Electric Vehicles: Updates and Industry Momentum

CPES Meeting
Watson Collins
March 17, 2014
Northeast Utilities launched an EV Tech Center to answer questions and help EV drivers get connected

www.PlugMyRide.org

or

855-463-6438
(Monday through Friday 8 a.m. - 5 p.m.)
Many of the States in the Northeast follow California’s Zero Emission Vehicle program.
Governors From 8 U.S. States Sign MOU to Put 3.3 Million ZEVs on the Road by 2025

State Zero-Emission Vehicle Programs
Memorandum of Understanding

WHEREAS, the Signatory States have adopted regulations requiring increasing sales of zero-emission vehicles (ZEVs), or are considering doing so; and

WHEREAS, accelerating the ZEV market is a critical strategy for achieving our goals to reduce transportation-related air pollution, including criteria air pollutants, mobile source air toxics and greenhouse gas emissions (GHGs), enhance energy diversity, save consumers money, and promote economic growth; and
ZEV requirements will require about 200,000 EVs in Connecticut by 2025
The states agreed to collaborate on the following

1. Multi-state ZEV Program Implementation Task Force

2. Work together to establish a fueling infrastructure that will adequately support this number of vehicles

3. Agency coordination
   › consistent statewide building codes and standards
   › developing streamlined metering options
   › time-of-use electricity rates and net metering for electric vehicles

4. Public fleet purchases and fueling stations

5. Incentives for ZEVs

6. Shared standards
   › universal signage
   › common methods of payment and interoperability of electric vehicle charging networks

7. Public – Private Partnerships

8. Research, Education and Outreach

9. Hydrogen-powered vehicles and infrastructure study
Connecticut: Focused on eliminating range anxiety

- State has identified the advancement of EVs as an important public policy objective
- Eliminating “Range Anxiety” is the foundation of the plan
- State using funds from Northeast Utilities, identified in a settlement agreement, to fund infrastructure grants and investments
- CL&P has a filing before regulators to modify rates for DC Fast Chargers
  - DC Fast Chargers are an important / effective part of the infrastructure needs
  - DC Fast Chargers have a load profile that is unique in comparison to typical customers (less than 5% load factor)
  - Expected usage profile results in electric bills with disproportionate demand charges

“We will be the first state to be able to declare an end to range anxiety, because you’ll always have a charging station within 10 or 15 minutes”

“WeConnecticut Setting Groundwork To Become First EV Friendly State”
PEV sales are off to a good start

Source: Manufacturer Data
PEV market share outpacing HEVs

Source: PEV sales: Manufacturer data; Annual sales totals: NADA; HEV sales: Alternative Fuels Data Center (DOE)

*2013 projected
Connecticut Plug-in Vehicle Registrations (through November 2013)
Two plug-in technologies (choose what fits driving habits)

<table>
<thead>
<tr>
<th>Battery Electric Vehicle</th>
<th>Plug-in Hybrid Electric Vehicle</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Battery Icon]</td>
<td>![Battery Icon with Fuel Can]</td>
</tr>
<tr>
<td><strong>Drivetrain</strong></td>
<td></td>
</tr>
<tr>
<td>70 – 240 miles</td>
<td>15 – 40 miles</td>
</tr>
<tr>
<td><strong>Electric Range</strong></td>
<td></td>
</tr>
<tr>
<td>Commuting, fixed routes, short routes, etc.</td>
<td>Irregular driving patterns, highway driving, long routes</td>
</tr>
<tr>
<td><strong>Driving Patterns</strong></td>
<td></td>
</tr>
<tr>
<td>Purists, principled, making statement, technology driven, 2nd vehicle, etc.</td>
<td>Primary vehicle, pragmatic consumers, expect same performance, no loss of convenience, etc.</td>
</tr>
<tr>
<td><strong>Expected Profile of Vehicle Owners</strong></td>
<td></td>
</tr>
<tr>
<td>Level 2 and DC Fast Charging</td>
<td>Recharging Equipment Sizes</td>
</tr>
<tr>
<td>![Home Icon, Work &amp; Public Icon]</td>
<td>120 v outlets and Level 2</td>
</tr>
<tr>
<td><strong>Recharging Locations</strong></td>
<td></td>
</tr>
<tr>
<td>Home, work &amp; public</td>
<td>Home &amp; work</td>
</tr>
</tbody>
</table>
Top Selling Current EV Models
Other EV Models Currently Available
EVs coming to market soon
Benefits of PEVs to utilities

- System utilization means downward pressure on price
  - In general: \( \text{rate} \ (\$/kWh) = \frac{\text{cost of service} + \text{rate of return}}{\text{kWh sales}} \)
- Flexible/shapeable load
  - Unlike many loads, charging characteristics (time, rate, location) are flexible and can be shaped with behavior
- Unlocks new opportunities
  - Near-term: demand-response, integration of renewable resources
  - Longer-term: distributed storage (V2G)
- Win-win situation
Utilities supporting the market

- Education and outreach
  - PEV information on websites draw heavy traffic
  - Employee programs, fleets, ride-and-drive events
- Incentives and pilot projects
  - Offset EVSE installation costs
  - Data-gathering projects
- EV rates
  - Time-of-use rates to shift off-peak
Need for education and awareness

- PEV awareness remains low:
  - November 18: “Consumers Have Favorable Views of Electric Vehicles, but Awareness Remains Low”¹
  - November 13: “Survey: Most Americans unaware of financial advantages of owning an electric car”²

- The Electric Generation
  - (thenelectricgeneration.org)

 Plenty of grid capacity

- 73% of the light-duty vehicle fleet could be supported by the existing grid

- Such a market penetration would displace 6.5 million gallons of oil per day, or 52% of U.S. oil imports

- Modeling shows essentially no generation or transmission impact through 2030

Source: Pacific Northwest National Laboratory, *Impacts Assessment of Plug-In Hybrid Vehicles on Electric Utilities and Regional Power Grids*
Impact on distribution is manageable

- Transformer level distribution is where impact will be more evident.
- To date, only tiny fraction of transformer upgrades due to PEVs.
- Utilities closely monitoring PEV adoption.
- Rising power levels could be a concern.

Source: Silver Spring Networks, How the Smart Grid Enables Utilities to Integrate Electric Vehicles.
Cars spend most of time at home

Source: National Research Council, *Overcoming Barriers to Electric-Vehicle Deployment, Interim Report*
# EV Charging Equipment

<table>
<thead>
<tr>
<th>Charging Level</th>
<th>Electrical Wiring</th>
<th>Charge Rate (kW)</th>
<th>Equipment Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1</td>
<td>120v, 15a</td>
<td>1.44 kW</td>
<td>NEMA 5-15 outlet, Cordset provided with vehicle</td>
</tr>
<tr>
<td>Level 2</td>
<td>240v, 20 - 100a</td>
<td>3.6 – 19.2 kW</td>
<td>EVSE* installed at site</td>
</tr>
<tr>
<td>DC Fast Charging</td>
<td>3 phase</td>
<td>50 kW</td>
<td>External battery charger installed at site</td>
</tr>
</tbody>
</table>

* Electric Vehicle Supply Equipment
For commuters, 8 hours provides enough time to satisfy their typical charging requirements.

<table>
<thead>
<tr>
<th>Charging Level</th>
<th>Electrical Wiring</th>
<th>Charge Rate (kW)</th>
<th>Potential Miles Provided by Charging in an 8 Hour Period *</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1</td>
<td>120v, 15a</td>
<td>1.44 kW</td>
<td>32 miles</td>
</tr>
<tr>
<td>Level 2 (low)</td>
<td>240v, 20a</td>
<td>3.6 kW</td>
<td>80 miles</td>
</tr>
<tr>
<td>Level 2 (med.)</td>
<td>240v, 40a</td>
<td>7.2 kW</td>
<td>160 miles</td>
</tr>
<tr>
<td>Level 2 (High)</td>
<td>240v, 100a</td>
<td>19.2 kW</td>
<td>427 miles</td>
</tr>
<tr>
<td>DC Fast Charging</td>
<td>3 phase</td>
<td>50 kW</td>
<td>1,111 miles</td>
</tr>
</tbody>
</table>

* Based on the Chevy Volt EPA rating of 36 kWh / 100 miles and no charge rate modulation
Charging infrastructure

- Charging priority:
  - 1) home charging
  - 2) workplace
  - 3) public

- Keeping costs down to drive market
- Public charging should be located intelligently
- Multi-Family Dwellings present a challenge
Open issues

Sale and Resale (i.e. third-party networks)

Interoperability (example: SAE Combo vs. CHAdeMO)

Flexibility is key
NU is working with the State of Connecticut to develop DC Fast Charging Stations

**National Highway System: Connecticut**
DC Fast Chargers at Darien Southbound Service Plaza
Thank You

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http://www.youtube.com/watch?v=0NaI9SYhN34