The Near Future of Electric Transportation

Pennsylvania Public Utility Commission
Alternative Fuel Vehicles Forum
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Mainstream PEV Commercialization Began December 2010

Chevrolet Volt
- Extended Range Electric Vehicle (EREV - 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
Electricity Pricing for Plug-in Electric Vehicles

Electricity ~ $1/Gallon (equiv.) … less expensive … relatively stable
Three Ways to Charge a Plug-in Electric Vehicle

120V – Level 1
Portable cordset
Use any 120V outlet
Up to 1.44 kW

240V – Level 2
Permanent charge station (EVSE)
Typ. 3.3 – 6.6 kW, but up to 19.2 kW

DC Fast Charging
Up to ~ 50 – 60 kW
Fast, expensive
Standard not yet in place
Three ‘Places’ to Charge

• Build Today’s Infrastructure Today
  • Infrastructure installation cost
    ~ $1500 home, $2500+ public
  • Focus on Residential
    – 95% of vehicles end day at home
    – Some costs can exceed $2200 - $2500
    – Cost and lead time minimization
  • Workplace
    – 2nd priority in terms of use
• Public Charging
  – Critical vs. convenience
  – Understand DC Fast Charging
  – Long-term sustaining of infrastructure
Environmental Benefits of Plug-In Vehicles

• Electricity is a low-carbon fuel
• Nationwide air quality benefits – under all generation source scenarios
• 3-4 million barrels/day petroleum reduction
• Significant increase to regional economic output, jobs, household income

Annual Reduction in GHG Emissions due to PHEV Adoption
Source – 2007 EPRI-NRDC Study
EPRI PEV Distribution System Impact Study

- Detail electrical model of selected feeders that includes each customer
- Assessment of different PEV charging type and penetration mode
- Hourly analysis using 8760 hours load profile to assess localized hotspots

Provide Planning Tool to Assess Potential of Localized Hotspots in Distribution System
Solar Assisted PEV Charging Stations

- Combines vehicle charging with solar power and battery storage along with smart grid interface
- First of its kind (TVA - EPRI @ Knoxville, TN)

Provides a field laboratory for evaluation of different charging infrastructure integrated with distributed resources and smart controls.
Smart Charging - Key to Reducing Grid Impacts

• ‘Smart charging’ is a compact between utility and vehicle owner
  – Low in cost and convenient for vehicle operator
  – Minimize system impacts
• Implement with Automated Metering (AMI), Home Area Networks (HAN), internet communications, etc.
• Vary time-of-day and charge power

Vision – By 2015, all plug-in electric vehicles can communicate to the smart grid and charging is intelligently controlled
What Does EV Readiness Mean?

- Organized and effective stakeholders
- Understanding the “local and regional” drivers of PEV adoption
- Education and outreach
- A comprehensive plan for charging infrastructure
  - Addressing residential charging first
    - Streamlining the process
    - Establish tariffs and utility role
  - A sensible plan for public infrastructure
EPRI Public Reports on Plug-In Electric Vehicles


“Characterizing Consumers' Interest in and Infrastructure Expectations for Electric Vehicles: Research Design and Survey Results”, EPRI, Palo Alto, CA and Southern California Edison, Rosemead, CA: 2010. #1021285


Together...Shaping the Future of Electricity