Plug-in Vehicles & the Grid

NC Sustainable Energy Conference

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Progress Energy

ENERGY EFFICIENCY

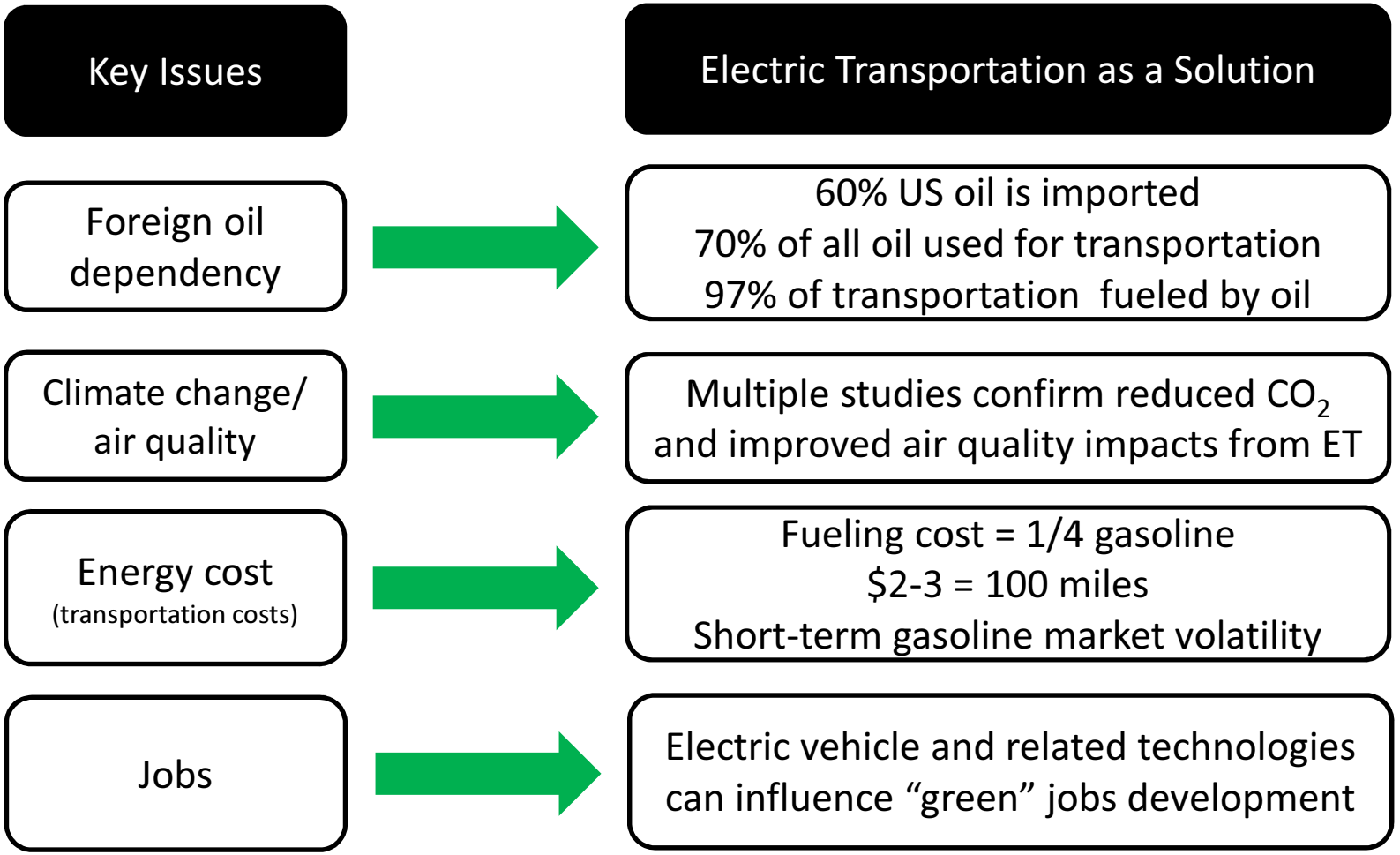
ALTERNATIVE ENERGY

STATE-OF-THE-ART POWER SYSTEM

Agenda

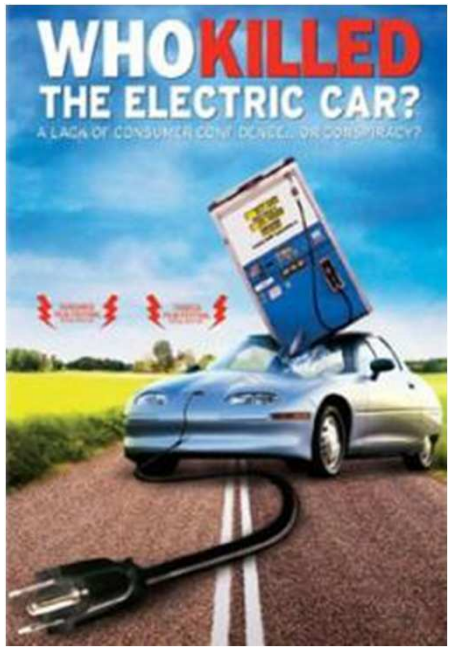
- Value Proposition
- Vehicles
- Charging Technology
- Grid Impact
- Utility Role
- Questions

Value Proposition



PEVs are not new… but this time it's different

- Technology
  - Plug-in *hybrid* electric technology
  - Improved batteries with higher energy density/longer range
- Marketplace
  - Driving factors include gas/oil prices, energy security, GHGs
  - Not just California
  - Broad support and incentives
- Customer Features
  - Instant torque
  - Preconditioning the cabin
  - Connectivity



Every Major Automaker Has a Plug-in Electric Vehicle Planned by 2013

Demo/Concept → Production

PHEV or EREV


Chevrolet Volt


Toyota Prius


BYD 3DFM


Mitsubishi PX-MiEV


BMW Concept


VW Golf TwinDrive


Hyundai Blue-Will


Volvo C30


Kia Ray


GM PHEV (?)


Cadillac Converj


Fisker Karma

ALL ELECTRIC


Nissan Leaf


Smart ED


Mitsubishi iMIEV


Ford Focus


Ford Transit Connect


Tesla


Chrysler/Fiat EV


Honda Fit EV


Toyota RAV4 EV


Mercedes BlueCell


Tesla Model S

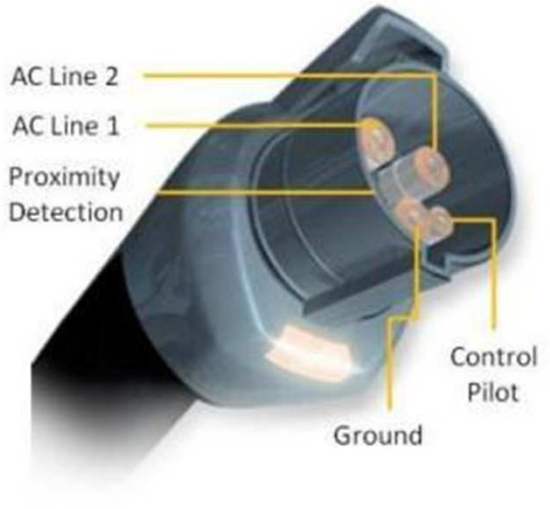

Toyota FT-EV

Charging Infrastructure Standards

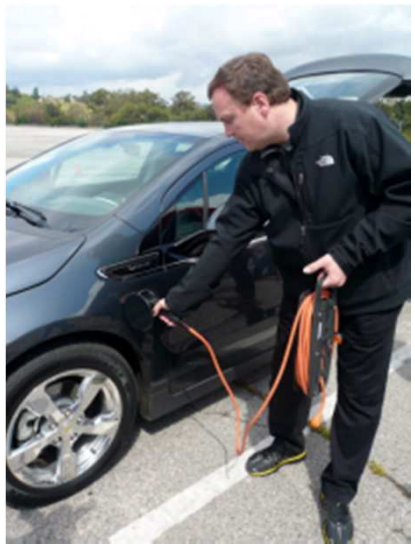
Key Point: The industry has agreed up upon a single charging connection standard – SAE J1772

	Voltage	Max Current	Likely Current	Charge Time (average)	Charge Time (full charge BEV)	Reference
AC Level 1	120 V	16 A	12 A	8-12 hrs	16-20 hrs	Hair Dryer
AC Level 2	208/240 V	80 A	16-30 A	2-3 hrs	6-8 hrs	Clothes Dryer
DC Fast	*Under development; 80% charge in 15-25 minutes (500V, 100A, 50 kW)*					Small Building

Level 1 can utilize a standard household outlet and stand alone cord set, but Level 2 requires a hardwired cord set into a special box with safety electronics.



Level 1

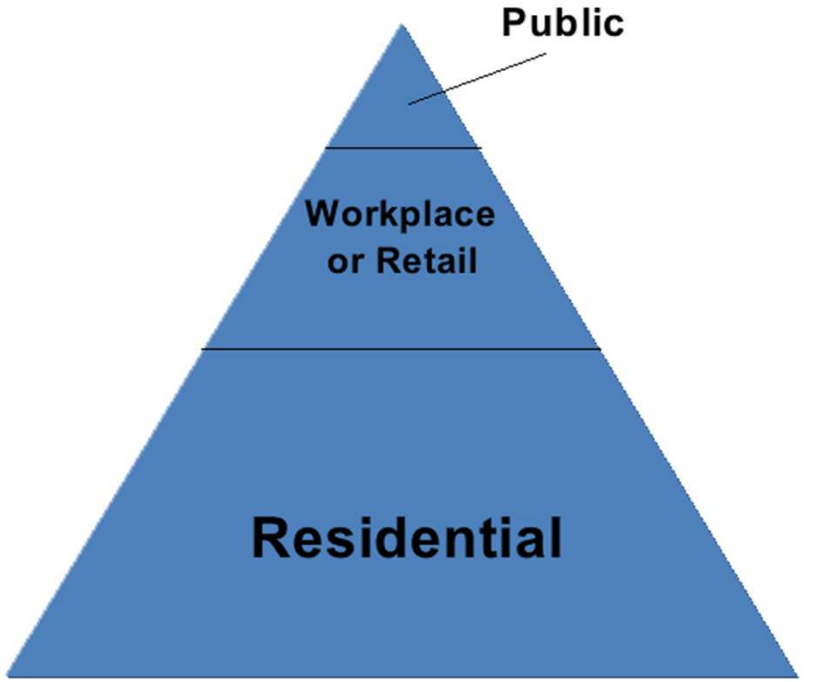


Level 2

Charging Locations

Key Point: Charging infrastructure is critical; majority will occur at home

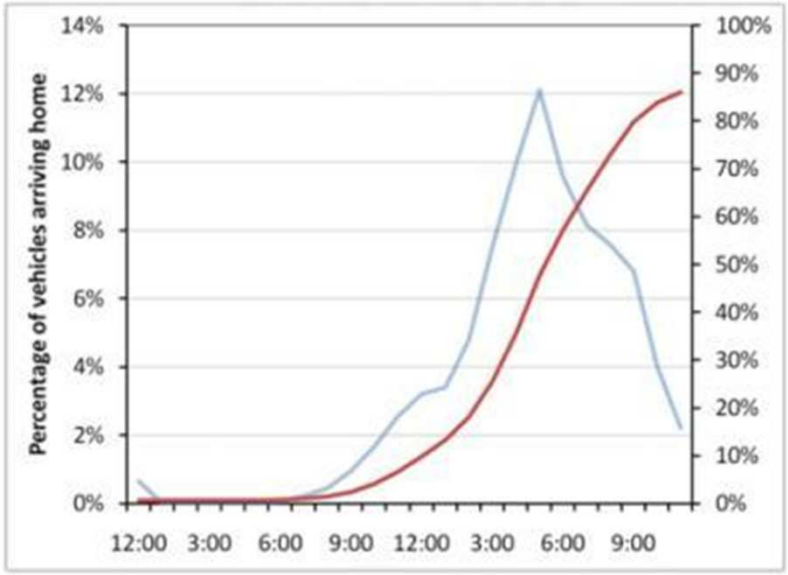
- Residential
  - Default charging
  - AC Level 1 or 2
  - $500-$2,000 hardware (L2)
  - $500-$1,500+ installation
- Workplace/Retail
  - 2nd most common location
  - AC Level 2
  - $2,000-8,000 hardware
  - Similar range for installation
- Public
  - Retail, decks, curbside
  - AC Level 2, DC Fast
  - Costs:
    - AC L2 similar to workplace
    - DC fast charging unknown



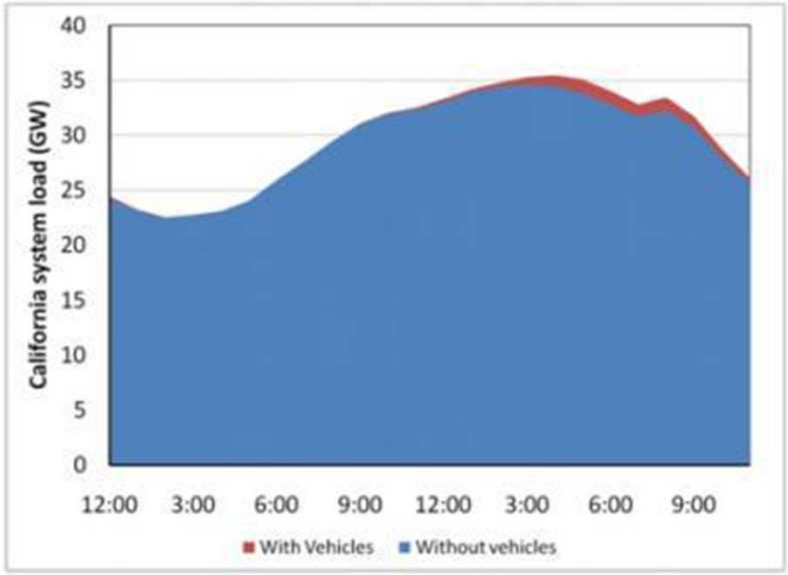
EPRI | ELECTRIC POWER RESEARCH INSTITUTE

System Impacts

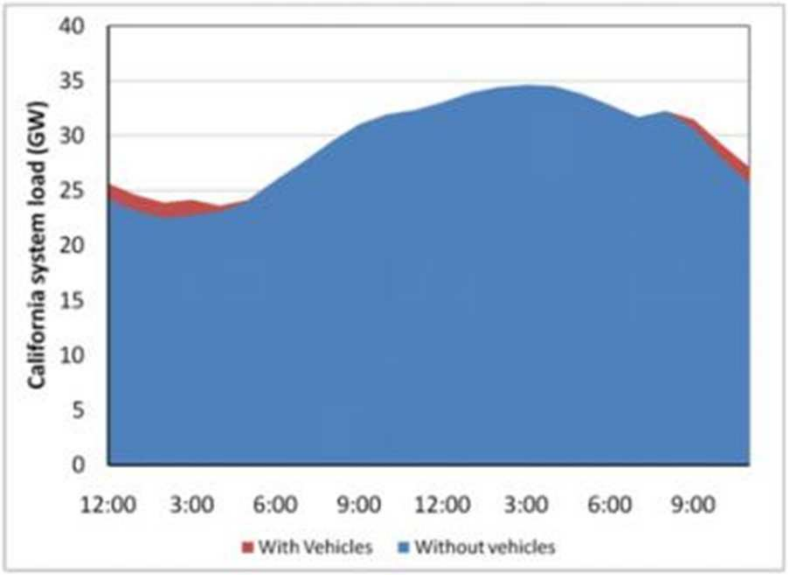
Source; Effects of transportation electrification on the electricity grid
Marcus Alexander Manager, Vehicle Systems Analysis
Workshop 4 – Plug-in Electric Vehicle Integration Issue July 15, 2009



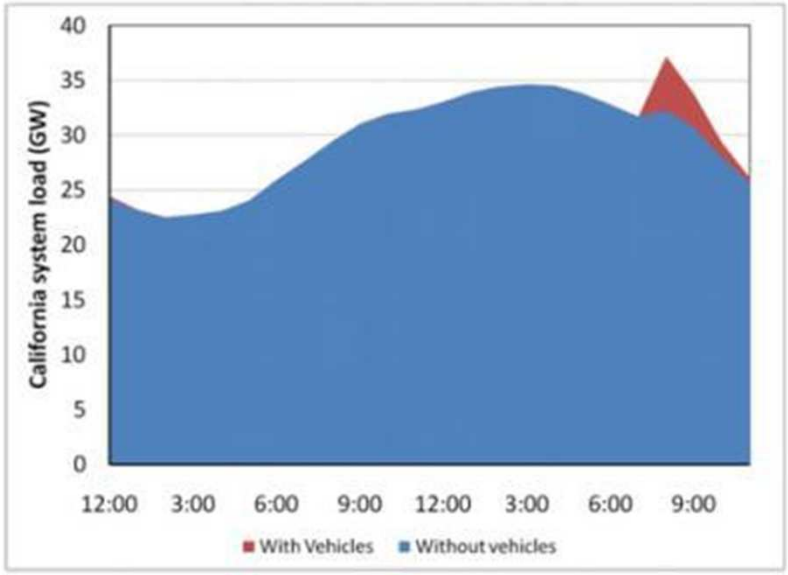
Maximum home arrival is 12% at 5 PM
By 8 PM, 70% of drivers have arrived home



This is the demand for 2 million simulated vehicles verses the demand for July 7, 2009; average load is 700W per vehicle

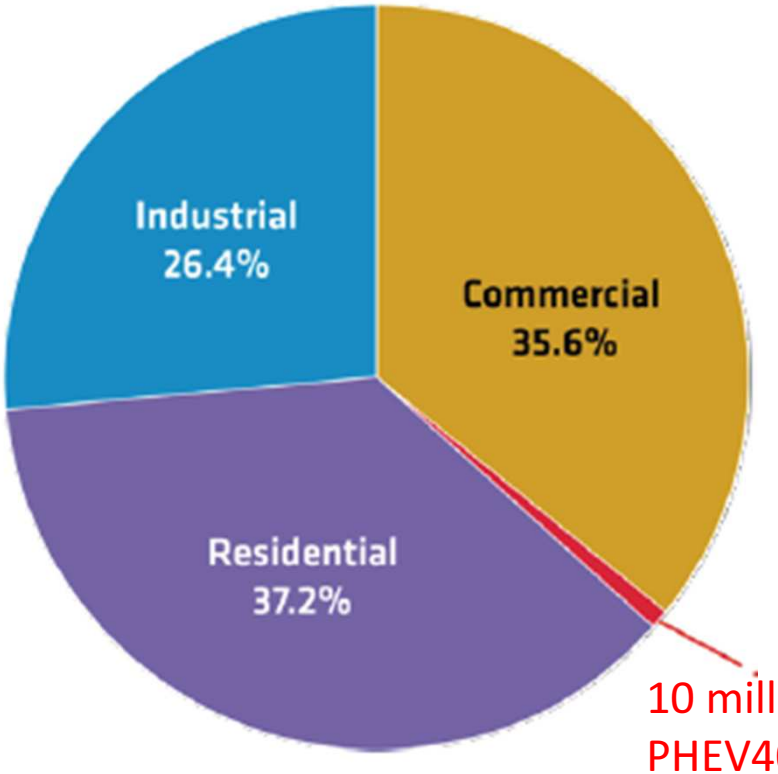


The same 2 million vehicles can be charged overnight with no increase in peak load



2 million badly controlled vehicles can create a new peak
This would be a serious disruption

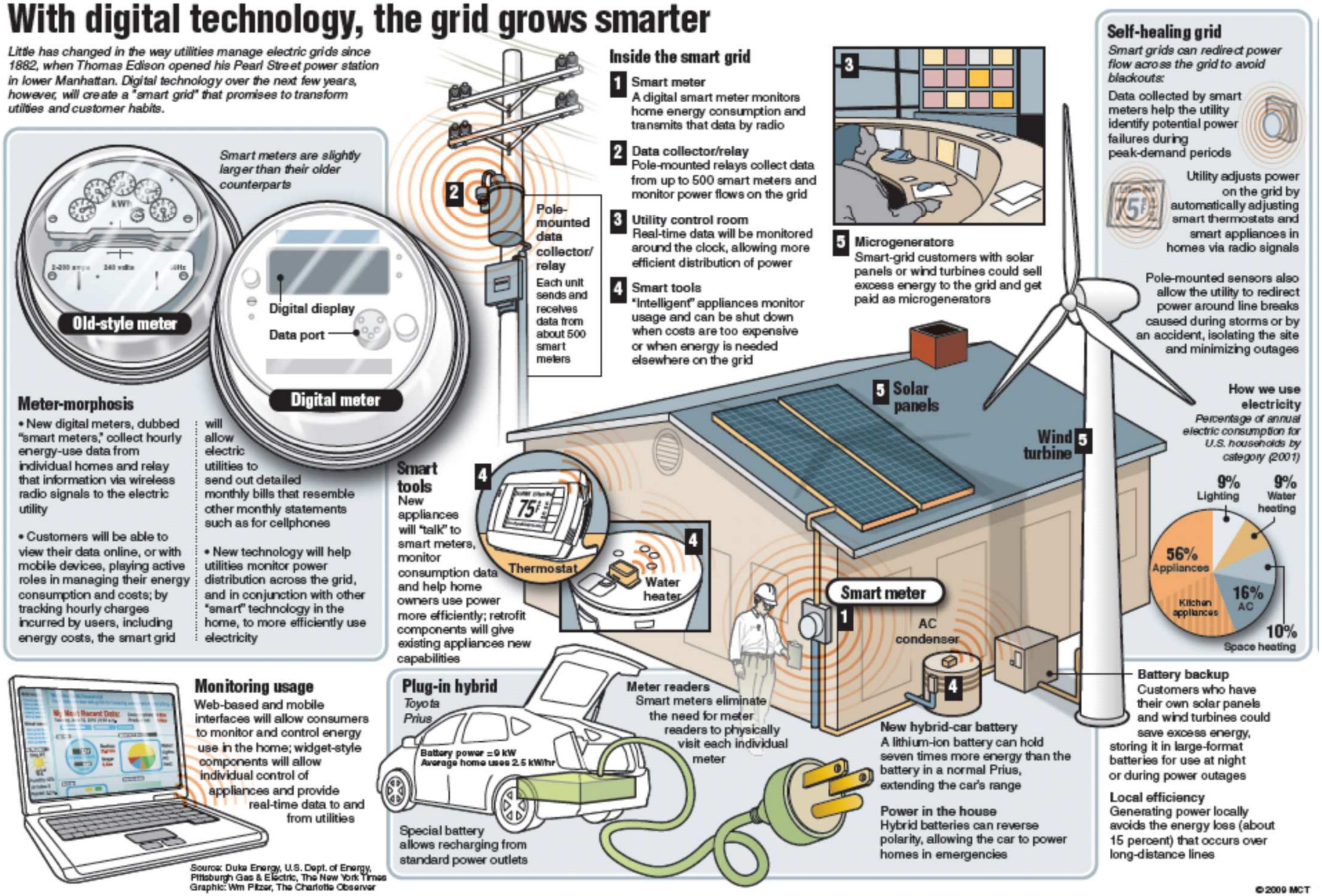
Grid System Impact in Perspective



- PNNL study indicated there is sufficient underutilized grid capacity to power 73% of today's vehicles as PHEVs
- ORNL study indicated smart charging can help minimize future power plant needs to between zero and 8
- 10 million PHEV40s (e.g. Chevy Volt) would account for less than 1% of national electricity generation

Source: EPRI

PEVs and the Smart Grid



The Utility Role

- Maintain a safe and reliable grid
- Explore approaches to manage costs
  - Mitigate impacts from distribution upgrades and peak generation
- Ensure positive customer experience
  - Seamless access to charging infrastructure
  - Identify service upgrade necessity and process
  - Initial purchase and on-going customer service
- Assist key stakeholder groups in planning efforts
- Support technology standards and research
- Edison Electric Institute pledge

1 Infrastructure	2 Customer Support	3 Customer and Stakeholder Education	4 Vehicle and Infrastructure incentives	5 Utility Fleets

Summary

- Plug-in vehicles are real and will be on the streets this year
- On/off road vehicle electrification can improve air quality while reducing GHG and petroleum dependence
- Impact to the grid is minimal although local issues may occur on a case by case basis
- Simple “smart” charging can help shift load/avoid peaks
- Progress Energy is committed to partnering with our communities to prepare for plug-in vehicles
- NC is a recognized leader in the country – join the effort!

www.progress-energy.com/environment/plugins www.GoElectricDrive.com

Progress Energy Electric Vehicle (Then…)

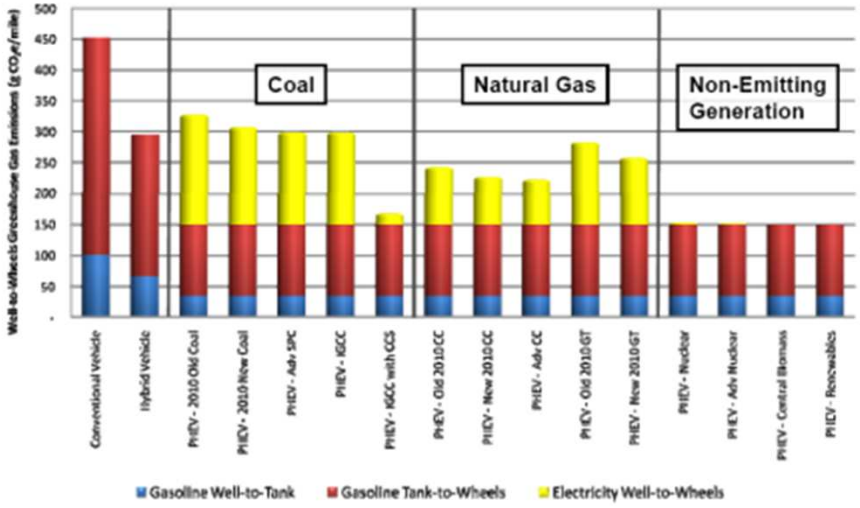
Progress Energy Electric Vehicles (Now)

Appendix Slides

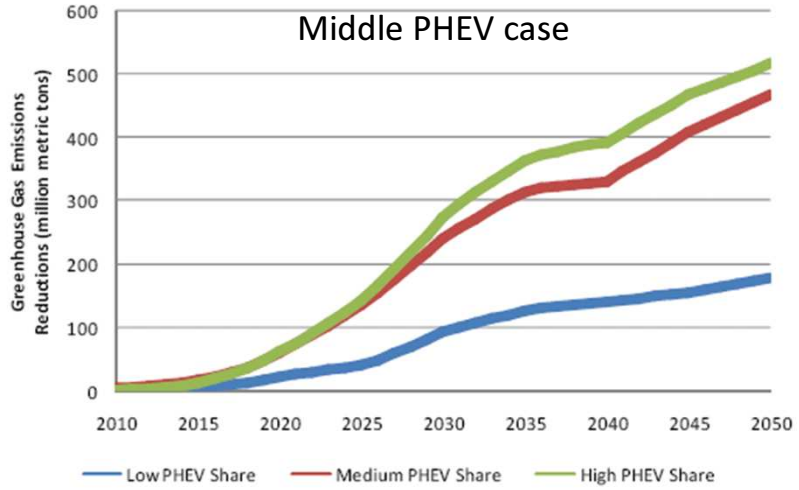
Helping Improve the Environment

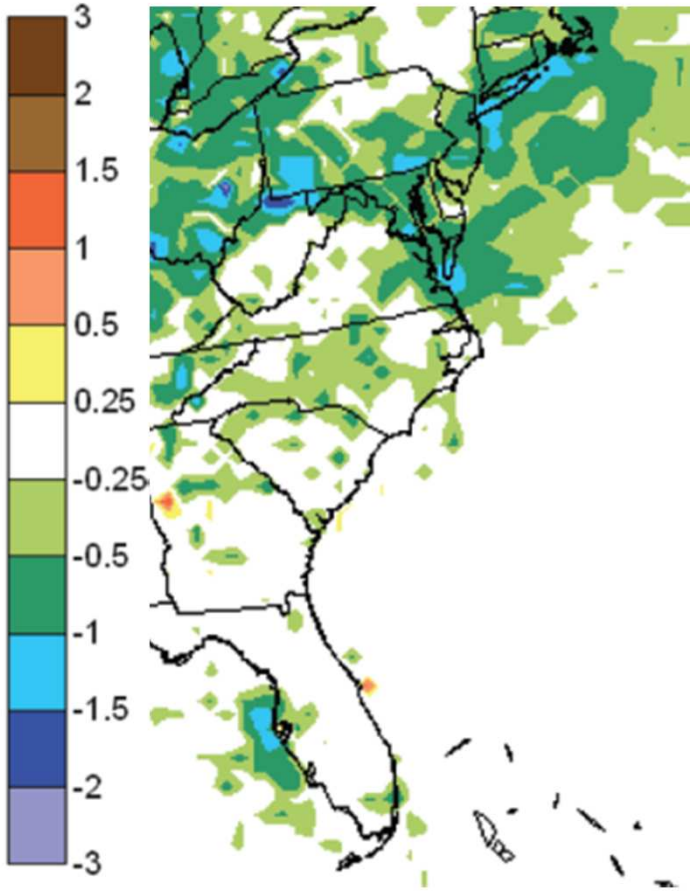
Key Point: Net emissions are reduced with PEVs and can be further reduced with nuclear/renewables

CO2 (g) per Mile
CV vs. HEV vs. PHEV w/ Various Grid Sources



Cumulative Net CO2 reduction
Middle PHEV case





Annual 4th Highest 8-hr Ozone Difference (ppb): PHEV middle case vs. base case

Source: EPRI/NRDC 2007 Impact Study