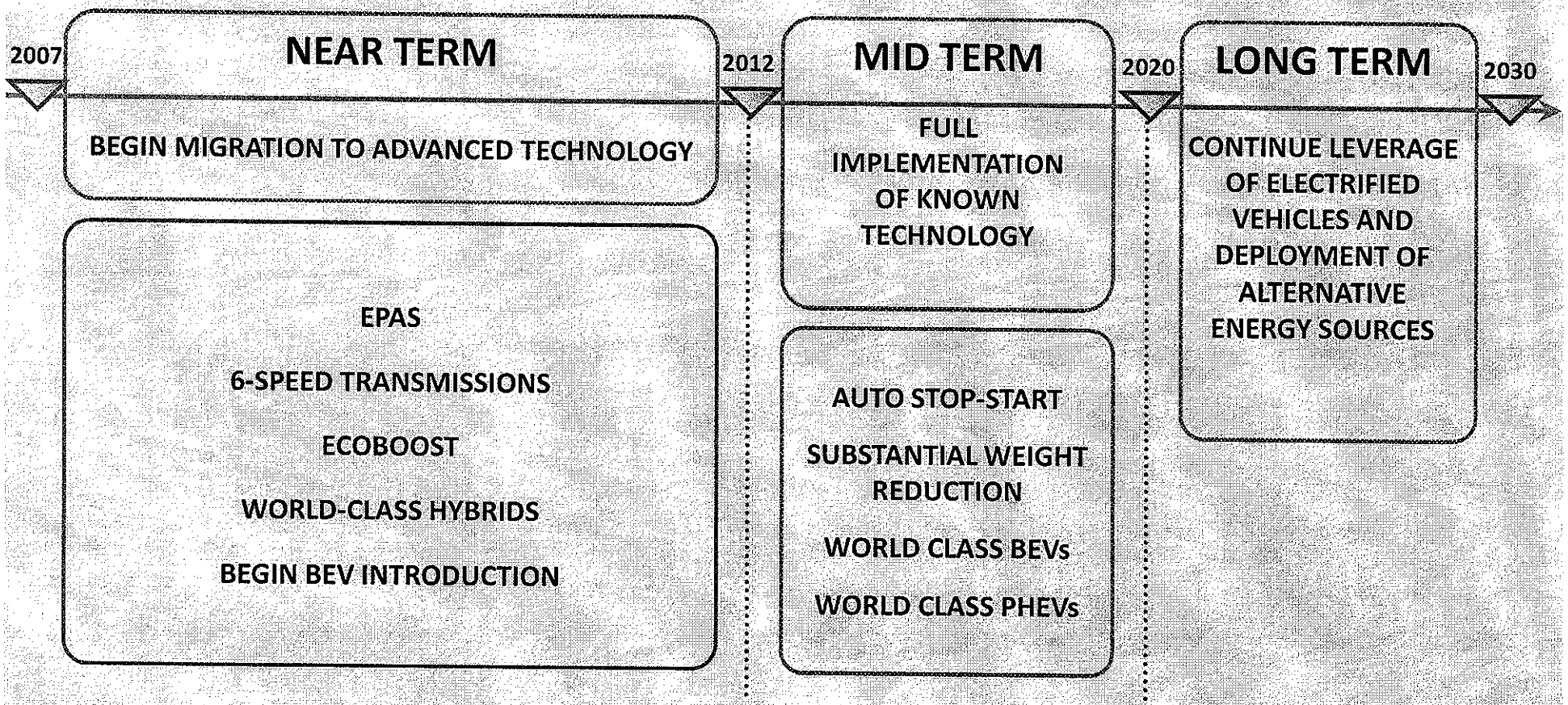
Urban (zero emissions but with range limitations)



Plug-In Michigan

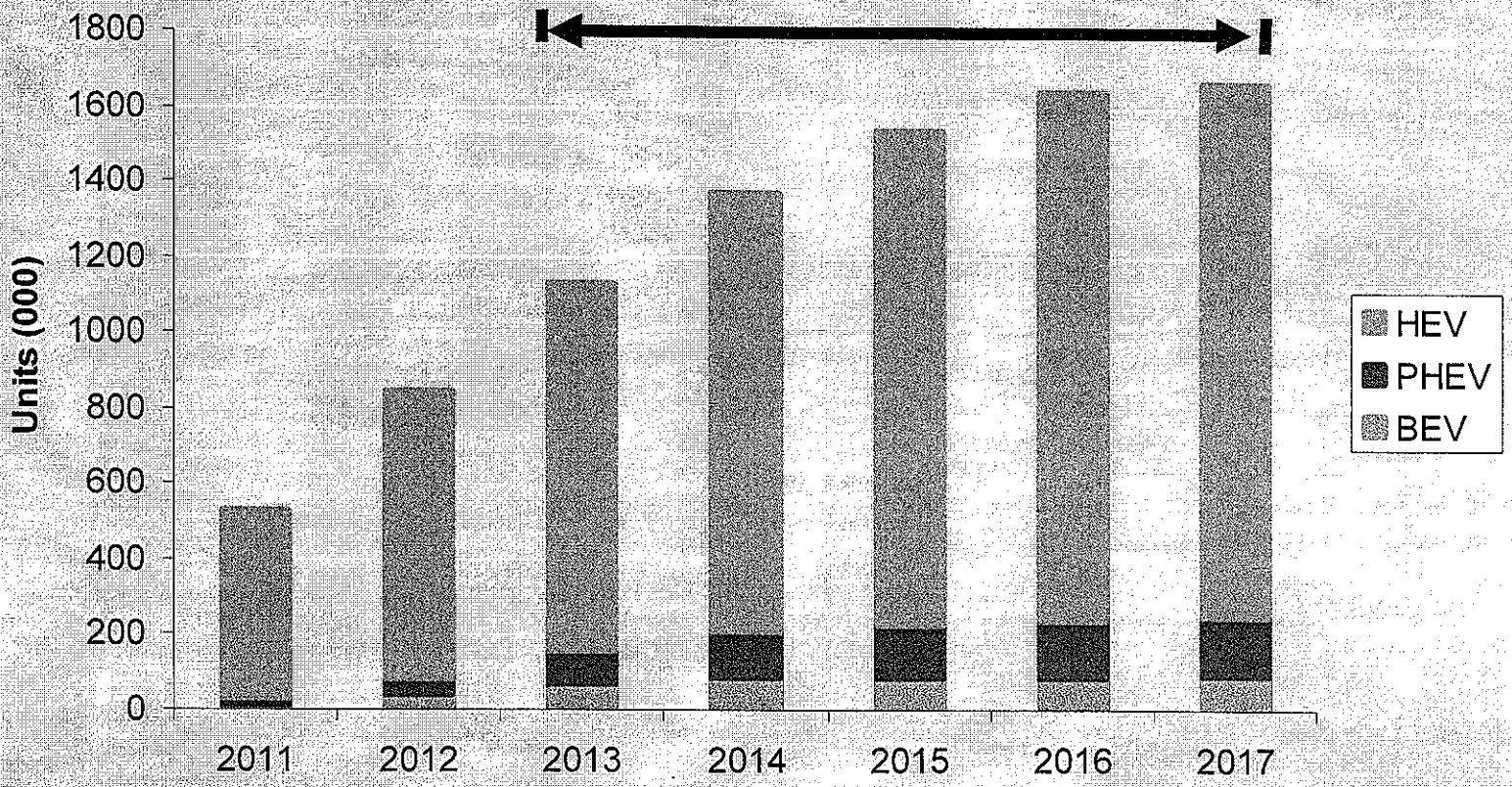
Ford Sustainability Strategy

TECHNOLOGY MIGRATION



Ford's Sustainability Strategy, Founded On Affordability For Millions Of Customers, Remains In Place As We Move To The Mid-Term

2011-2017 U.S. EV Volumes by Technology Type

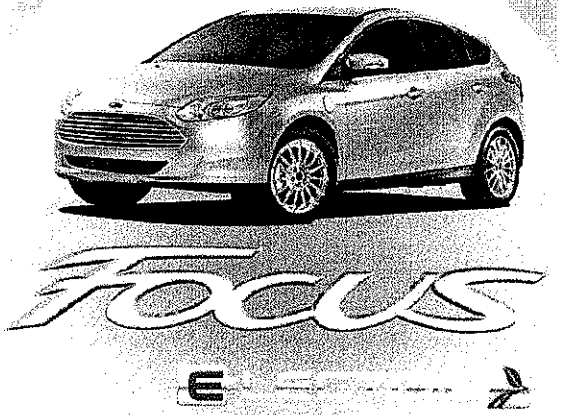


Source: JDPA U.S. Hybrid-Electric Vehicle Forecast - Second Quarter 2010

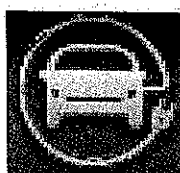
Plug-In Michigan

New Electrified Vehicles

THE POWER OF ONE



Ford's Strategy Is To Electrify Global Platforms With All 3 Electric Solutions – To Drive Choice Of Top Hats, Scale And Affordability



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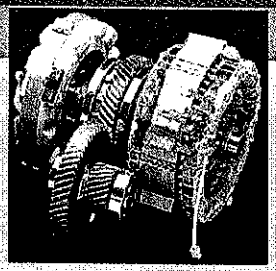
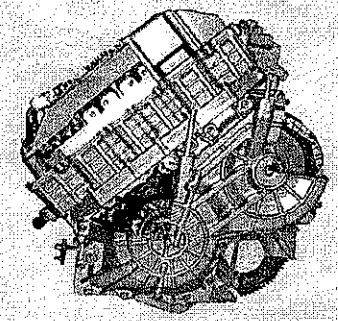
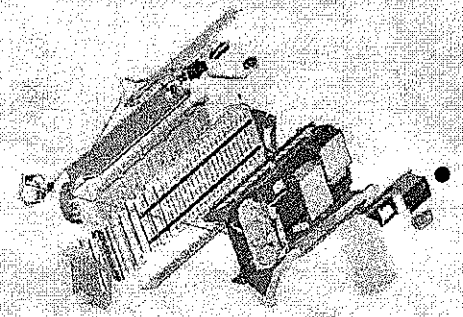
Michigan Assembly Plant Wayne, Michigan

- Transformed Michigan Assembly Plant (MAP), which will produce the fuel-efficient new global Ford Focus for North American customers, features flexible manufacturing, environmentally friendly practices and a highly trained work force
- A $550 million investment transformed the plant, creating new benchmarks for flexible manufacturing. Multiple models to run down the same production line, making Michigan Assembly the world's first plant to build gasoline-powered, battery electric, hybrid electric and plug-in hybrid electric vehicles on the same line
- The plant has about 3,200 employees
- MAP also features one of Michigan's largest solar-powered generation systems and electric vehicle charging stations

Plug-In Michigan





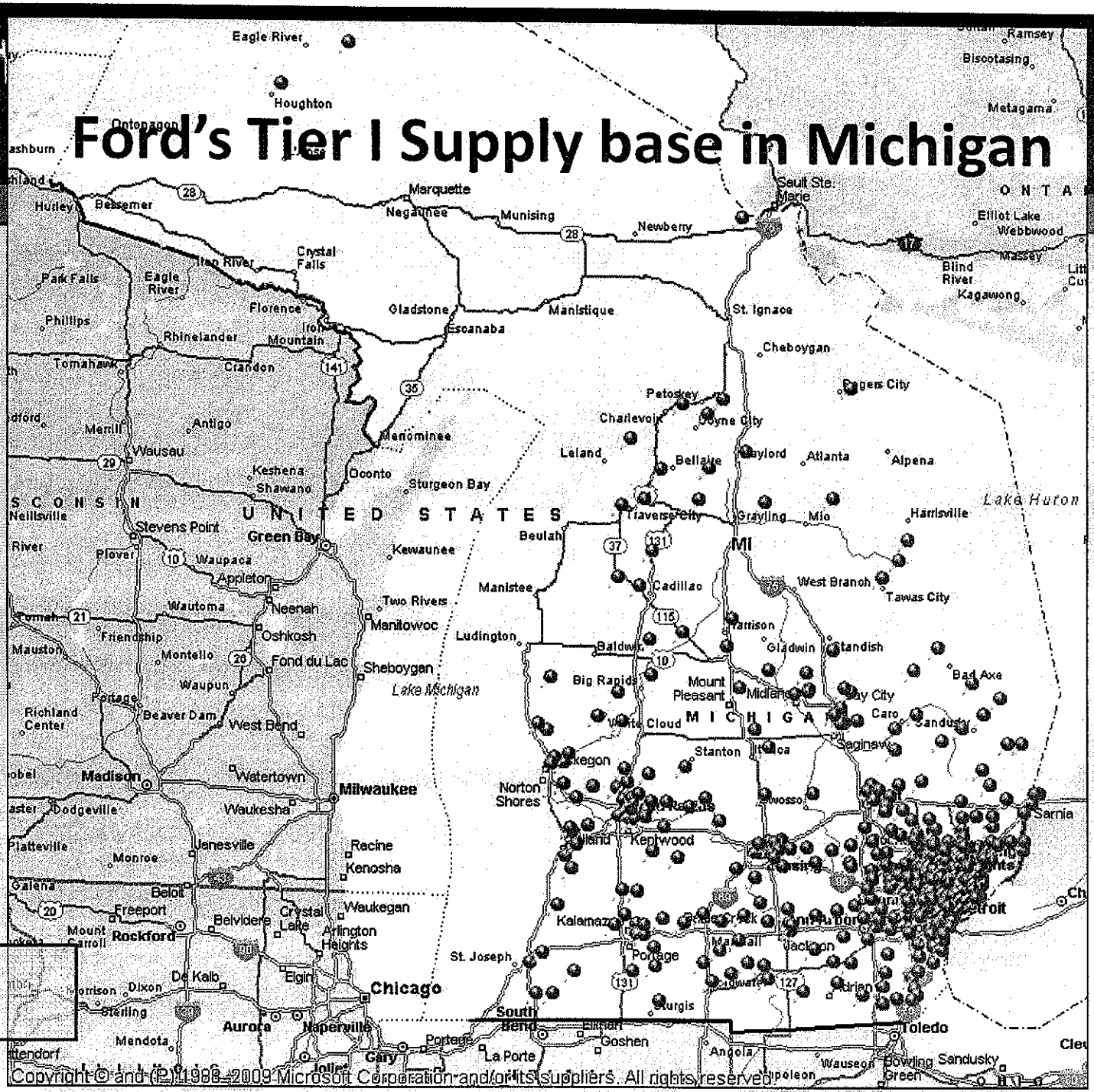


- Electric motor design, development and production technologies are critical drivers for electric drive efficiencies
- Electronic transaxle (PHEV/HEV) and Electronic Drive Unit (BEV) manufacturing in the U.S. will support growth of supply chain – from machining suppliers to commodity providers
- Battery Pack and Cell manufacturing and R&D builds upon U.S. future as the Center of Vehicle Electrification. Assembly alone does not bring long-term value of R&D and manufacturing

Sourcing decisions for key electrification components during the transition to these technologies will define where the jobs go for decades…the U.S. must compete and win

Plug-In M

Ford's Tier I Supply base in Michigan



2689 locations,
$15.8 Billion in 2010

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Plug-In Michigan

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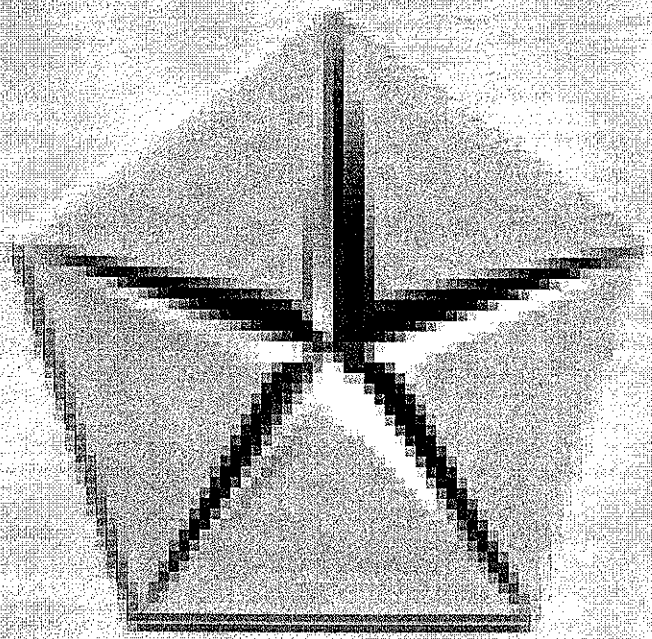
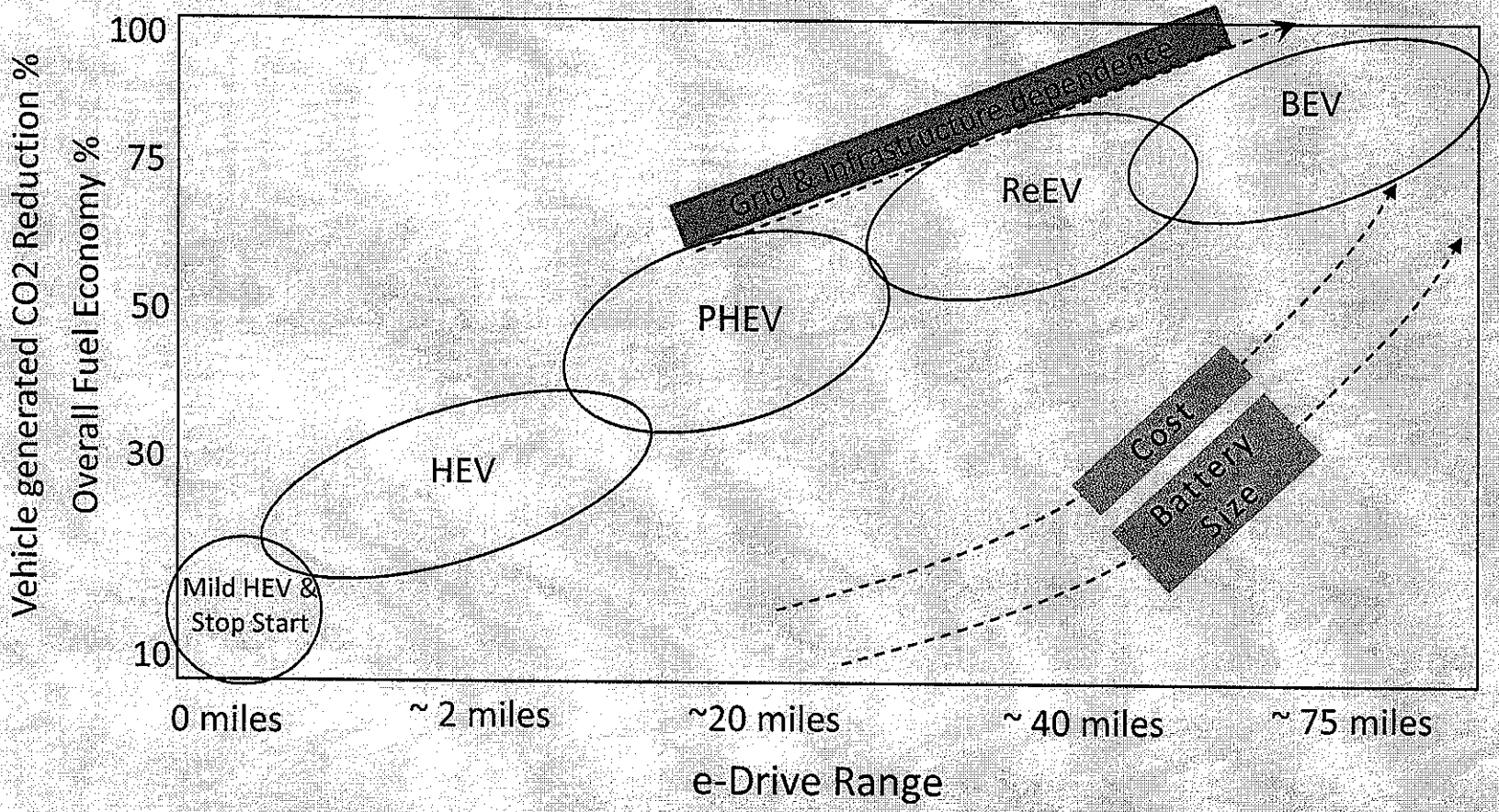


Plug-In Michigan

Jay Iyengar
Head of Electrified Powertrain
Chrysler Group LLC

Electrification Overview

Technology Choices – Degrees of Electrification



Mild HEV : Stop-Start, KERS (Kinetic Energy Recovery)
HEV : Hybrid Electric Vehicles
ReEV : Range Extended Electric Vehicles
PHEV : Plug-in Hybrid Electric Vehicles
BEV : Battery Electric Vehicles

Electrification Challenges

Challenges of Plug-in Technology

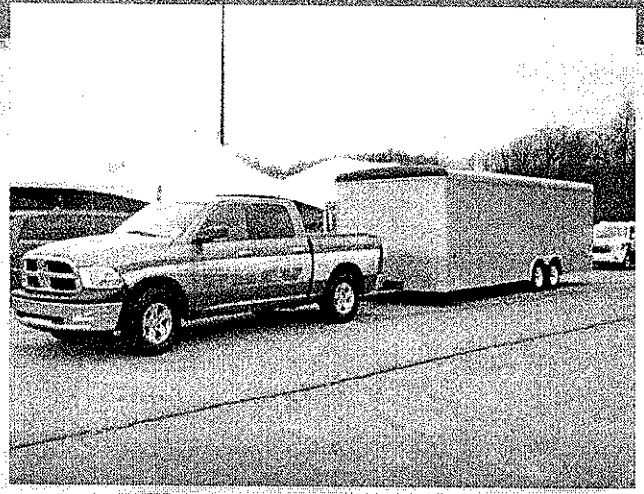
- Battery Technology – Cost, size, weight, energy density, aging, thermal management
- Grid Interface – Standardization
- Customer Acceptance - Availability of infrastructure

PHEV Ram Truck DOE Demonstration Program

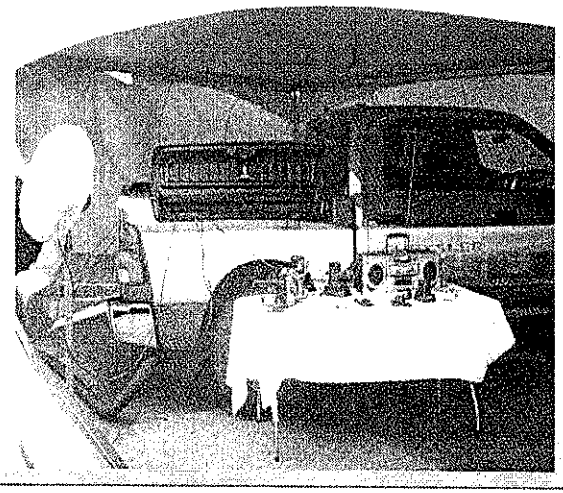
- Demonstrate 140 pickup trucks in diverse geographies and climates, across a range of drive cycles and consumer usage patterns
- Smart Grid Interface and Bi-Directional Power flow capability
- Support the creation of "Green" Technology jobs and advance the state of Plug-in technology for future production integration

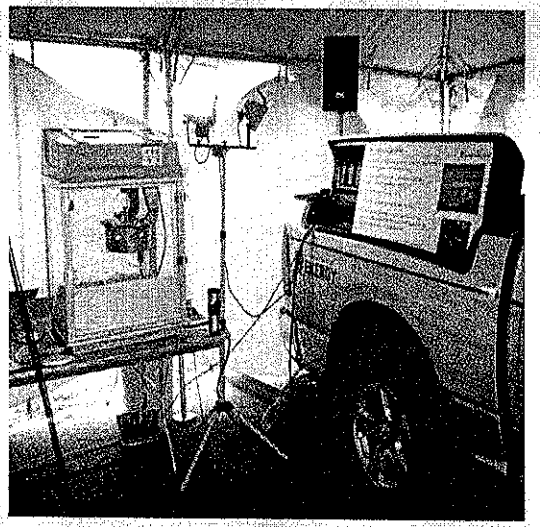
Plug-In Michigan

Ram Truck PHEV DOE Demo Project Summary



- V8 engine **Advanced Technology Partial Zero Emissions**
- Next Generation **Lithium Ion Battery**
- 6.6 KW charger, Charge Times : 2hrs at 220V
- Fuel Economy (City) : Charge Depleting **32MPG**
- Electric Drive Range (City) : 20 miles equivalent
- Range: **655 miles**
- Transmission : Advanced Technology Two-Mode Hybrid
- Brakes : **Regenerative Brake System**
- On-board AC power generation

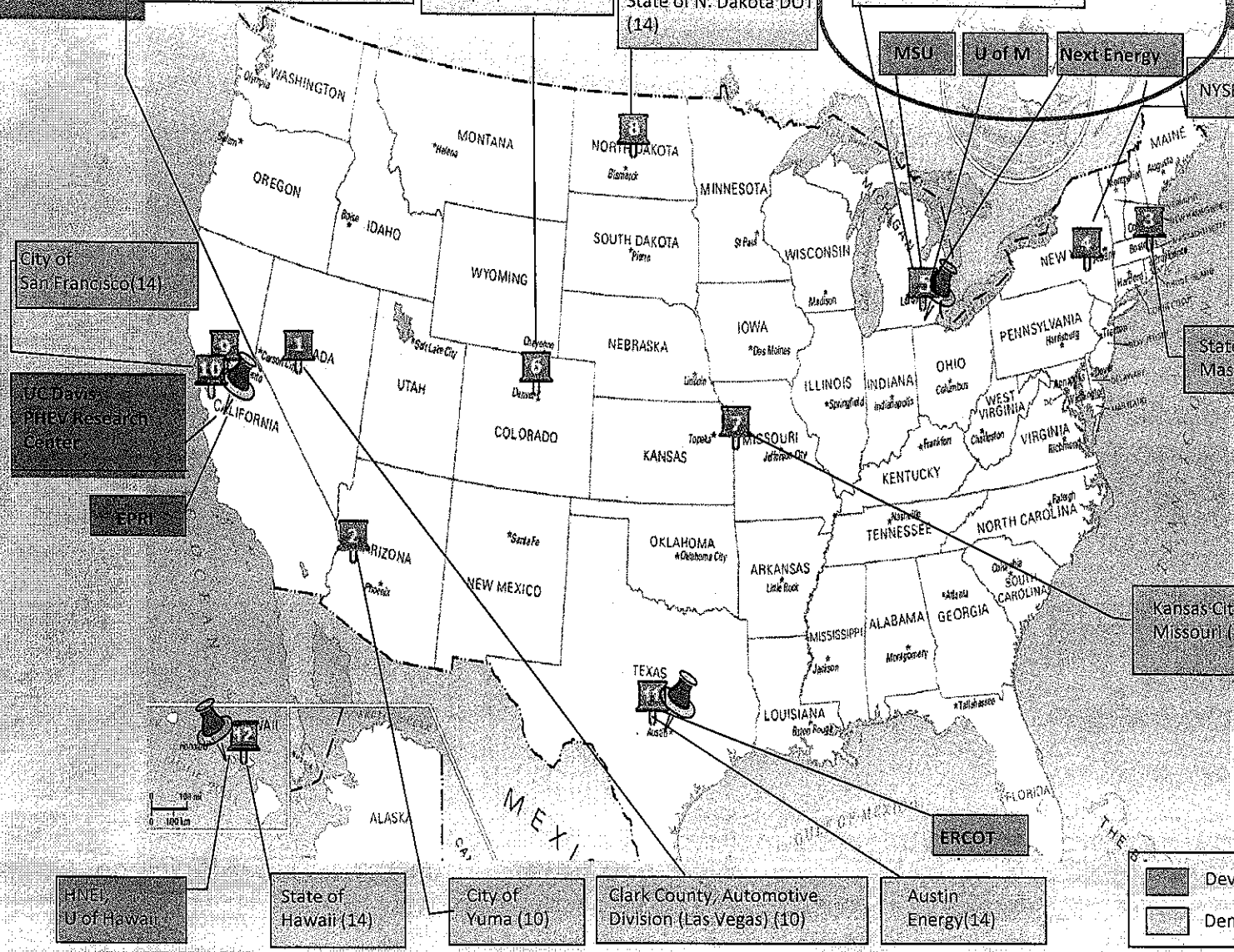




- DOE Demonstration program to accumulate 6 million miles, 2 million in extreme ambients
- Partnership with Academia, Suppliers, Vehicle Fleets, and Utility Companies

Plug-In Michigan

Ram Truck PHEV Demo Locations



Sacramento Municipal Utility District (SMUD) (14)

State of Colorado DOT (14)

State of N. Dakota DOT (14)

State of Michigan (4)

MSU

U of M

Next Energy

NYSERDA (14)

City of San Francisco(14)

State of Massachusetts (14)

UC Davis PHEV Research Center

EPRI

Kansas City Missouri (4)

ERCOT

HNEI U of Hawaii

State of Hawaii (14)

City of Yuma (10)

Clark County, Automotive Division (Las Vegas) (10)

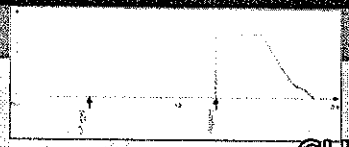
Austin Energy(14)

Development Partner

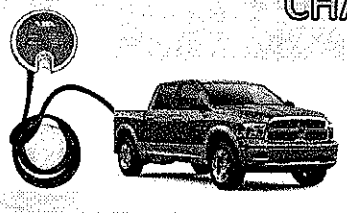
Demo Regional Lead

Plug-In Michigan

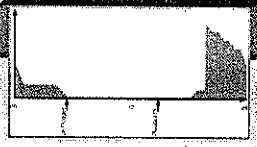
Ram Truck PHEV Vehicle Charging Functionality Roadmap

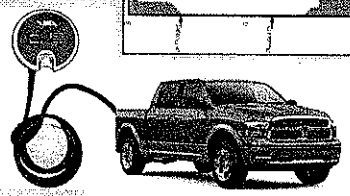


CHARGE NOW

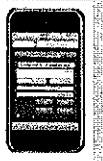


Improvements to Charge Efficiency



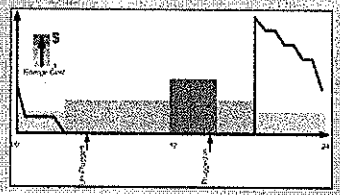


OPTIMIZED CHARGEING



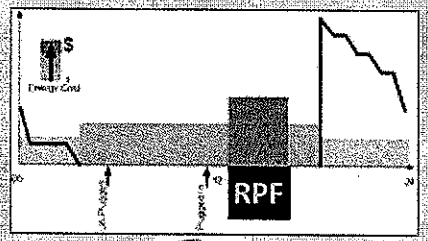
- Customer Input
- Max System Input
- Most Efficient Charge Rate

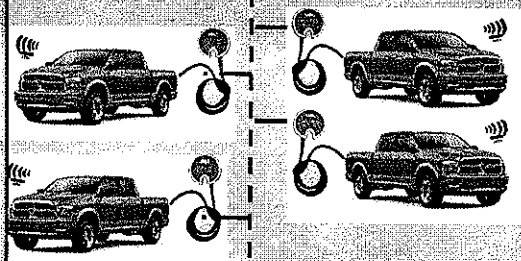
SMART GRID INTERFACE



- Utility Interface
- Time of Use Rates
- Achieve Optimized Charge @ Lowest Cost
- Minimize effect on Grid

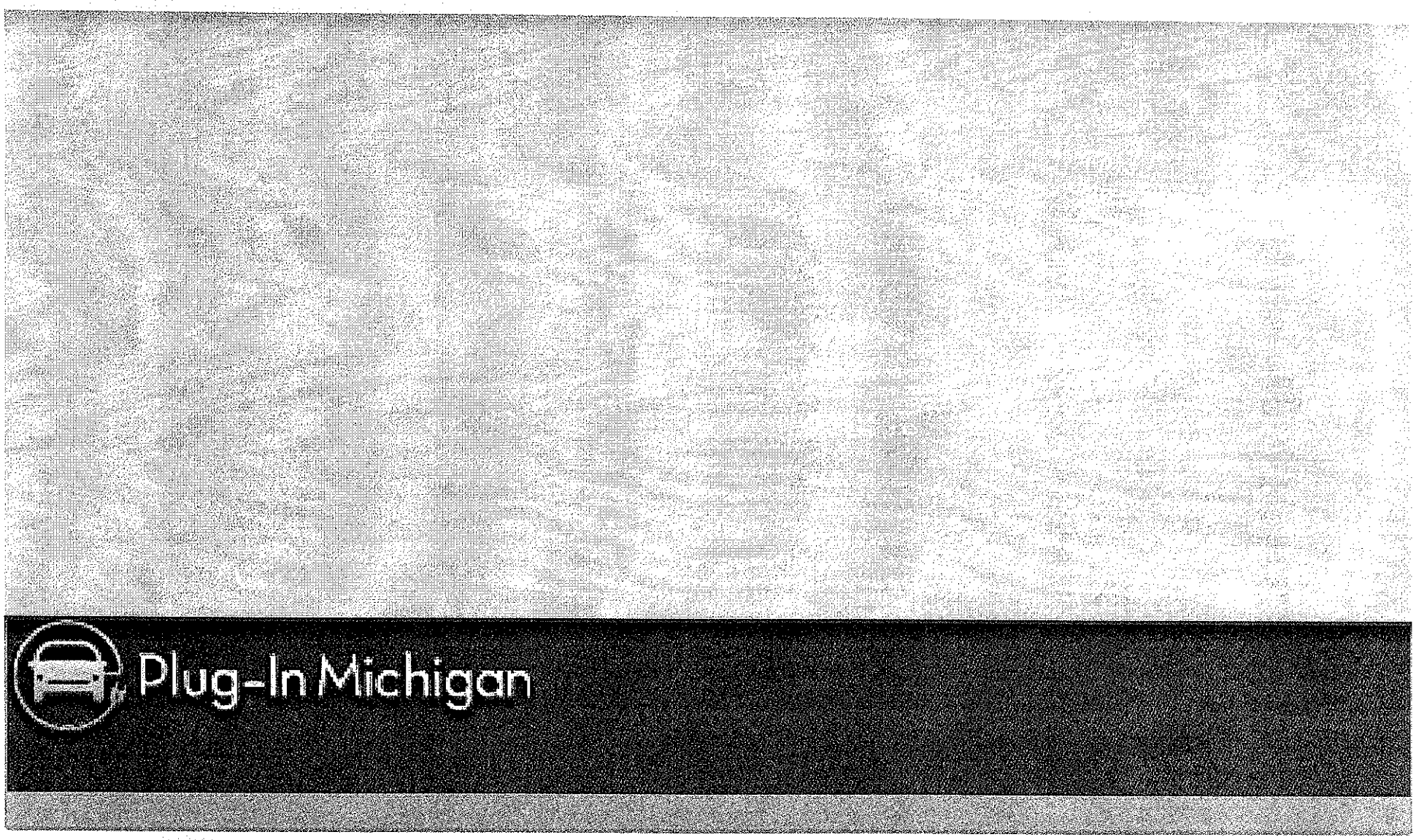
REVERSE POWER FLOW





- Reverse Power Flow
- Smart Grid Comm.
- Micro Grid Development
- Emergency Load Curtailment

Infrastructure is a key enabler for propagation of the Plug-in Technology



Utility Perspective

Steve Kurmas, Detroit Edison
Kellee Christensen, Board of Water and Light
Sue Swan/ Dan Malone, Consumers Energy

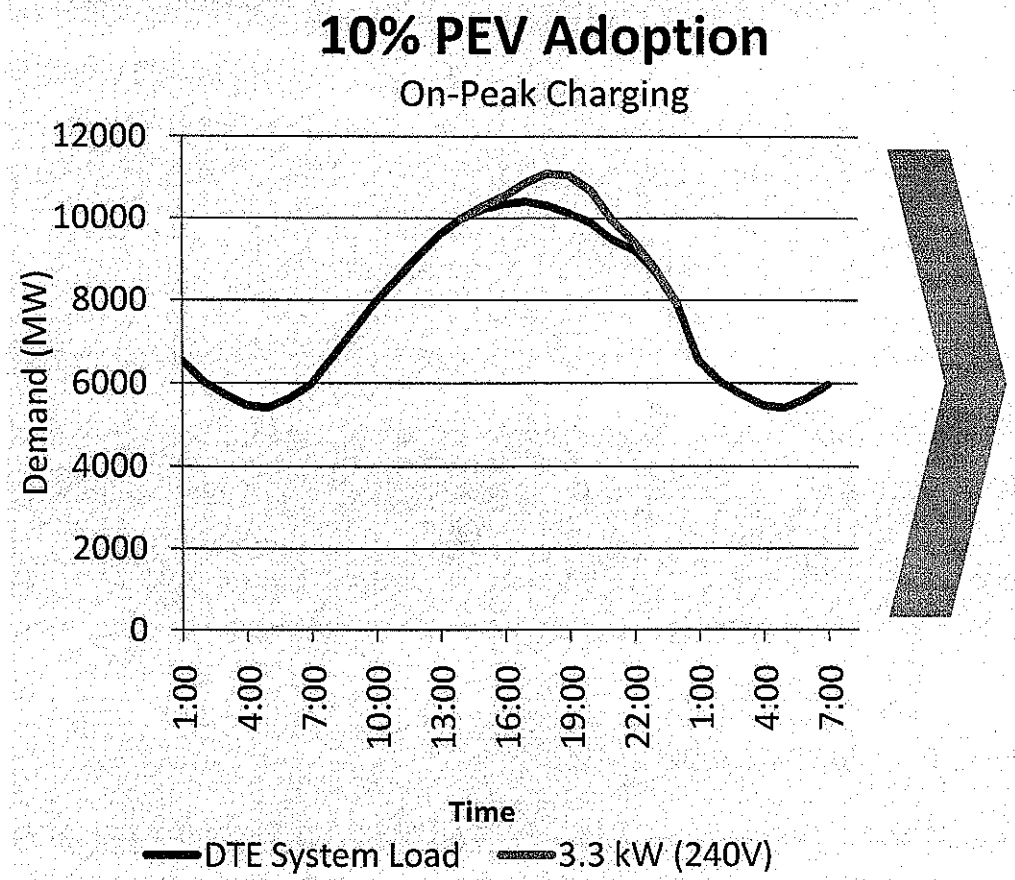
Plug-In Michigan

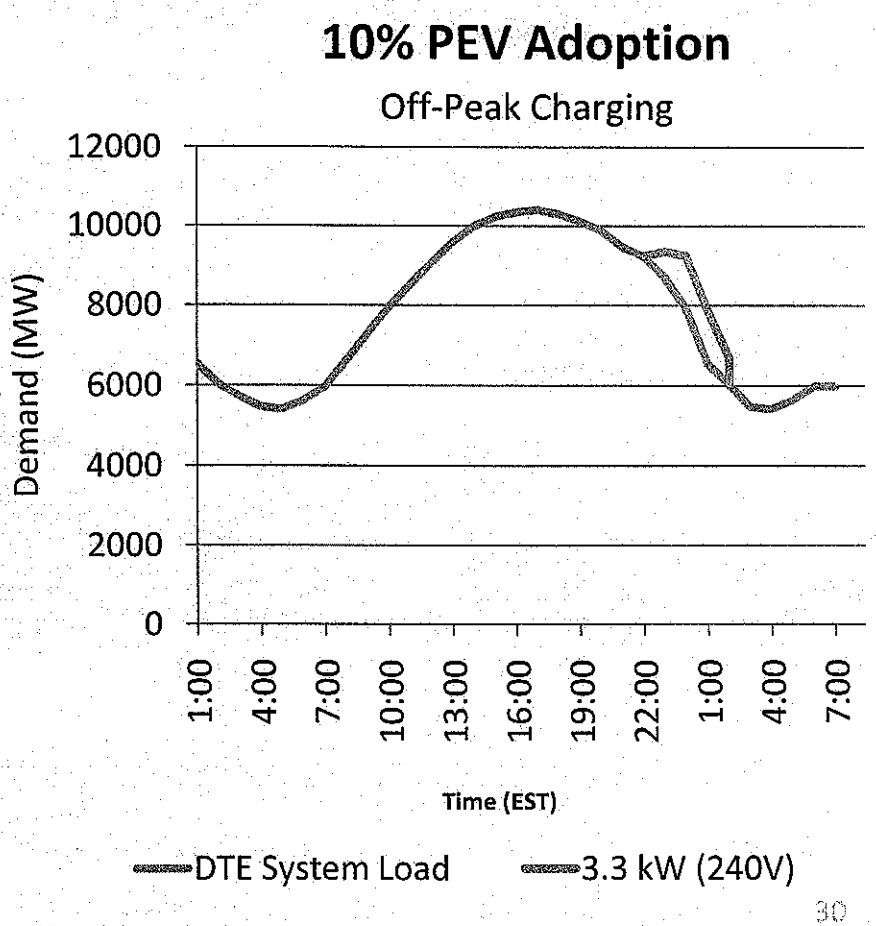
Steve Kurmas
Chief Operating Officer
Detroit Edison

Plug-In Michigan

Is the Grid Ready for PEVs?

Overall, our grid is ready to handle PEV load.





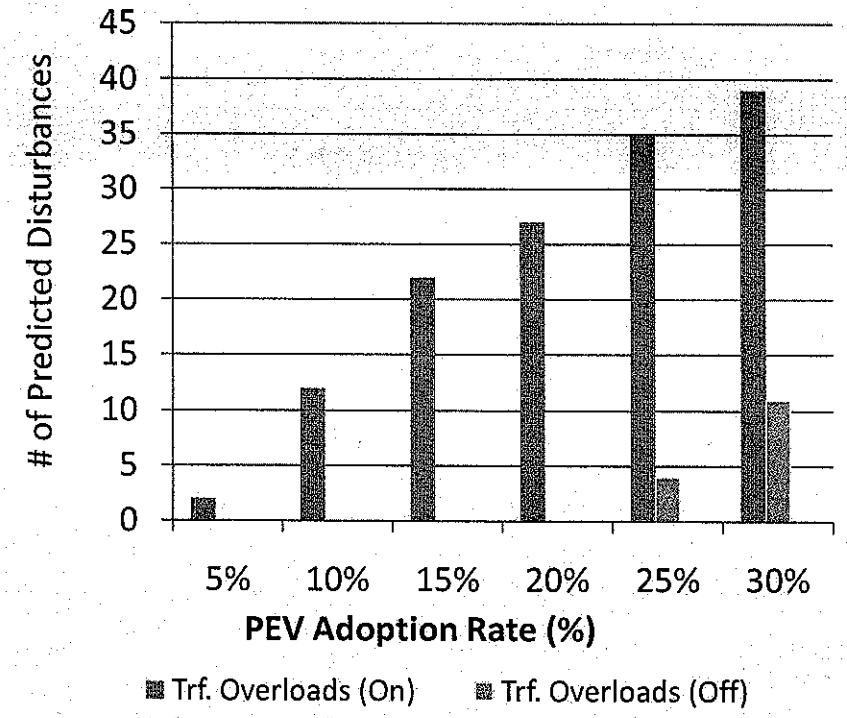
Plug-In Michigan

Impact of PEVs to the Distribution System

We anticipate clusters of plug-in electric vehicles, but there are ways to manage impact on the distribution system.

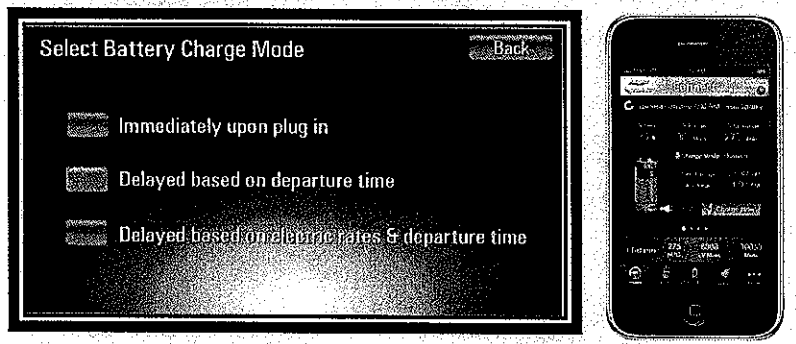
PEV Impacts on the Distribution System

Level 2 – On-Peak vs. Off-Peak Charging



How can we mitigate the risk?

- Create incentives to promote off-peak charging
- Educate customers of the advantages of off-peak charging



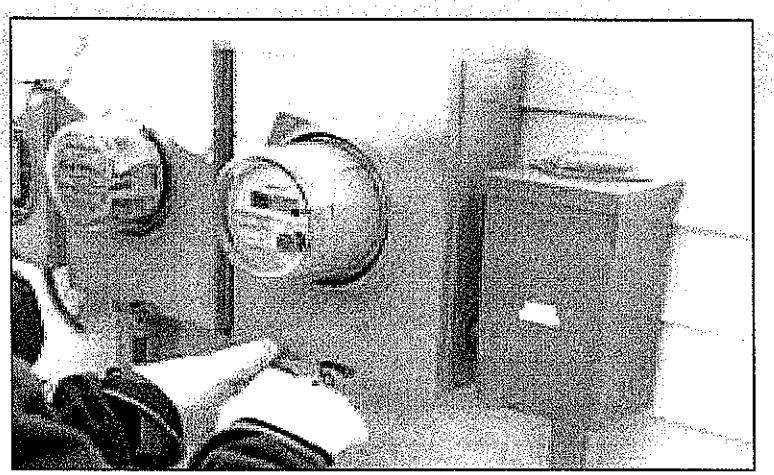
Chevrolet Volt : Programming for Delay Charge

Plug-In Michigan

DTE Energy Electric Vehicle Program

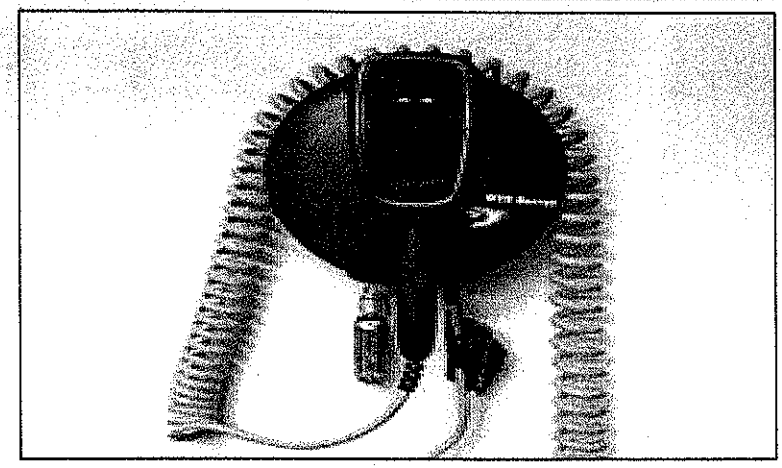
EV Rate (D1.9)[1]

Option 1	On-Peak	18 cents kWh
	Off-Peak	8 cents kWh
Option 2	Monthly Flat Bill: $40 Limited first 250 customers	



EVSE Incentive[2]

Customers that enroll in our EV Rate qualify for up to $2,500* which covers EVSE, installation and separate meter wiring.



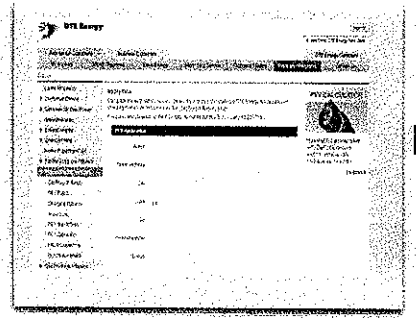
[1] RD1.9 requires 240v, separate meter.
Rate Schedule: On-Peak: 9 a.m. – 11 p.m. (Mon – Fri) Off-Peak: 11 p.m. – 9 a.m. (All day weekends and Mon - Friday)

[2] Available for the first 2,500 customers that qualify, or until December 31, 2012.

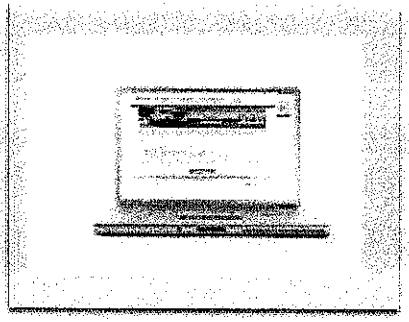
Plug-In Michigan

DTE Energy EVSE Installation Process

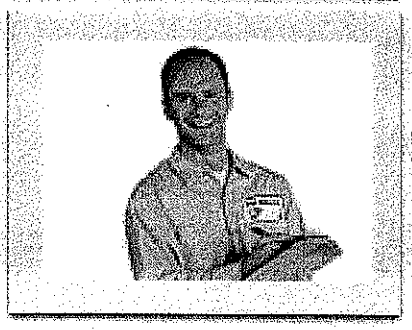
Step 1: Complete application



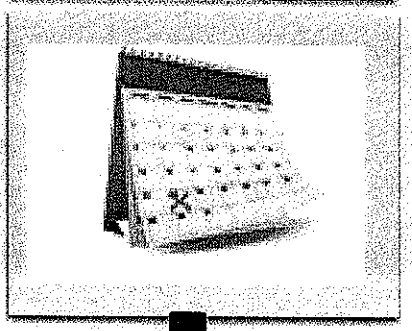
Step 2: Online Site Assessment



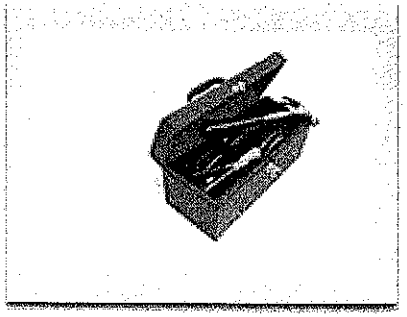
Step 3: Onsite Quote



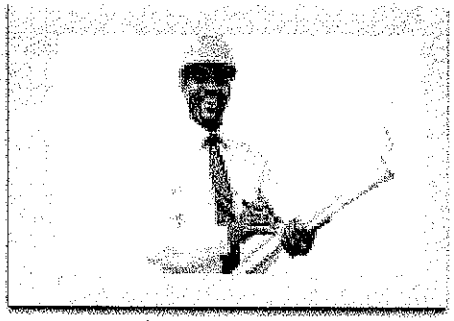
Step 4: Installation Scheduling



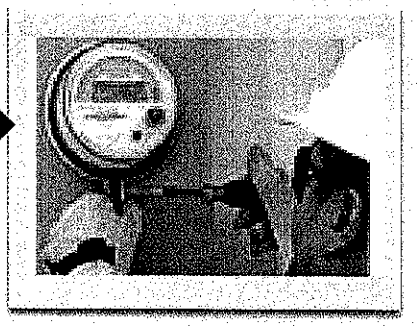
Step 5: Permitting and Installation



Step 6: Post Installation Inspection

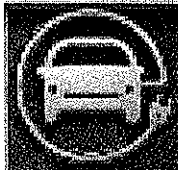


Step 7: Meter Installation



Step 8: Post Install

- Welcome Pack
- Customer Survey
- Ongoing Support



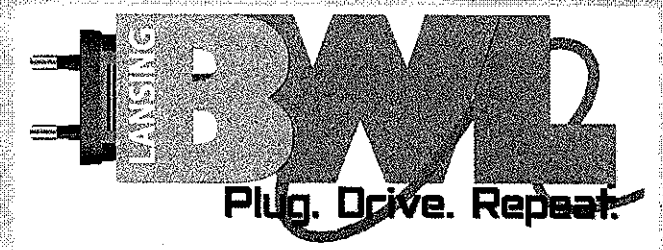
Plug-In Michigan

Kellee Christensen
Manager Customer Projects, Development & Marketing
Lansing Board of Water & Light

Plug-In Electric Vehicle Community Project

- The BWL Received Federal Appropriation in 2010 towards implementation of plug-in electric vehicles and supporting infrastructure

- In cooperation with surrounding communities and participating residential customer we will demonstrate the practicality and usefulness of electric vehicles for a number of purposes



Goals

- Identify and address barriers to deployment of vehicles and infrastructure
- Assess the impact of charging vehicles on the electric distribution system
- Gain the support of the community for continued deployment and use of electric vehicles
- Bridge our community project to surrounding communities to further the goal of making Michigan plug-in ready

LANSING BWL
Plug. Drive. Repeat.

Where We Are Now

- We have 5 Chevy Volts in our electric service territory as part of our program
- We have installed 4 charging stations and associated infrastructure
- Served on the Michigan Preparedness Taskforce to assist with addressing barriers new plug-in electric vehicle drivers may encounter

LANSING BWL Plug. Drive. Repeat.

Plug-In Michigan

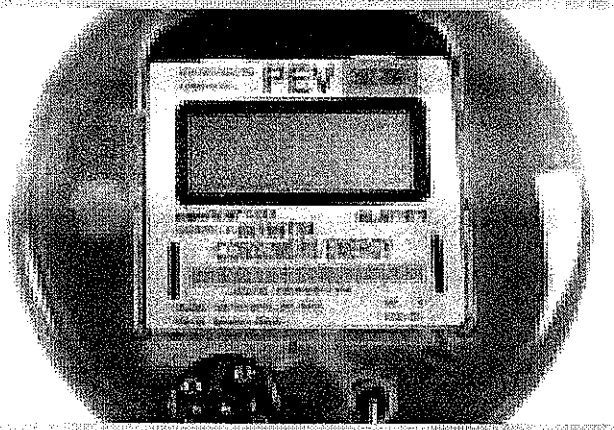
Sue Swan, VP of Smart Grid
Dan Malone, SVP Dist & Cust Operations
Consumers Energy

Plug-In Michigan

Consumers Energy PEV Rate Options

Rate Option 1

- Whole house time of use (TOU) rates
- Single meter
- PEV charger wired into existing panel



Rate Option 2

- TOU rates for PEV only
- Separate meter for PEV
- Standard meter and rates for all other usage

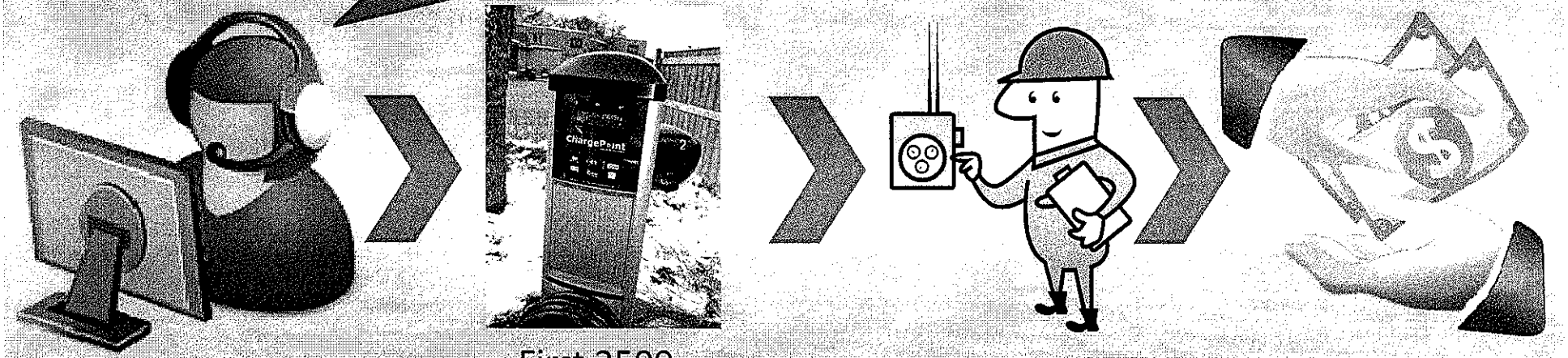
Rate Option 3

- Monthly flat rate of $35 for PEV charger usage
- Separate meter
- Standard meter and rates for all other usage

Plug-In Michigan

Consumers Energy Incentive Program

Consumers Energy will provide up to $2500 to cover the cost of purchase, installation and home wiring of a charging station



Incentive program specialists available

First 2500 customers eligible for reimbursement

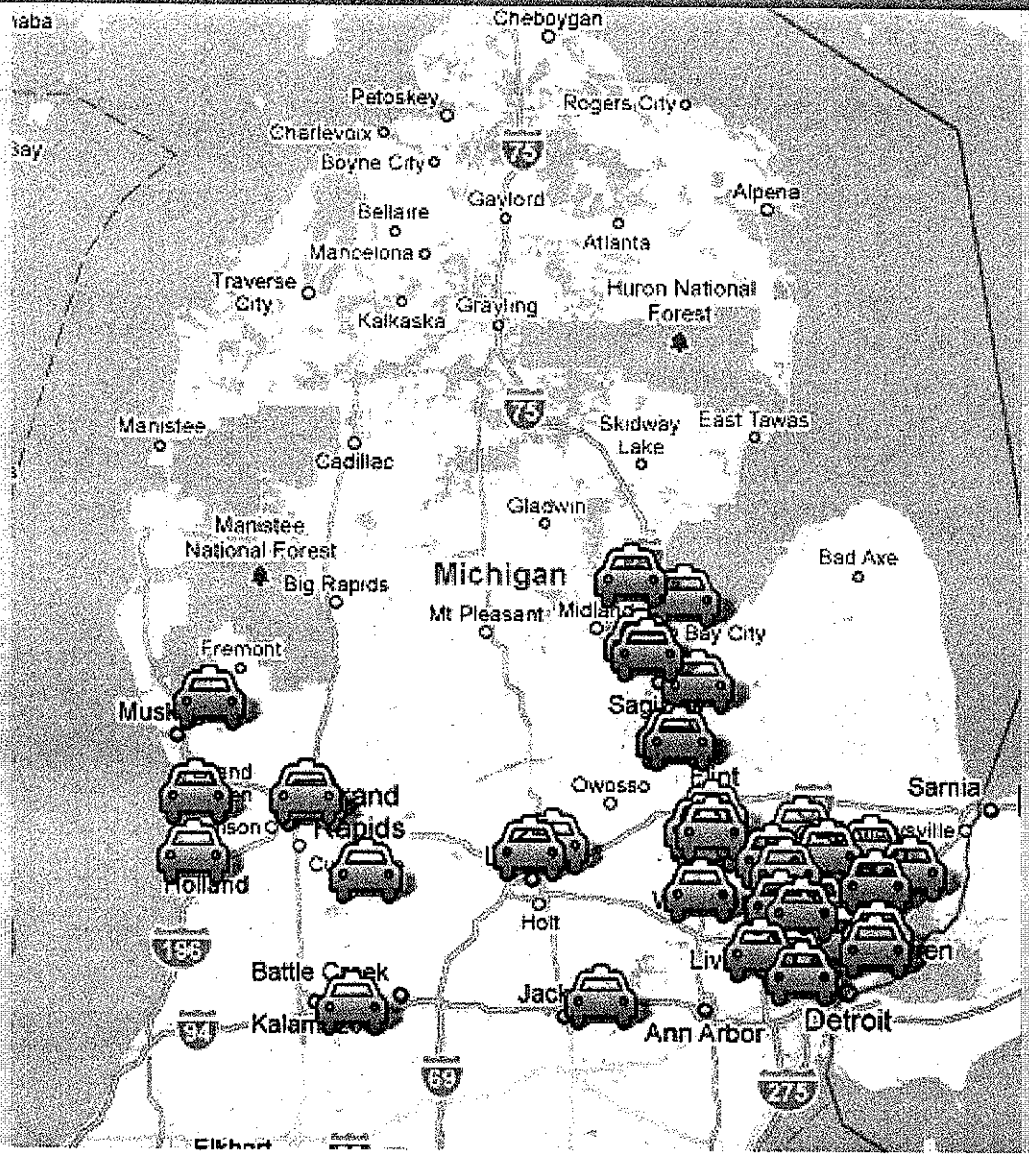
Charging station installed by licensed electrician

Customer reimbursed up to $2500

Consumers Energy's PEV installation program Nov. 1, 2010 - Dec. 31, 2012

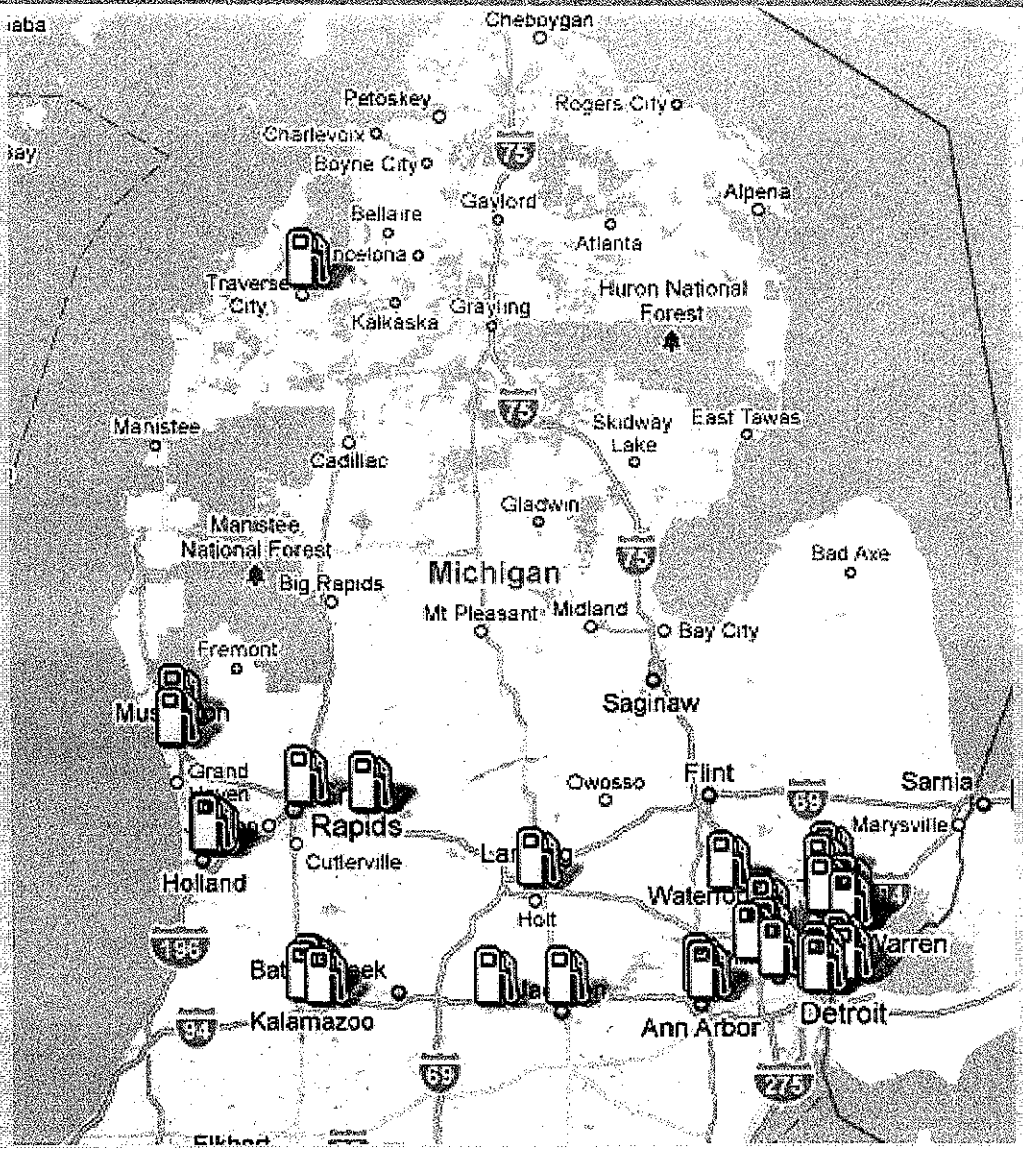
Plug-In Michigan

Private Charging Stations



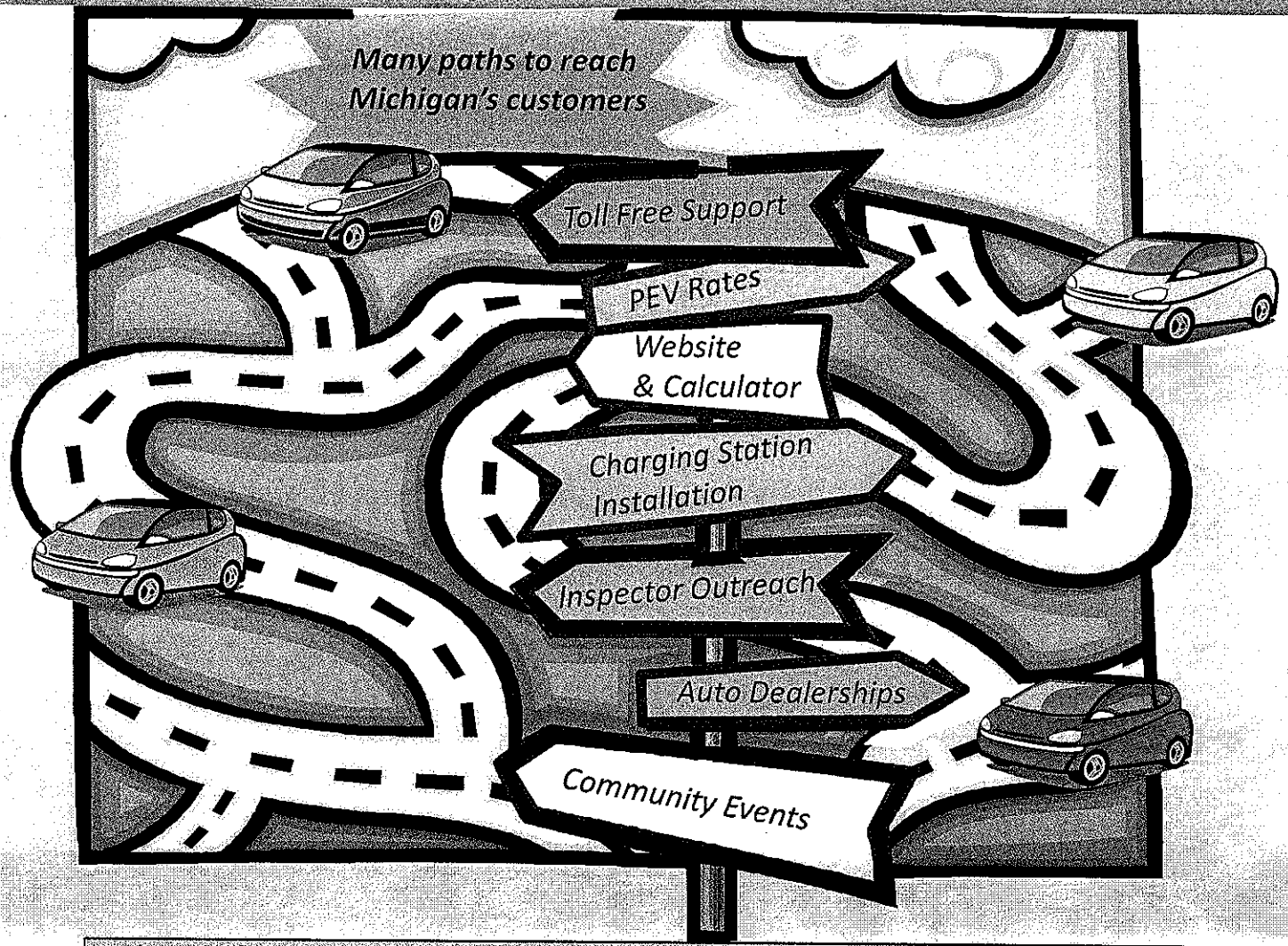
Plug-In Michigan

Public Charging Stations

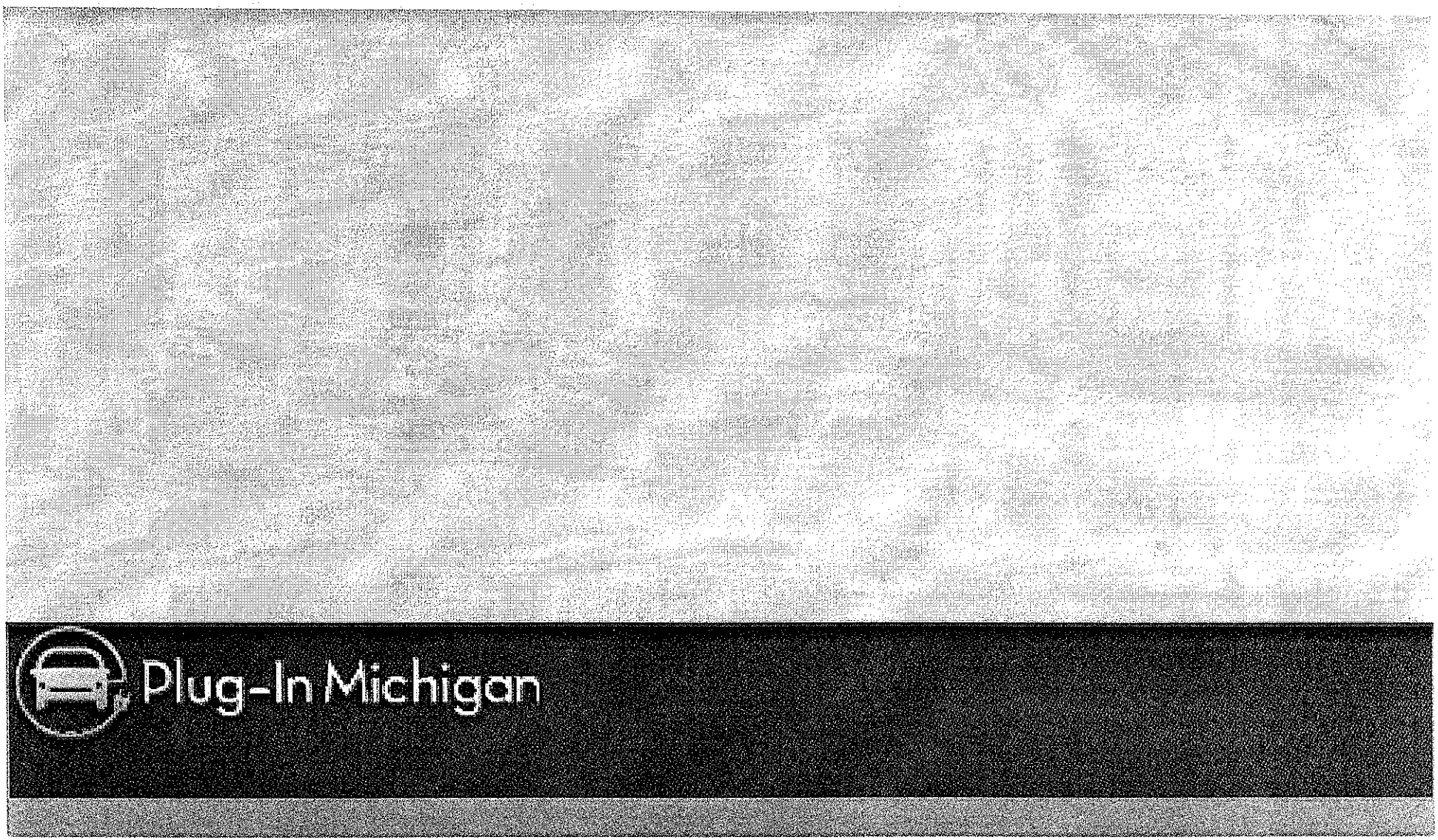


Plug-In Michigan

Customer Outreach & Education



www.PlugInMichigan.org



Michigan Economic Impact

Jim McBryde, VP Governmental Affairs
Michigan Economic Development Corporation

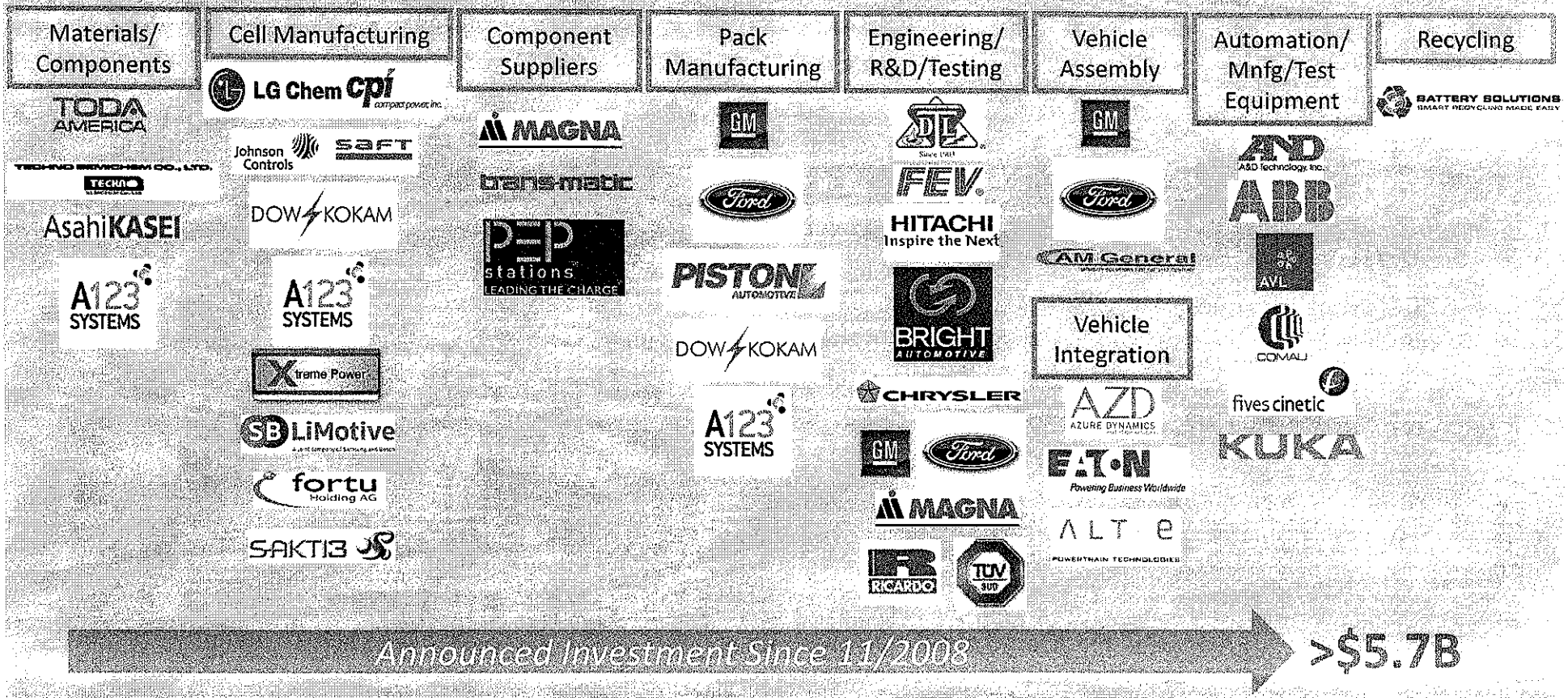
Plug-In Michigan

Michigan Assets: Strong Supply Chain

- Over 35 companies across 9 key supply chain segments
  - More than any other state in the US
- More than **$5.7 billion** in announced investment since November 2008
- World class Universities developing engineering curriculum to support this new industry
- A robust pipeline of companies looking to become a part of the Michigan energy storage 'eco-system'

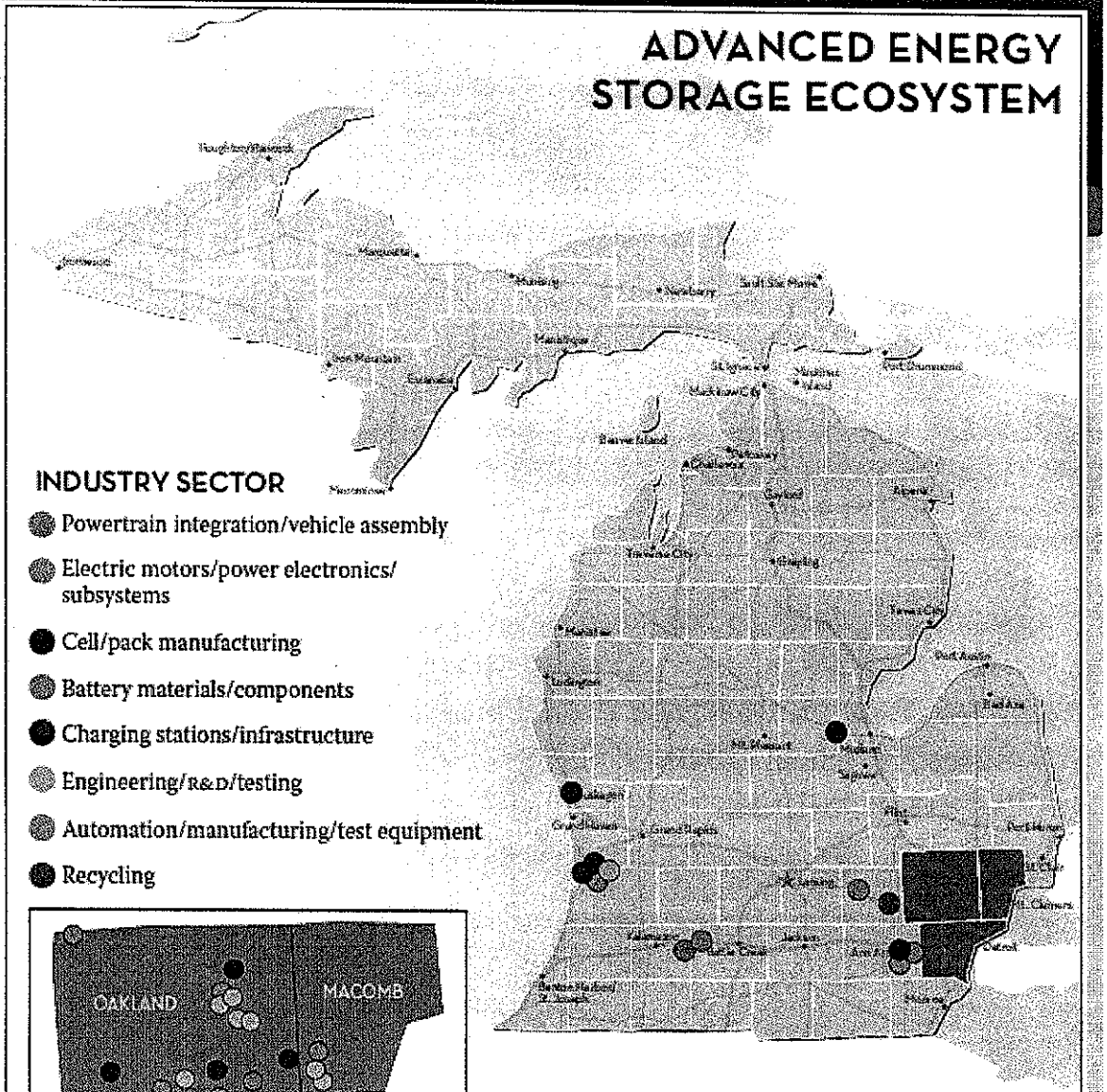
Plug-In Michigan

Michigan Assets: Strong Supply Chain



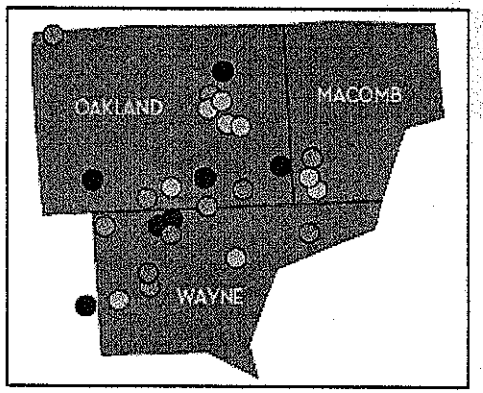
Plug-In Michigan

ADVANCED ENERGY STORAGE ECOSYSTEM



INDUSTRY SECTOR

- Powertrain integration/vehicle assembly
- Electric motors/power electronics/ subsystems
- Cell/pack manufacturing
- Battery materials/components
- Charging stations/infrastructure
- Engineering/R&D/testing
- Automation/manufacturing/test equipment
- Recycling



Data: Compiled by MEDC staff, Mapping: Michigan GIS Library and ESRI
January 2011

MICHIGAN'S ADVANCED ENERGY STORAGE COMPANIES

Powertrain integration/vehicle assembly
ALTe
AM General
Azure Dynamics
Eaton Corporation
Ford Wayne Assembly
General Motors (Detroit-Hamtramck Assembly)

Electric motors/power electronics/subsystems
Magna Electronics
Trans-Matic

Cell/pack manufacturing
A123 Systems, Inc. (Livonia)
Cobasys/SB LiMotive
Dow Kokam
Ford Motor Company (Rawsonville)
fortu PowerCell
General Motors (Brownstown Battery Assembly)
Johnson Control–Saft
LG Chem Michigan
LG Chem Power
Saktij3
Xtreme Power

Battery materials/components
A123 Systems, Inc. (Romulus)
Asahi Kasei
Toda America
TSC Michigan

Charging stations/infrastructure
PEP Stations

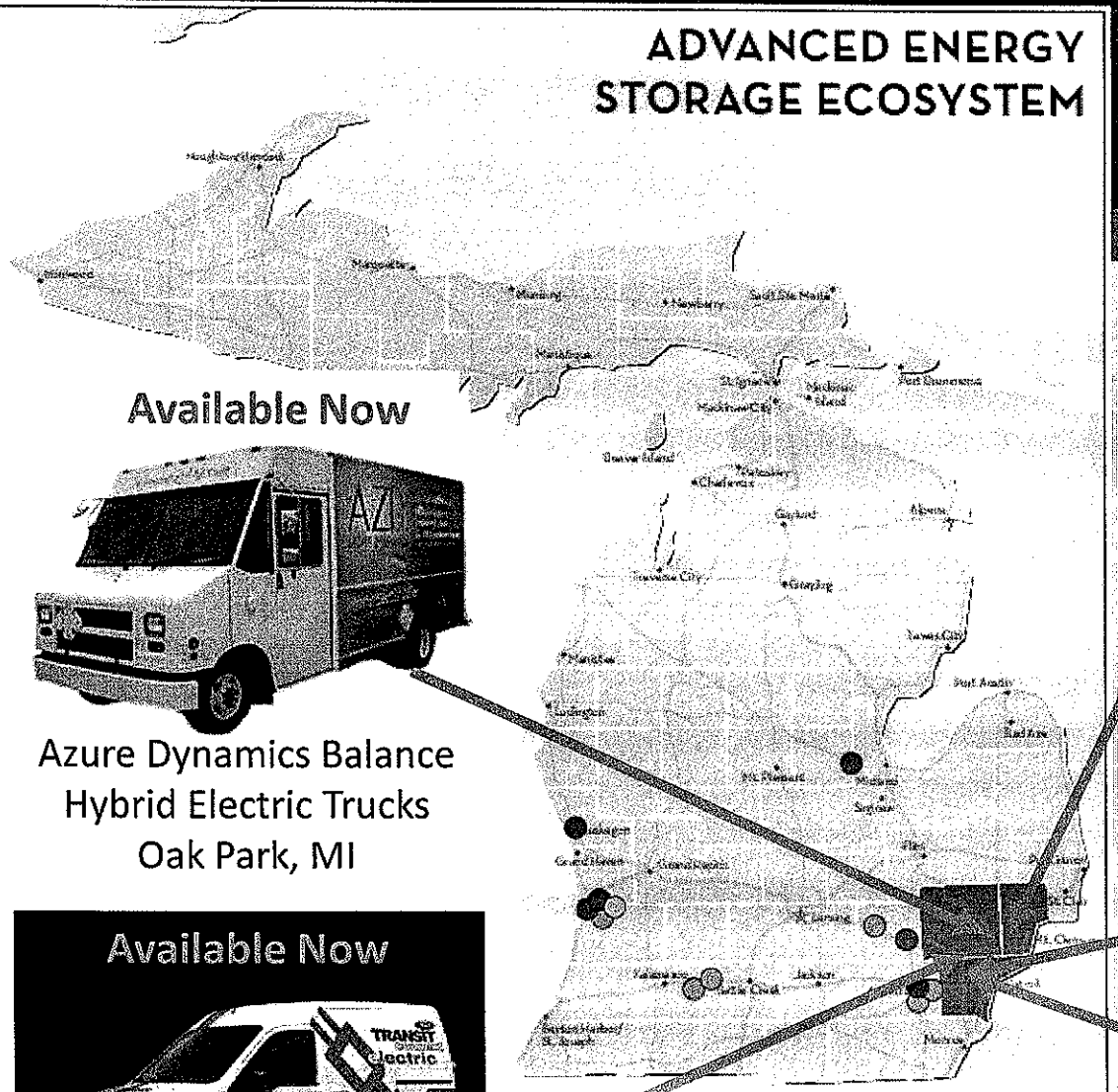
Engineering/R&D/testing
Bright Automotive
Chrysler Battery/Vehicle Engineering
Detroit Testing Lab
FEV
Ford Motor Company (Dearborn)
General Motors Technical Center
Hitachi Automotive Systems Americas
Magna E-Car
Ricardo, Inc.
TUV SUD

Automation/manufacturing/test equipment
A&D Technologies
ABB Flexible Automation
AVL Powertrain
Comau, Inc.
Fives Cinetic Automation
KUKA Systems Corporation, N. America

Recycling
Battery Solutions

Michigan Assets: Vehicle Builds

ADVANCED ENERGY STORAGE ECOSYSTEM



Available Now

Azure Dynamics Balance
Hybrid Electric Trucks
Oak Park, MI

Available Now

Ford Transit Connect Electric
Livonia, MI

Available Now

Chevy Volt
Hamtramck, MI

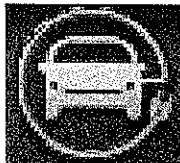
2012

Ford Focus Electric
Wayne, MI

2013 Model

Ford C-Max Energi (PHEV)
Wayne, MI

Data: Compiled by MEDC staff; Mapping: Michigan GIS Library and ESRI
January 2011



Plug-In Michigan

Michigan Assets: Leading The Way With Education

- Energy Systems Engineering (UM) – Master's Degree
- University of Michigan - $2.5 Million ARRA Grant
- Michigan Technological University - $2.98 Million ARRA Grant
- Wayne State University - $5 Million ARRA Grant
- Michigan Academy for Green Mobility (MTU & WSU)

Plug-In Michigan

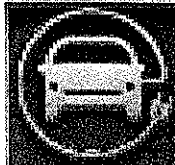
Michigan Assets: Battery Manufacturers Update

- **A123's Livonia** facility was commissioned Sept. 2010 and is running to full capacity; second facility in **Romulus** has commenced operations
- **Dow Kokam** and **LG Chem** are finishing construction on their plants in **Midland** and **Holland**; product to start shipping Q1 2012
- **Johnson Controls-Saft's Holland** facility is supplying battery packs to **Azure Dynamics (Oak Park)** for **Ford's** Transit Connect Electric assembled by **AM General (Livonia)**
- **fortu Power Cell** will commence groundbreaking in **Muskegon** Summer 2011

Plug-In Michigan

Future Focus: Complementary Markets

- **Power Electronics**
  - An industry that can leverage Michigan's automotive, energy storage, and renewable energy assets
- **Advanced Materials – Carbon Fiber**
  - A materials opportunity to leverage Michigan's automotive, energy storage, and renewable energy assets

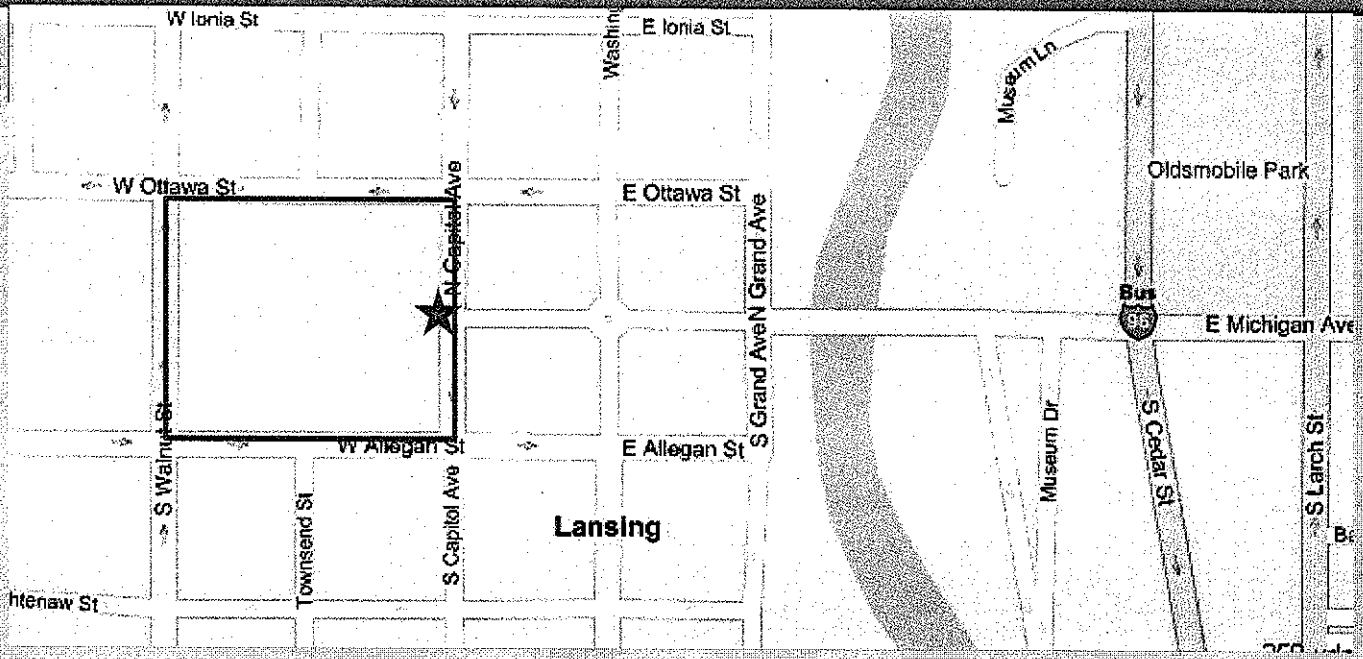


Plug-In Michigan

Thank you!

Plug-In Michigan

Ride and Drive Route



The route is:

Begin at Michigan Ave, in front of Capital Building (star) There is a check in table to verify Drivers Licenses, sign waivers and receive tickets. A single lane around the Capitol is blocked off for this event.
Proceed South on N Capitol Ave two blocks to W Allegan St. (against traffic) Turn right.
Proceed West on W Allegan St. two blocks to S Walnut St. Turn right.
Proceed North on S Walnut St one block to W Ottawa St. (against traffic) Turn right.
Proceed East on W Ottawa St two blocks to N Capitol Ave. Turn right.
Proceed South on Capitol to starting point.