Electric Vehicles: Charging Up Your Sustainable Network

Charlie Alcock
Portland General Electric

Oregon's Vision for Transportation Electrification

- National leadership in Transportation Electrification and lower carbon emissions for transportation
- Premier US Launch & Adoption Market for Plug-In Vehicles
- All manufacturers, all designs and all vehicle styles welcome and invited (vehicles, charging infrastructure, support services, etc)
- Full coordination with mass transit and urban planning/development
- Charging infrastructure will be ready
  - Charging stations, building codes, contractor training, process streamlining
- Fleet deployment commitments in place
  - “Soft Orders” survey among public agencies, private employers (organizational use and employees)
- Universities ready to study usage & trends
  - Optimal charging locations, usage patterns, consumer behaviors

Portland General Electric Service Area

E Electric Vehicles:

1

1

1
## Oregon is an Early Deployment Market

- Toyota Plug-in Prius: June 2010
- Navistar eStar electric truck: Summer 2010
- Nissan Leaf: December 2010
- Smart EV: December 2010
- Ford Transit Connect EV: Mid-2011
- Mitsubishi "i": Fall 2011
- Ford Focus EV: Fall 2011
- GM Volt: Fall 2011
- Many other models: 2012-13

## Oregon’s Collaborate Approach

- Collaborative Oregon approach: public and private sector working together
- Infrastructure work underway
- Working with all vehicle and charging station manufacturers
- Governor’s Transportation Electrification Executive Council

## EV Types

<table>
<thead>
<tr>
<th>Attributes</th>
<th>Hybrid</th>
<th>PHEV</th>
<th>NEV</th>
<th>BEV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plug-In</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Range</td>
<td>500 mi.</td>
<td>500 - 600 mi.</td>
<td>20 – 40 mi.</td>
<td>80 – 120 mi.</td>
</tr>
<tr>
<td>Cost</td>
<td>$$$</td>
<td>$$$</td>
<td>$</td>
<td>$$</td>
</tr>
<tr>
<td>Drive</td>
<td>Gas/Electric</td>
<td>Gas/Electric</td>
<td>Electric</td>
<td>Electric</td>
</tr>
<tr>
<td>Charging Time</td>
<td>N/A</td>
<td>4 - 5 hours</td>
<td>2 - 4 hours</td>
<td>6 - 10 hours</td>
</tr>
<tr>
<td>Operation Speeds</td>
<td>Freeway capable</td>
<td>Freeway capable</td>
<td>≤ 25 mph</td>
<td>Freeway capable</td>
</tr>
</tbody>
</table>
### Charging Stations

<table>
<thead>
<tr>
<th>Level</th>
<th>Input Voltage</th>
<th>Typical Charging Time</th>
<th>Breaker Size (A)</th>
<th>Electrical Loads (kW)</th>
<th>Typical Locations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>120 V</td>
<td>8 – 12 hours</td>
<td>15-20</td>
<td>2</td>
<td>Standard 120 volt plug; PHEV/NEV charging, Emergency charging</td>
</tr>
<tr>
<td>2</td>
<td>240 V</td>
<td>2 – 4 hours</td>
<td>40 amp Typical</td>
<td>3-6</td>
<td>Residential garages, parking lots, public garages, transit centers</td>
</tr>
<tr>
<td>DC Quick Charge</td>
<td>208/480 V 3 phase</td>
<td>20 – 40 minutes</td>
<td>various</td>
<td>30-60</td>
<td>Rapid charging facility near high traffic volume arterials</td>
</tr>
</tbody>
</table>

### Oregon’s Charging Station Network

**Over 50 public charging stations installed in Oregon**

- Many different owners
- Majority are sub-metered to capture usage and trends data
- Over 50% upgraded to J1772 standards (Level 2)
- Many stations are powered by 100% PGE renewable energy
- North America’s only publicly available DC Quick Charger in Portland

![Map of Oregon charging stations](image.png)

### USDOE Grant (“The EV Project”)

- USDOE awarded a $100 million grant to eTec to build and study a mature charge infrastructure based on Nissan EVs. (October 2009) Project has since been expanded to include more regions, more chargers, etc.
- A total of $200+ million will be expended (1:1 match)
  - 5-market area originally: Seattle, Oregon, San Diego, Phoenix/Tucson, Tennessee
  - 5000 Nissan LEAF EV
  - 12,500 Proposed Level 2 EVSE
  - 250 Proposed Level 3 Fast Chargers
- Infrastructure can be used by all EVs (not limited to LEAF)
- Infrastructure studies and modeling
  - Data collection
  - Vehicle learned
  - Grid interaction
- Results will become basis for nationwide EV charging infrastructure deployment strategy

www.TheEVProject.com for additional information
Operating Costs and Carbon Emissions

The typical passenger car
- 15,000 miles annually
- 20 mpg; 15 cents/mile fuel cost
- Carbon emissions: 7.3 tons

The typical light truck
- 20,000 miles annually
- 10 miles/gallon; 30 cents/mile fuel cost
- Carbon emissions: 19.6 tons

All electric passenger car
- 15,000 miles annually
- 4 miles/kWh; 2 cents/kWh fuel cost
- Carbon emissions: 1.9 tons (at 2,000 lbs/ton)

All electric light truck
- 20,000 miles annually
- 1 mile/kWh; 8 cents/kWh fuel cost
- Carbon emissions: 2.5 tons (at 2,000 lbs/ton)

BEV Payback Model

<table>
<thead>
<tr>
<th>Cost Type</th>
<th>Initial</th>
<th>Fuel Saver</th>
<th>Electric</th>
<th>Gasoline</th>
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</thead>
<tbody>
<tr>
<td>Cost</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Gasoline</td>
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West Coast Collaboration

Signed by Governors of Washington, Oregon and California and Premier of British Columbia
Vancouver, B.C.
February 12, 2010

- Build a Pacific "Green Highway" (I-5 corridor)
- Promote public-private partnership
- Share standards and best practices for alternative fuels
- Collaborate on all electric and plug-in electric vehicles
- Maximize impact of public fleets policies
- Maximize results from research and commercialization efforts
- Create consistent roadside signage for alternative fuel stations
West Coast Green Highway

- Initiative to promote the use of cleaner fuels
- Aims to reduce the transportation sector's impact upon the environment and dependency on foreign oil
- 1,350 miles of Interstate 5 (I-5) stretching from the U.S. border with Canada, through Washington, Oregon, and California, to the U.S. border with Mexico
- Designated a “Corridor of the Future” by the U.S. Department of Transportation. I-5 could soon become the nation’s cleanest, greenest, and smartest highway
- The drivers of hundreds of thousands of cars and trucks that travel on this major roadway each day soon may select from a menu of clean alternative fuel such as natural gas, biodiesel, ethanol, or hydrogen

Source: Washington State Department of Transportation

DC Quick Chargers Allow for Regional Long-Distance Travel

DC Quick Chargers – Mission not Impossible

RFI from both Oregon Department of Transportation (ODOT) and Washington Department of Transportation (WashDOT)

- Seeking information from manufacturers and suppliers of Electric Vehicle (EV) Quick Charge Equipment
- Goal: select one or more suppliers and/or site developers to expand the Charging Network beyond the EV Project
- Goal: Coordinated RFI/RFP process in two states
- Single largest US project to-date
- Quick Charger suppliers selected through RFP March 2011
Other On-going Efforts

- While USDOE grant for EV charging infrastructure is a key component, other complementary activities are envisioned
  - Areas in Oregon/SW Washington outside the grant
  - Electric trucks, off-road transportation electrification
- Oregon State Building Code Division already amended electrical code for EV charging stations
  - Statewide rule preempts local regulations
  - Established standards for permitting and inspection
- Next Oregon building code update (2010-11) for new homes/buildings to include PIV charging
- ODOT finalized EVSE installation manual for both residential and commercial sites

Common Logo Available to Identify EV Chargers

Come Take a Look

Hilton Hotel
5 Blocks East of Salmon St NW
World Trade Center Charging Station
**US Government Plans**

- Goal - 1 million advanced technology vehicles on US roads by 2015
- Change $7500 Federal tax credit for EV into rebate at point of sale
- Hot off the press – May 11, 2011
  - Promoting Electric Vehicles Act introduced by US Senate
- Enhanced R&D investments in electric drive, batteries and energy storage technologies
- Prioritized advanced EV charging infrastructure in up to 30 “designated communities”
- Increased tax credit for EV charging stations
- Higher tax credit for hybrid and pure electric trucks
- Incentives for using old reconditioned batteries from EV for energy storage

**Positioning Your Community or Business**

- Become EV Ready
  - Think about incentives and programs to encourage Electric Vehicles
  - Assess your organizational needs for EVs in your fleet.
  - Identify where the vehicles, “home base” would be, and identify other locations where these vehicles would need to charge as part of their daily use routine.
  - Think about EVs and EVSE compatibility in all new construction and renovation project scopes to either include them during that process or facilitate implementation in the future.
- Actions
  - If you are interested in free Electric Vehicle Supply Equipment (EVSE), installed at your home or business with the purchase of a new Nissan Leaf Electric Vehicle register at [www.see我家.oregon.gov/leaf-electric-car](http://www.see我家.oregon.gov/leaf-electric-car)
  - If you are interested in hosting a public location for an EVSE and having some of the costs paid by The EV Project, sign up at [www.theEProject.com](http://www.theEProject.com)
- Resources
  - [www.evroadmap.com](http://www.evroadmap.com)
  - Electrification Roadmap Report can be downloaded at [www.electrificationcoalition.org](http://www.electrificationcoalition.org)

**Summary**

- Leadership
- Visibility
- Confidence
- Experienced Users
- Energy Security
- Preparedness
Contact Info

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