



Utilities Prepare for Electrification of Transportation

**Southern Automotive Conference
Tunica, MS**

October 7, 2010

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Key Focus Areas as Utilities Prepare for PEV's

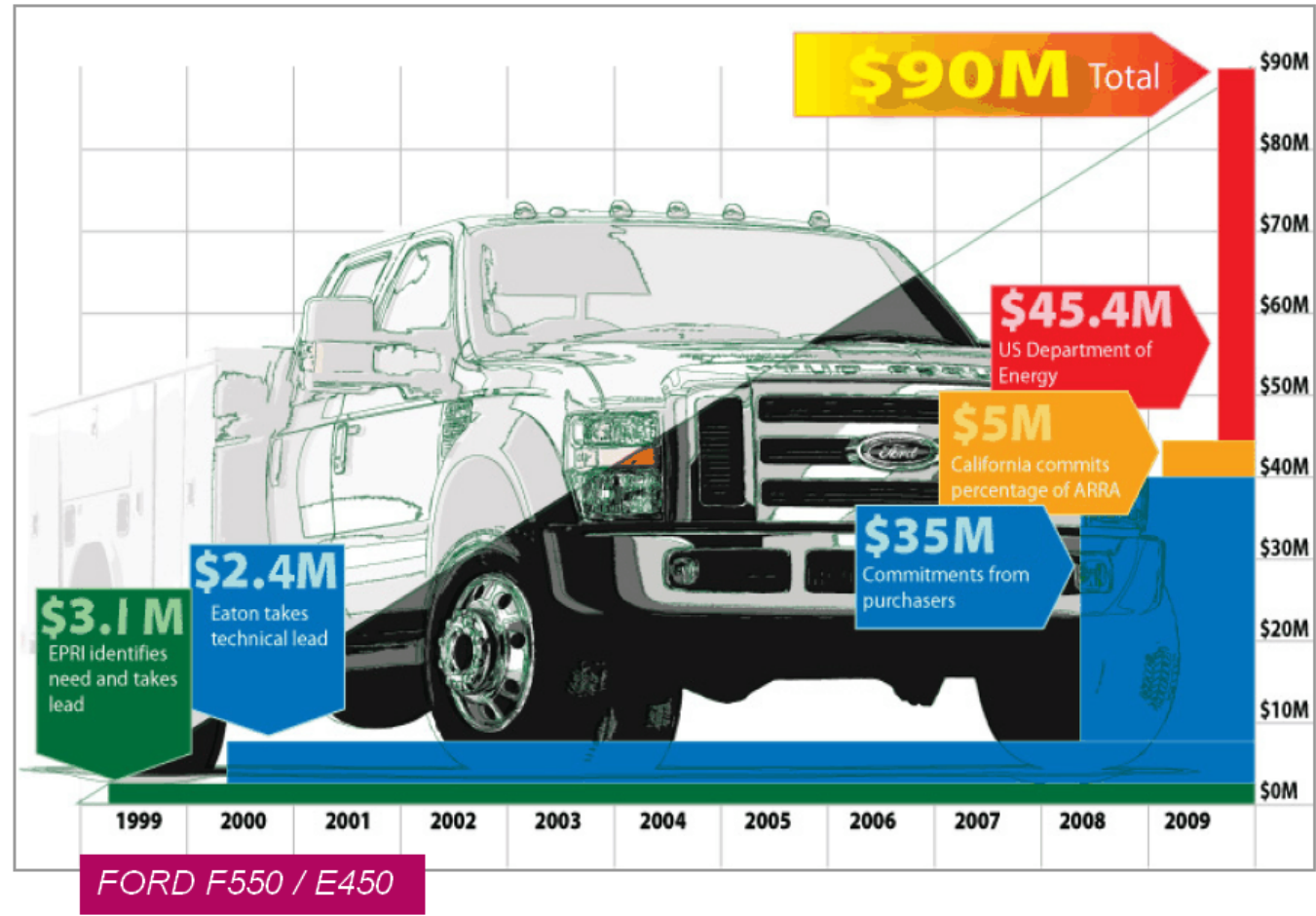
- Promote collaboration between auto and utility industry
 - *Includes pilot PEV activities to test performance*
- Determine impact to the electric grid
 - *What does plug-in readiness mean?*
- Understanding customer expectations
 - *Information, education, services*
- Engage in development of vehicle and infrastructure technology
 - Development of codes and standards
- Assess deployment timing and penetration rate
 - Perform environmental and economic evaluation

Collaboration – Auto and Utility Sectors

- **Utilize electric industry associations (EPRI, EEI) as the “bridge” between the electricity sector and the automobile industry**
- **Through R&D raise awareness and understanding of role of PEV’s**
- **Evaluating impact of real-world usage of PEV’s on the vehicles and electricity infrastructure**
 - *Includes PEV performance and acceptance*
 - *Utility regulator education*
- **Conduct studies on benefits and impacts of PEV’s**
- **Developing codes and standards for connectivity to grid**
- **Monitor federal and state policy activity**

Collaboration Includes Performance Testing

- August 2009, DOE awards \$45 million in cost share stimulus funding.....total project \$90 million
- Partners: EPRI, SCAQMD, Eaton Corp, CEC, Azure Dynamics, Altec Industries
- Target 378 PHEV trouble trucks (~45 at Entergy)

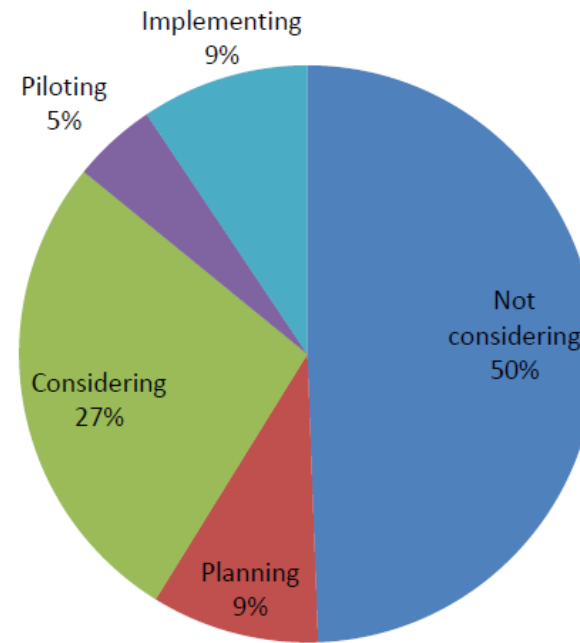


Source: 2010 Electric Power Research Institute, Inc.

Who Killed the Electric Vehicle?

- In 1912, 30,000 electric vehicles roamed America's mostly unpaved roads and Henry Ford prepared to multiply that fleet two years later with a cheaper mass-produced model.
- A Chartwell survey shows just more than half of responding utilities – 43 of 85 said they are implementing, piloting, planning or considering projects for plug-in electric vehicles

Q. Are you implementing, piloting, planning, considering or not considering projects for plug-in electric vehicles?



Source: Chartwell Inc., 2010

“Revenge of the Electric Vehicle”

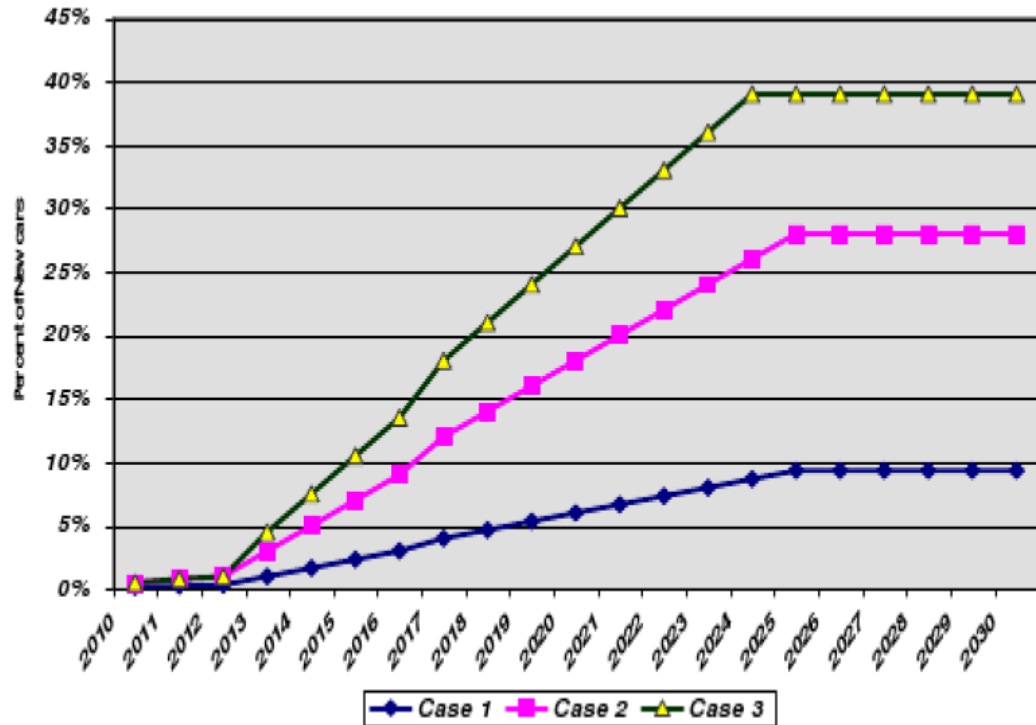
Chartwell forecasts

260,000 electric vehicles on the road by 2012.....

- 380,000 in 2013
- 640,000 in 2014
- 830,000 in 2015.....

which would be just short of President Barack Obama’s goal of 1 million.

Assumed new car market share for PHEVs



Case 1: 10% market share

Case 2: 28% market share

Case 3: 40% market share

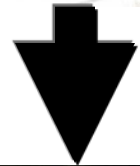
Source: Chartwell Inc., 2010

Sales of plug-in hybrid vehicles are expected to accelerate in 2014.

Source: Northwest Power

What Does Plug-In Readiness Mean?

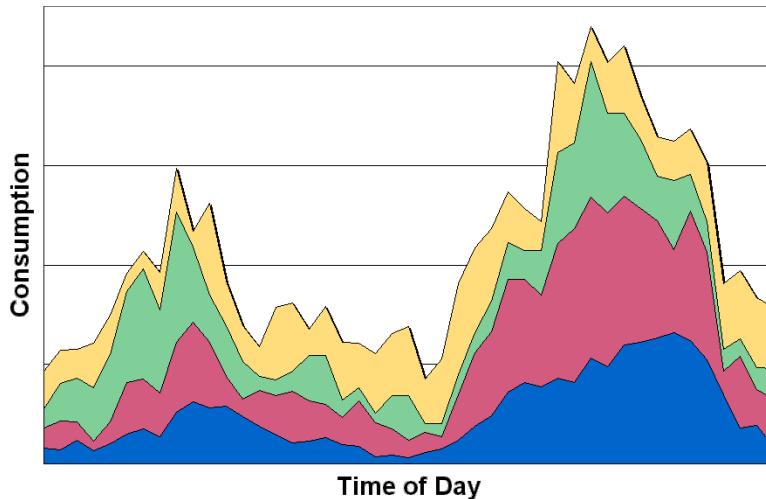
- Internal organization across departments:
 - Transportation, distribution, customer service, metering, etc
- Understanding the drivers of PEV adoption
 - Fleet adoption of PEVs
 - Customer requirements and adoption potential
 - Understand grid impacts
 - Support community planning activities
- A plan for customer education and outreach
- A comprehensive plan to address the challenges of charging regardless of utility's ultimate role
 - Addressing residential charging first
 - Looking at all aspects of streamlining the process
 - Incentives, permitting, installation, costs
 - A sensible plan for public infrastructure
- Can a prepared community and utilities increase awareness and ultimately adoption?



Source: 2010 Electric Power Research Institute, Inc.

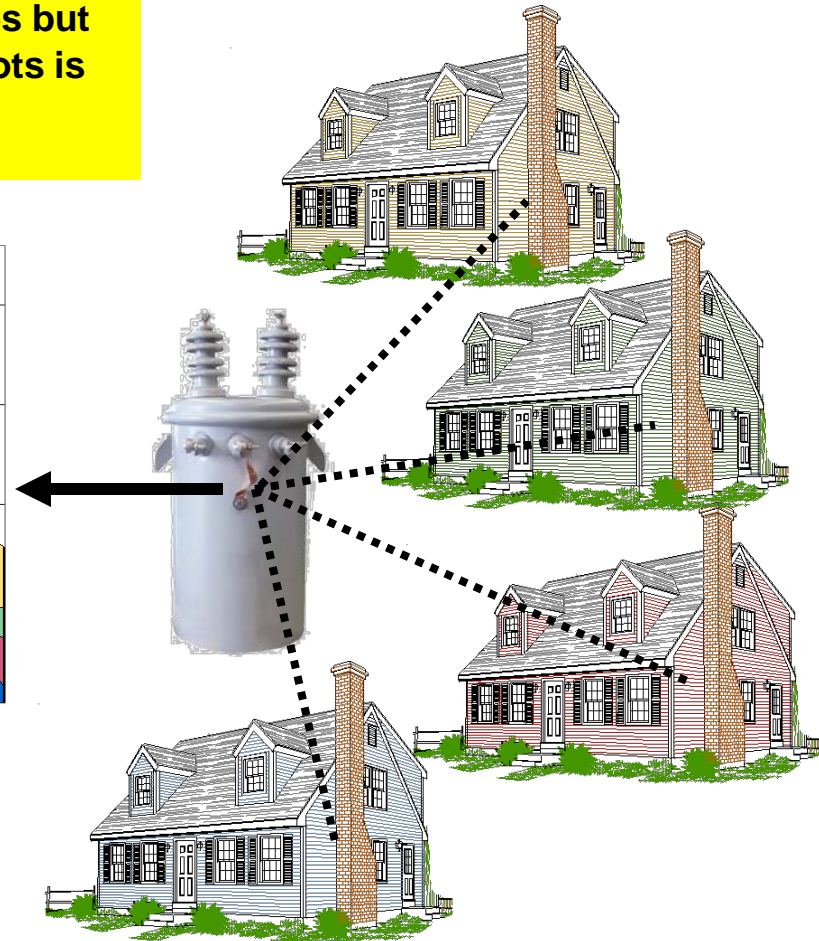
Planning for PEV Peak Demand – Load Monitoring

Planning tool using detail electrical model helps but the real solution to predicting localized hotspots is load monitoring



- Transformer Load Monitoring

- Directly
- Using AMI (if integrated with transformer database)



Source: 2010 Electric Power Research Institute, Inc.

Summary of Grid Impact

- **Adequate supply to meet PEV energy need**
 - Could help in addressing nighttime over generation issue

- **PEV peak demand has the potential to impact distribution and customer electrical infrastructure**
 - Closest to the customer, existing heavy loading, smaller transformer sizes

- **Anticipating potential PEV overload impact**
 - Load planning based on detail distribution model
 - Transformer load monitoring (direct or via AMI)

- **Potential adjustments to future distribution planning standards**
 - Transformer sizing, customers served off each transformer, transformer thermal ratings

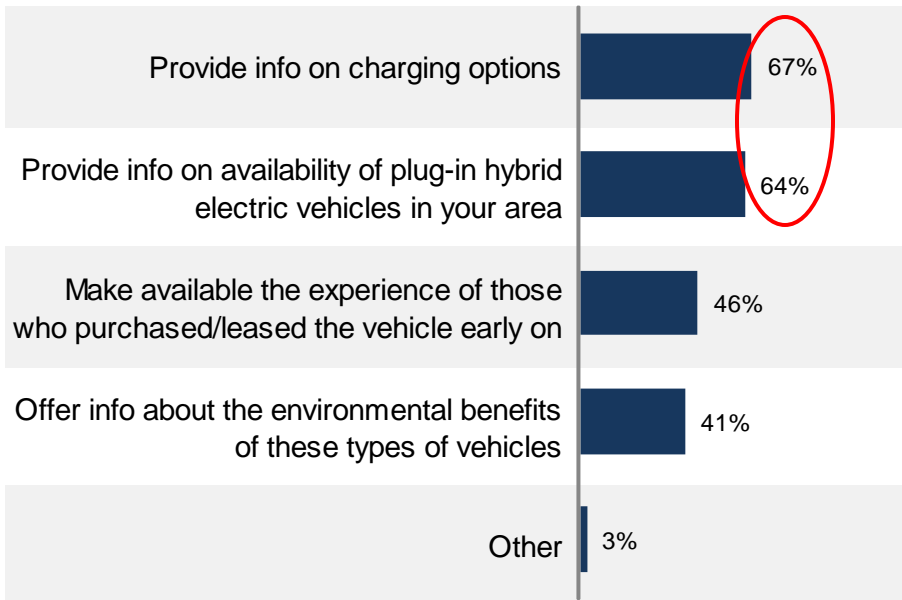
Source: 2010 Electric Power Research Institute, Inc.

Customer Expectations of Their Utility

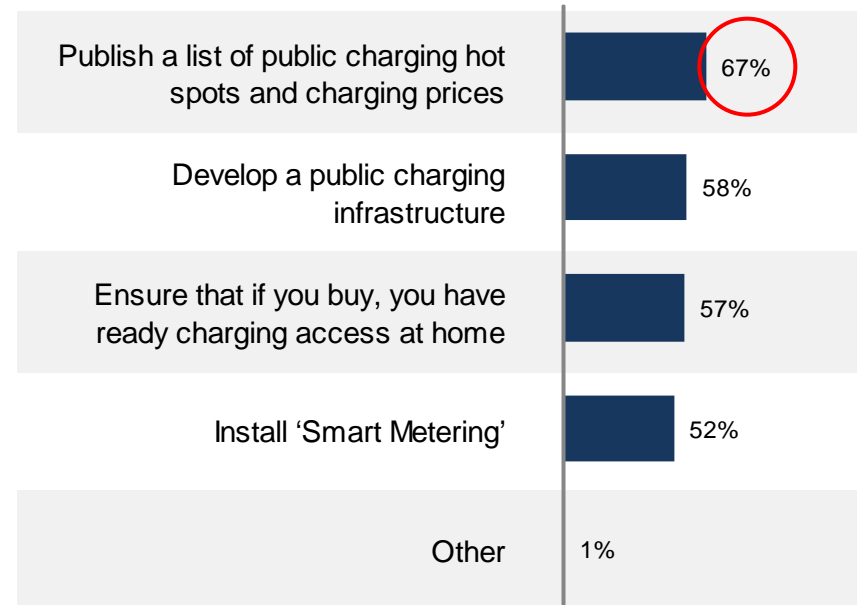
Expectations Of The Utility

Base: General Market (n=602)

How The Electric Company Can Help Keep Consumers Informed



Consumers' Desired Services From The Electric Company



Q. 40a How can your electric utility company best help you stay informed about plug-in hybrid electric vehicles?

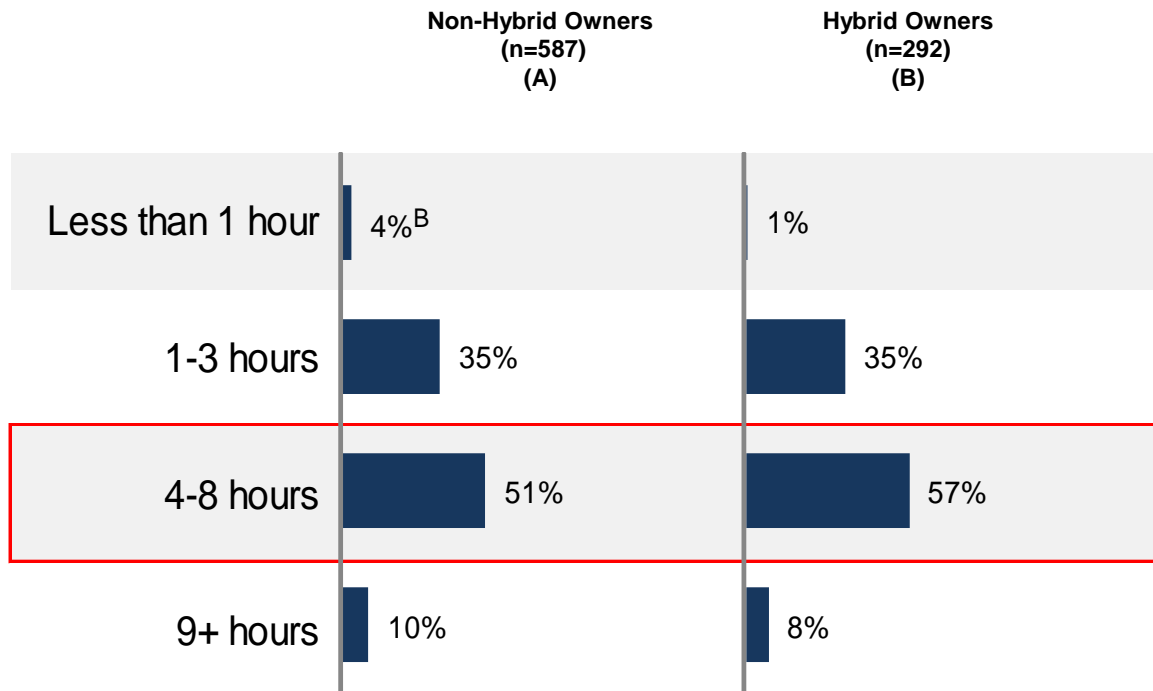
Q.40b If you were planning on purchasing or leasing a plug-in hybrid electric vehicle, which of the following services would you want from your electric company?

Source: 2010 Electric Power Research Institute, Inc.

Customer Expectation about Charging Time

Expected Time To Charge PHEV

Base: Total Respondents



NOTE: Capital letters represent statistical differences at a 95% confidence level.

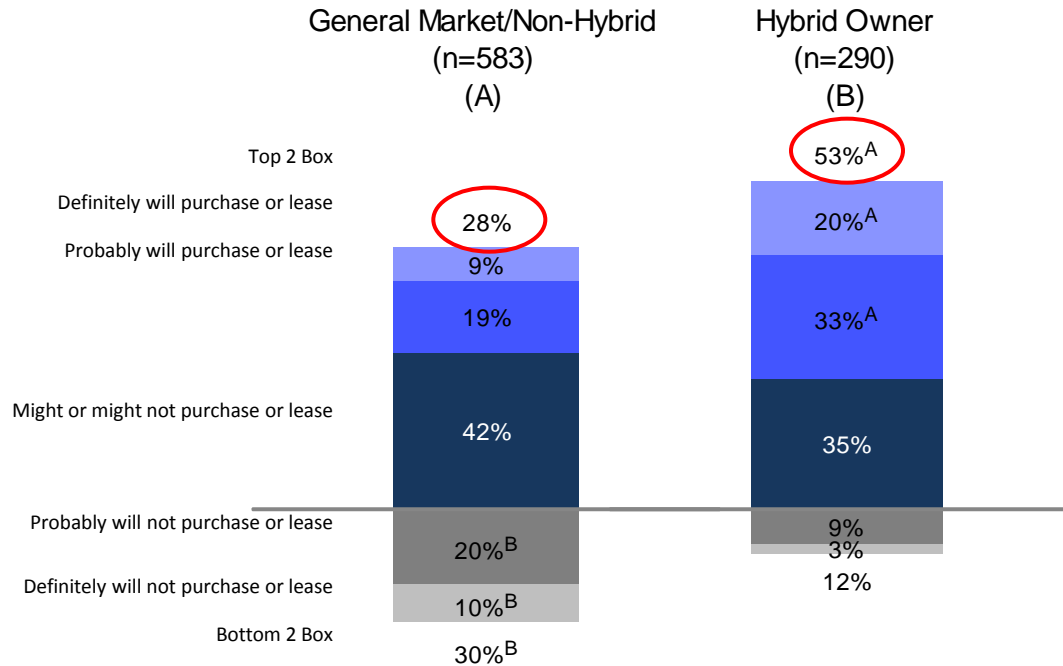
Q. 21 How much time do you expect it to take to fully recharge a plug-in hybrid electric vehicle, assuming that the battery was low? ENTER HOURS/MINUTES.

Source: 2010 Electric Power Research Institute, Inc.

PHEV Purchase Interest Hybrid and Non-Hybrid Owners

PHEV Purchase Interest

Base: Among Those Who Currently Own A Standard Vehicle

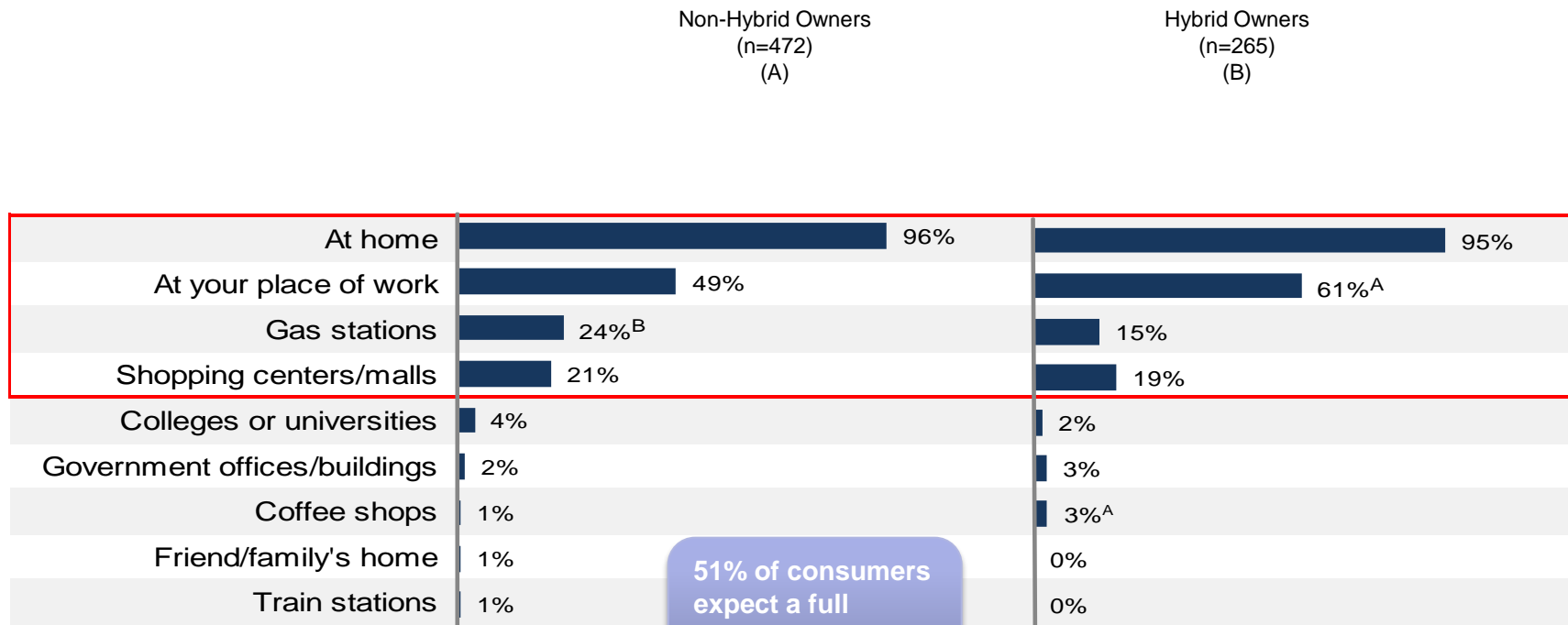


NOTE: Capital letters represent statistical differences at a 95% confidence level.
Q. 15 How likely are you to purchase or lease this vehicle as a plug-in hybrid electric vehicle the next 5 years?

Source: 2010 Electric Power Research Institute, Inc.

Charging Location Preferences

Most Preferred Public Charging Stations



51% of consumers expect a full charge to take 4-8 hours

NOTE: Capital letters represent statistical differences at a 95% confidence level.

Q. 19 If you owned a plug-in hybrid electric vehicle, which locations do you think you would use the most to charge the vehicle? SELECT 2 LOCATIONS

Q. 21 How much time do you expect it to take to fully recharge a plug-in hybrid electric vehicle, assuming that the battery was low?

Source: 2010 Electric Power Research Institute, Inc.

The Plug-In Vehicle Standards Space

EPRI's Infrastructure Working Council (IWC) is the Hub

Society of Automotive Engineers

- J1772 (Connector)
- J2847/2836/2931 (Communications)
- J2894 (Power Quality)

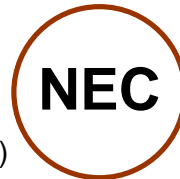


Infrastructure Working Council

- Utility-funded stakeholder group
- Identify and address needs for codes and standards
- Not a standards body

National Electric Code

- NEC625 (EV Charging Systems)

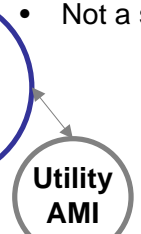
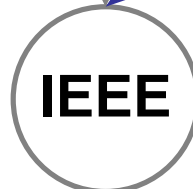


Intl Electrotechnical Comm

- TC69 (Charge Infrastructure)
- TC22/ SC3 (Electrical)



- IEEE 1547 (Grid Tie)
- IEEE P1809 (Electric Trans)
- IEEE P2030 (Smart Grid)



- Priority Action Plan 11 (Electric Trans)
- Priority Action Plan 15 (Communication)

Source: 2010 Electric Power Research Institute, Inc.

PEV Standard Development Currently Underway

PEV to Grid Communications

- SAE J2847 / J2836: Communications between the vehicle and grid
- SAE J2931: Power Line Carrier Communications for Plug-in Electric Vehicles
- Zigbee / Homeplug Alliance Smart Energy 2.0: Common Messaging for PEV communication

Charging Connector

- SAE J1772: North America and Japan charging connector published Jan 15, 2010
- Current focus on DC charging connector

Power Quality and Energy Efficiency

- SAE J2894: Standard for on-board chargers

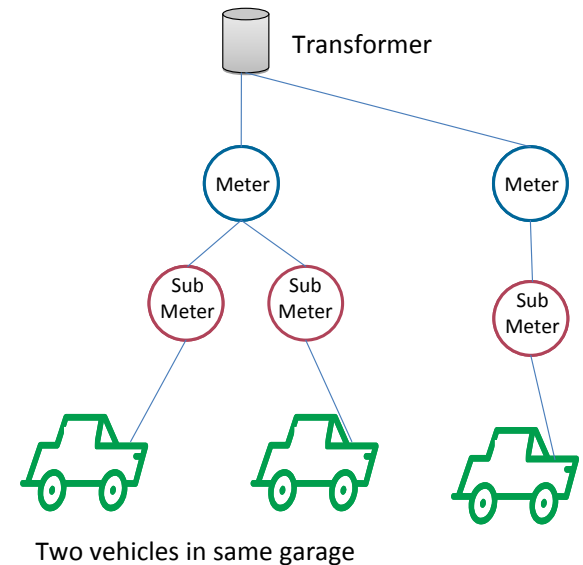
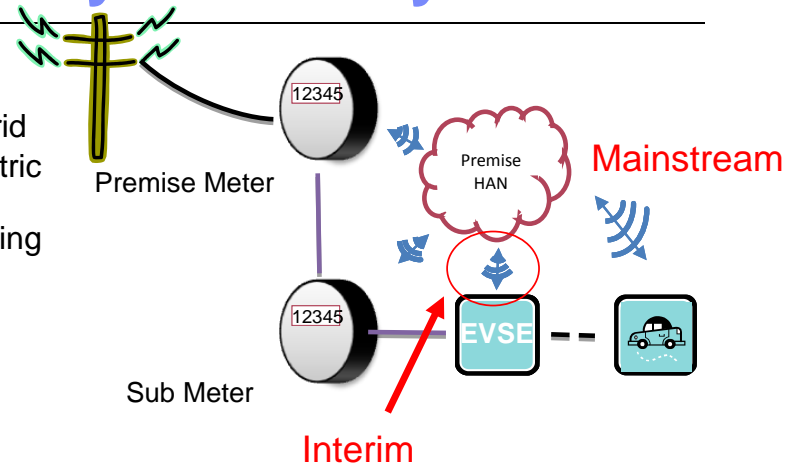
National Smart Grid Standards

- National Institute of Standards and Technology (NIST) is working on mainstreaming standards associated with Smart Grid Technology
 - Priority Action Plan (PAP) 11
 - PAP15

Institute of Electronic and Electrical Engineers (IEEE)

- P2030

Source: 2010 Electric Power Research Institute, Inc.



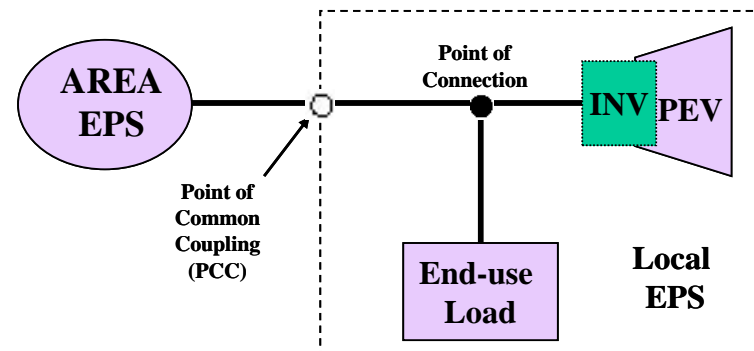
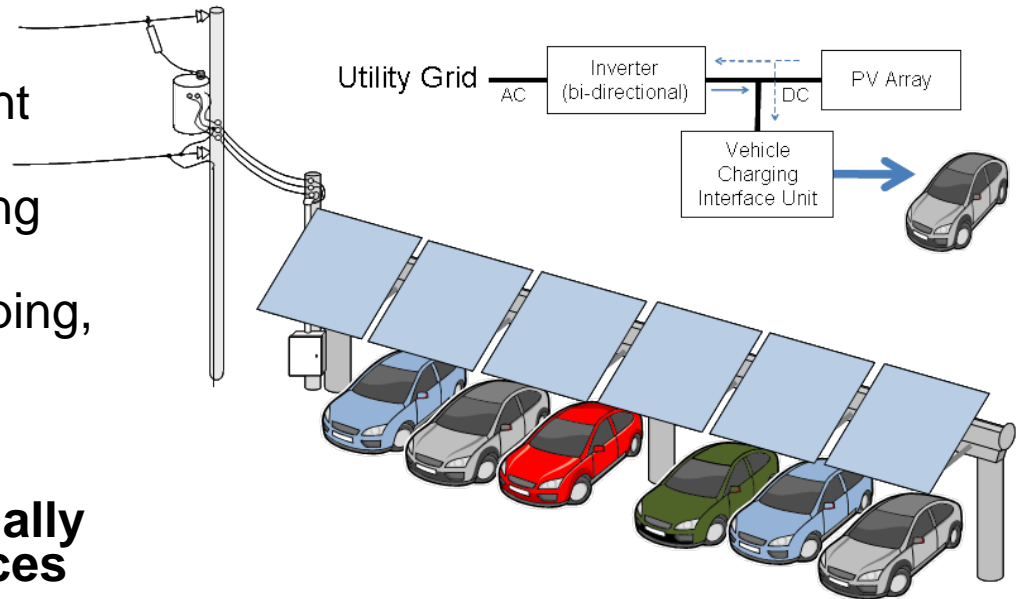
Plug-In Vehicles as Distributed Energy Resources

• Definitions

- V2G – bidirectional transient power & ancillary services
- V2H – premise peak shaving and DR
- Smart charging – load shaping, DR, etc.

• Whether or not true V2G is realized, vehicles will eventually be aggregated for grid services

- 3rd party DR
- Grid regulation, even if one-way
- 3rd party smart charging
- Renewables integration



Source: 2010 Electric Power Research Institute, Inc.

Mainstream PEV Commercialization Begins Nov/Dec 2010



Chevrolet Volt

- Extended Range Electric Vehicle (E-REV - A plug-in hybrid with a guaranteed electric range).
- 40-mile range
- Charging: 8-9 hours at 120V, 12A
 - 3 hours at 240V, 15A

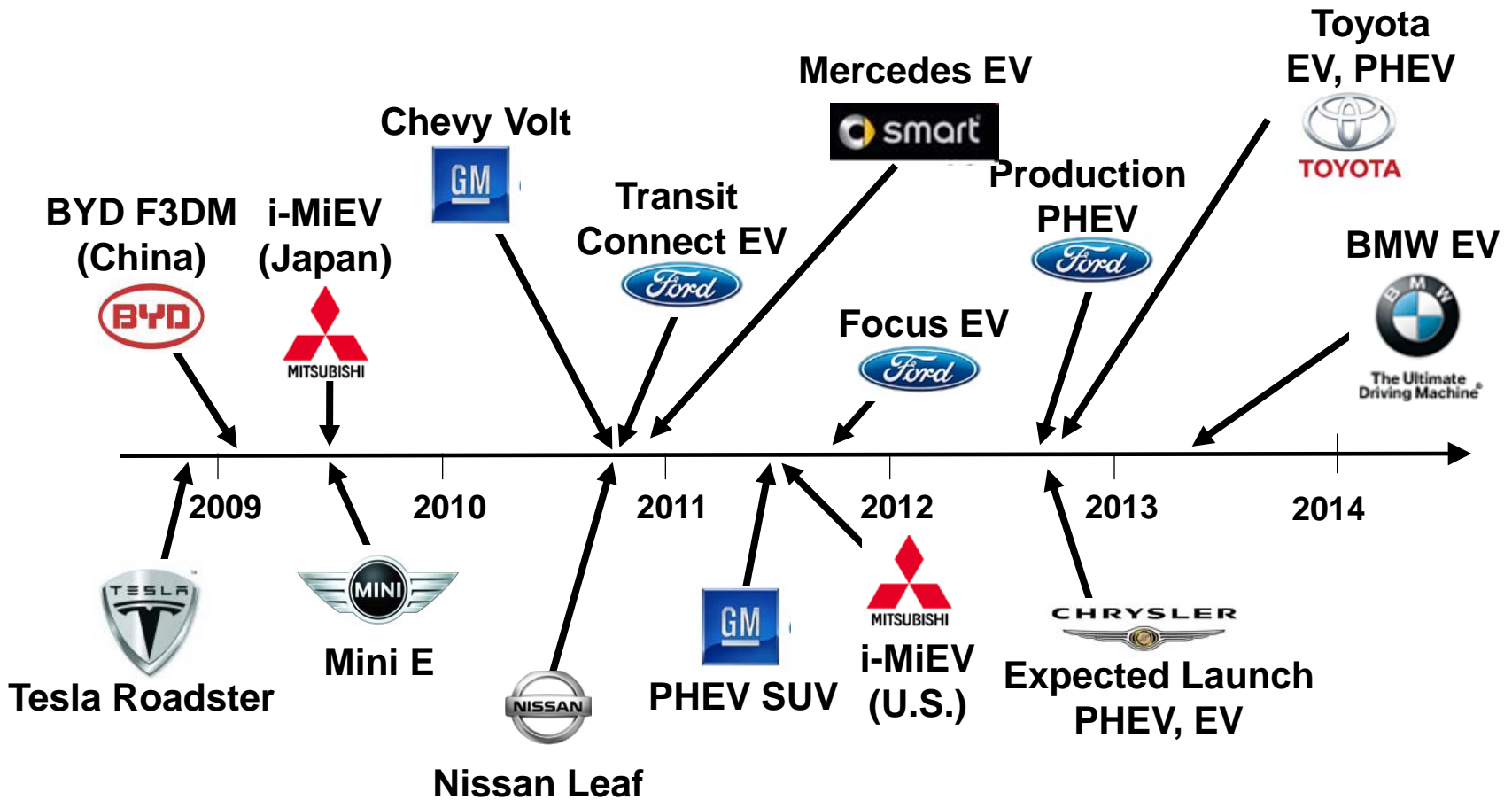


Nissan Leaf

- Battery Electric Vehicle
- 100-mile range
- Charging: 20 hours at 120V, 12A
 - 8 hours at 240V, 15A
 - 30 min at 400V, 150A

Source: 2010 Electric Power Research Institute, Inc.

Plug-In Vehicle Commercialization Timeline



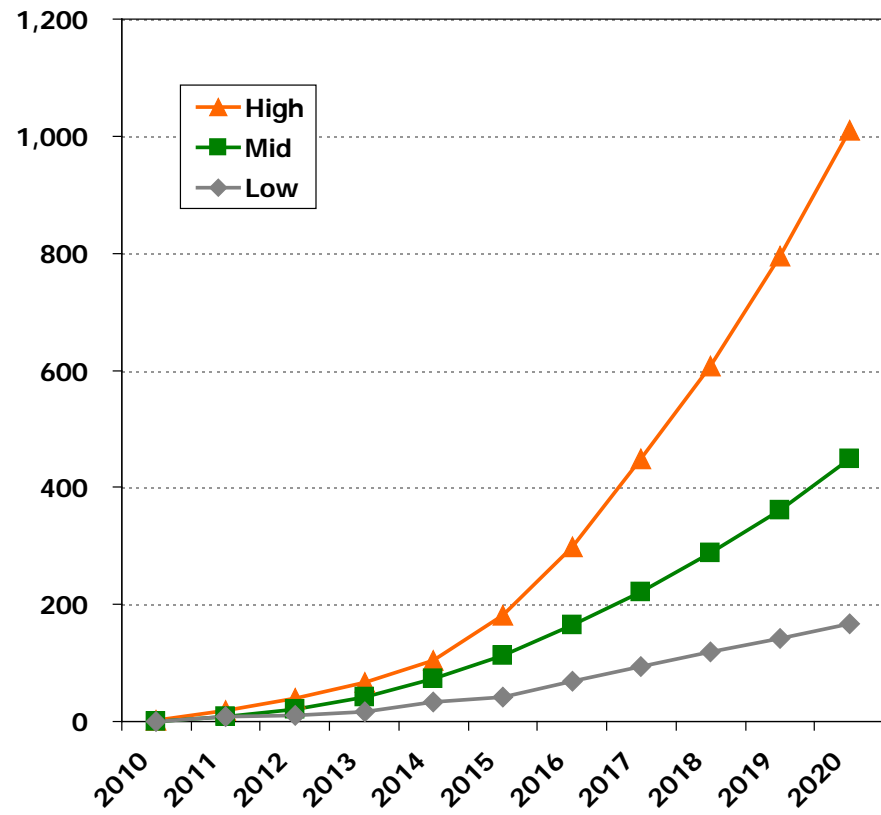
Consumers are saying they don't want to invest in an EV until the cost is right and the infrastructure is solidly in place.

Source: 2010 Electric Power Research Institute, Inc.

PEV Adoption – Large Utilities May See Up to 1M Vehicles by 2020

- Automaker announcements and commitments challenging to translate
- Uncertainty and risk with low volume and initial rollout
- System impact management and customer experience efforts must scale with volume

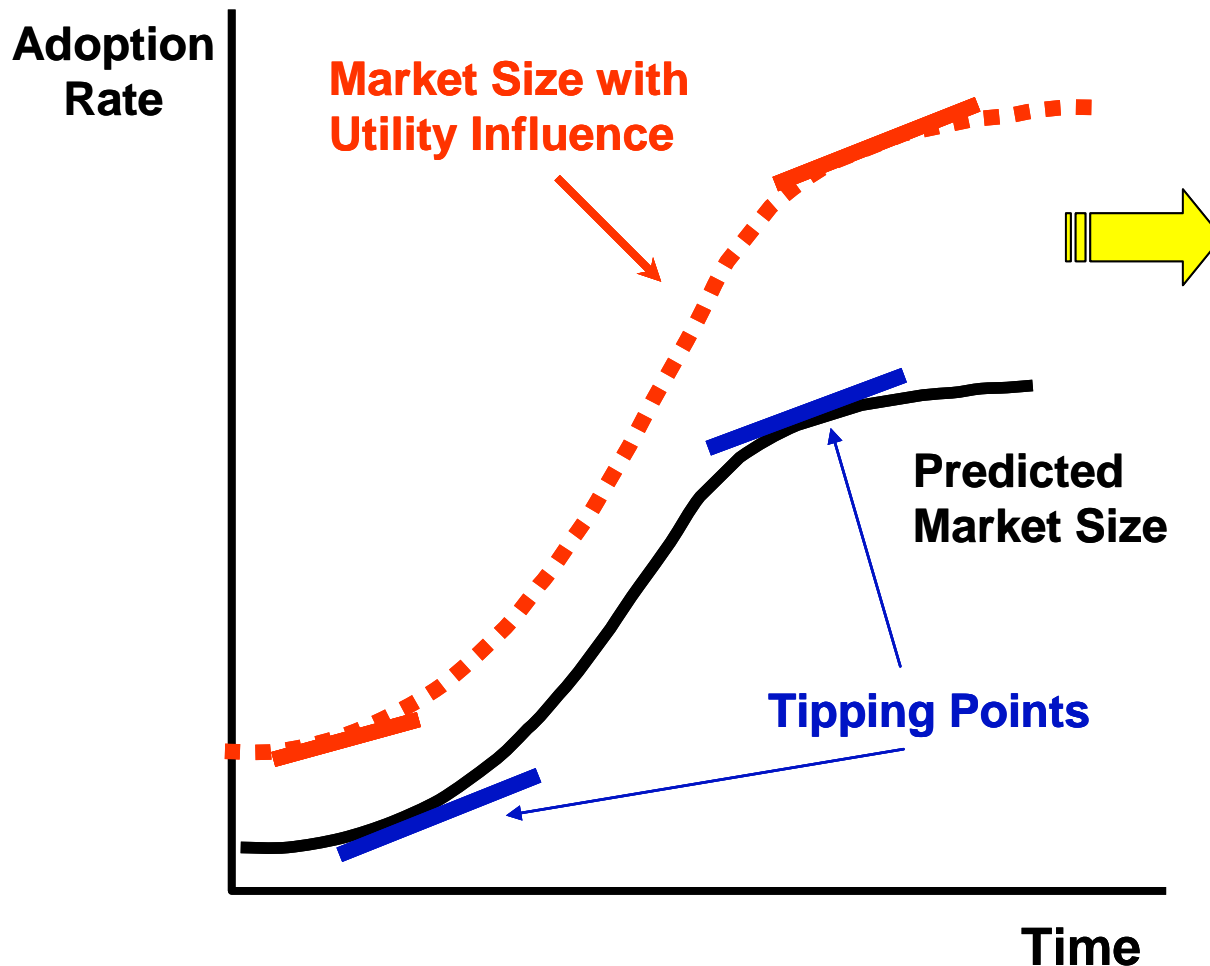
Cumulative Plug-in Vehicles in SCE Territory
(in thousands)



Source: 2010 Electric Power Research Institute, Inc.

Note: Forecast includes plug-in hybrid and battery electric vehicles.

Utility Actions can Influence the Rate of Adoption



Influences

- Plug-ready homes and neighborhoods
- Benefit maximizing charging rates
- Informed and savvy consumers
- Just-in-time infrastructure

Source: 2010 Electric Power Research Institute, Inc.

Industry Challenges...

- **Automotive Industry...**
 - Provide consumers the most value and least content (battery) vehicle
 - Extend vehicle distance and life
- **Utility Industry...**
 - Anticipate and address customer concerns
 - Proactively manage the impacts of PEV deployment and integration
 - Provide infrastructure support with the least cost to ratepayers



Source: 2010 Electric Power Research Institute, Inc.

Industry opportunities...

- Improve the environment
- Accelerate technologies
- Help rejuvenate the auto industry
- Reduce dependence on imported oil
- Educate consumers



Great benefits for utilities, auto makers and consumers!

Source: 2010 Electric Power Research Institute, Inc.