I-5 Electric Highway
Public/Private Partnership Project

Jeff Doyle
Director, Public/Private Partnerships
Washington State Department of Transportation

Presented to
AASHTO Climate Change Steering Committee,
AASHTO Spring Meetings 2011
May 4, 2011
GHG emissions from Washington State’s transportation sector (47%) are nearly double the national figures.

Within the next 30 years, the central Puget Sound region is expected to grow by 1.5 million people – increasing travel demand by 40%.

Puget Sound region population and employment forecasts, 2040.
2008 WSDOT Alternative Fuels Corridor Economic Feasibility Study:

“The primary challenge to Alternative Fuels commercialization is how to build a market – simultaneously – for new vehicle technologies, new fuels, and new infrastructure to support them.”

Comparative Costs for Alternative Fueling Stations

<table>
<thead>
<tr>
<th></th>
<th>Land &amp; Building</th>
<th>Fueling Equipment</th>
<th>Supply Chain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gasoline</td>
<td>$1,348,500</td>
<td>$571,000</td>
<td>Established</td>
</tr>
<tr>
<td>Biodiesel</td>
<td>(Co-located?)</td>
<td>$127,000*</td>
<td>Limitations</td>
</tr>
<tr>
<td>Hydrogen</td>
<td>(Co-located?)</td>
<td>$318,000</td>
<td>Not Established</td>
</tr>
<tr>
<td>Electricity</td>
<td>Kiosk</td>
<td>$50,000 - $90,000**</td>
<td>Grid</td>
</tr>
</tbody>
</table>

* Number of pumps scaled for smaller initial demand
** Upper range includes utility connections and necessary upgrades
Electric Vehicles: Battery Electric (BEV) vs. Plug-in Hybrid (PHEV)

Example: Nissan LEAF
- All Electric Range: 60 - 200 Miles, depending on battery size
- Level 1 (120 v), Level 2 (240 v) and optional Quick-Charging (480v)
- Target markets:
  - Urban Commuters
  - Second Car in Every Home
  - Eventually: all-purpose

Example: Chevy Volt
- Battery Electric plus ICE range extender
- 10-40 mi all-electric, 200-300 mi gas
- Level 1 (120v) and Level 2 (240v) Charging
- Target Market: all automotive applications
## Nissan LEAF Range and Vehicle Efficiency

<table>
<thead>
<tr>
<th>Speed and Driving Conditions</th>
<th>Outside Temp (F)</th>
<th>Accessories</th>
<th>Estimated Range (mi)</th>
<th>Vehicle Efficiency (mi/kWh)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cruising 38 mph</td>
<td>68°</td>
<td>None</td>
<td>138</td>
<td>5.75</td>
</tr>
<tr>
<td>Fairly steady 24 mph City traffic</td>
<td>77°</td>
<td>None</td>
<td>105</td>
<td>4.38</td>
</tr>
<tr>
<td>Steady 55 mph Highway</td>
<td>95°</td>
<td>A/C on</td>
<td>70</td>
<td>2.91</td>
</tr>
<tr>
<td>Crawling 15 mph Stop-and-go</td>
<td>14°</td>
<td>Heater on</td>
<td>62</td>
<td>2.60</td>
</tr>
<tr>
<td>Average 6 mph Heavy stop-and-go</td>
<td>86°</td>
<td>A/C on</td>
<td>47</td>
<td>1.96</td>
</tr>
</tbody>
</table>

WHY ELECTRIC?

Charging Options and Time to Fully Recharge

120 V (Level 1)
- Slow, but works with a standard outlet, adequate for long layovers, may take 16-20 hours to fully recharge

240V (Level 2)
- Home recharging, requires a charging unit to be installed, typical 4-6 hour recharging time
- Works for public charging at places where you WANT to be for a few hours (dining, entertainment, workplace)

DC Fast-Charging
- 20 minutes for about 80 miles of range, may allow for extended driving distances
- Requires serious and expensive charging unit and installation
EV’s are not fully utilized when “range anxiety” exists

Source: Tokyo Electric Power Company (TEPCO)
Why Electric?

Strategically-located Fast Charge stations alleviate range anxiety

Source: Tokyo Electric Power Company (TEPCO)
WHY ELECTRIC?

Strategically-located Fast Charge stations alleviate range anxiety.

Drivers returned EV’s with > 50% SOC

Drivers returned EV’s with < 50% SOC

Source: Tokyo Electric Power Company (TEPCO)
This ‘green freeway’ you’re planning…would link your states with a network of rest stops that allow you to do more than just grab a cup of coffee, but also charge your car.

- President Barack Obama
3/19/2009

The I-5 Electric Highway

President Barack Obama
Goal: 1 million electric vehicles by 2015
Project Purpose: Commercialization of Electric Vehicles

- Develop safety net of EV Fast-Charge stations throughout I-5 corridor – WSDOT’s niche is outside of Seattle-metro area

- Public/Private Partnerships: retailers to serve as host sites; and DBFOM to develop, install and operate chargers

- Coordinate EV infrastructure development with other EV chargers planned for Seattle, Vancouver, BC, State of Oregon (ODOT), and eventually, California (missing link)
Electric Highways Project

- **Funding**: $1.32 m seed funding from US Dept. of Energy (via state energy program block grant)

- **Minimum of DC Fast-charge stations**: 9 (7 along I-5; 2 along US-2 (E-W route over Cascade Mtns))

- **Coordination**: with Oregon and B.C. to make PNW EV-ready

- **Target completion date**: October 31, 2011
Emerging Policy Issues to Consider (from WSDOT’s perspective):

- Capital efficiency of PPP (leverage) vs. strong government ownership role
- What happens after Year 3 (turn-back)?
- Long-term sustainable business model for EV charging stations?
- Non-financial incentives to increase EV sales – HOV lane access
- Roadway cost responsibility: diminution of gas tax revenues from alt fuel and super-efficient vehicles
Opportunities and Resources for State DOTs and Municipalities

- **Transportation Pooled Fund Study Opportunity**: “Strategies and Best Practices for State Departments of Transportation to Support Commercialization of Electric Vehicles (EV) and Infrastructure” Solicitation
  #128 [http://www.pooledfund.org/projectdetails.asp?id=1289&status=1](http://www.pooledfund.org/projectdetails.asp?id=1289&status=1)

- West Coast Green Highway ([www.westcoastgreenhighway.com](http://www.westcoastgreenhighway.com))

- The EVProject ([www.TheEVProject.com](http://www.TheEVProject.com))

- Electric Drive Transportation Association ([www.GoElectricDrive.com](http://www.GoElectricDrive.com))

- Pew Center on Global Climate Change ([www.PewClimate.org](http://www.PewClimate.org))
Goal: Accelerate the adoption of plug-in electric vehicles by defining an action plan for integrating these vehicles with the U.S. electrical grid

Stakeholders include:
All levels of government (including N. Carolina and Washington DOT’s)
Automakers
Vehicle recharging companies
Battery manufacturers
Electric power providers
NGOs
Research organizations
Pew Center Deliverables: 3 Comprehensive White Papers

1. **State of Play**: identification of challenges and current practices re PEV integration with utilities and government policy

2. **Literature Review**: summarizing key issues and public policy options

3. **The Action Plan**: propose recommendations for integrating PEVs with the U.S. electrical grid, including roles of government and private sectors.

Contact: Nick Nigro, Solutions Fellow, Pew Center on Global Climate Change

Nigron@PewClimate.org  tele (703) 516-0628
I-5 Electric Highway
Public/Private Partnership Project

For more information, contact:

Jeff Doyle
Director of Public/Private Partnerships
WSDOT (360) 705-7023
DoyleJ@wsdot.wa.gov
www.westcoastgreenhighway.com