The role of infrastructure in PEV adoption

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STEPS Workshop: Critical Barriers and Opportunities for PEV Commercialization in California
April 26, 2016
Focus Groups: The Role of Public Infrastructure

• Group 1
  • 12 participants
• Group 2
  • 15 participants
• Vehicles
  • Tesla Model S, Honda Fit, Toyota RAV4, Nissan Leaf, Ford C-Max, Toyota Prius Plug-in, Fiat 500e, Chevy Volt, Mercedes B-Class, Ford Fusion, Chevy Spark

Topics
• **What was the role of public infrastructure in the decision to buy the PEV?**
• How does public infrastructure impact purchase and will it change PEV usage?
  • Location
  • Type
  • Willingness to pay for public charging
• Etiquette
• Future Vehicles
The Role of Chargers in Buying PEV Focus Group Results:

• Nissan LEAF leased household:
  • The free workplace charging balanced out the lease cost, we would have stay with one car without it.

• Fiat 500 household:
  • We just stopped at the dealer to kick tires, we had no idea where we will plug it in when we drove it home.

• Toyota Prius household:
  • My next car will be a BEV, but I’m waiting for the electric highway to be finished.
Who buy new ICE cars and who can plug-in at home?

- 4% of HH purchased 2+ cars = 28% of new cars
- 21% bought 1 car = 72% of new car purchases
- 75% of the households did not purchase new car in the last 3 years

In San Diego, about 80% of detached households can charge on level 1, about 40% can charge on level 2. The national average is about 55% for level 1 (Axsen and Kurani 2012).

**Housing Type**

- No Vehicles
- No New Vehicles
- 1 New Vehicles
- 2+ New Vehicles

- Others
- Building with apartments/condos
- Single family house attached
- Single family not attached
Where/do they Charge?

- BMW i3: Only at Home
- Ford Focus Electric: Both home and Public
- Toyota RAV4 EV: Both home and Public
- Tesla Model S 85: Both home and Public
- Honda Fit EV: Both home and Public
- Nissan LEAF: Both home and Public
- BMW i3 REX: Both home and Public
- Fiat 500e: Only at Public
- Chevrolet Spark EV: Both home and Public
- Chevrolet Volt: Both home and Public
- Ford C-Max Energi: Both home and Public
- Ford Fusion Energi: Both home and Public
- Toyota Prius Plug In: Both home and Public

UC Davis
Plug-In Hybrid & Electric Vehicle Research Center
of the Institute of Transportation Studies
The Impact of Workplace Charging Drops With Longer Range PEVs

eVMT Projections W/Home Charging and Work Charging for PHEVs.

- eVMT if everyone had work charging
- Projected eVMT w/home charging
- Percent of total miles attributed to work charging. Only needed energy.
Most Important Non-Monetary Incentives

- Toyota Prius Plug-In
- BMW i3 REX
- Ford C-Max Energi
- Tesla Model S 85
- BMW i3
- Ford Fusion Energi
- Chevrolet Spark EV
- Toyota RAV4 EV
- Chevrolet Volt
- Ford Focus Electric
- Nissan LEAF
- Fiat 500e

Legend:
- HOV lane access
- Workplace Charging
- Discounted Parking
- Preferred Parking Location
How Important is it for Purchase?

- 3 = Extremely Important. -3 = Not at All Important

Importance of Workplace Charging to Purchase

Chevrolet Volt  Ford C-Max Fusion  Ford Fusion Energi  Nissan Leaf  Tesla Model S  Toyota Prius Plug-in  Mean
## Analysis of all Incentives

<table>
<thead>
<tr>
<th></th>
<th>Federal Tax Credit</th>
<th>State Incentives</th>
<th>Home Charger Subsidy</th>
<th>Workplace Charging</th>
<th>HOV Lane Access</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Applicability</td>
<td>Importance</td>
<td>Applicability</td>
<td>Importance</td>
</tr>
<tr>
<td>Chevrolet Volt</td>
<td>2389</td>
<td>91%</td>
<td>1.99</td>
<td>54%</td>
<td>1.48</td>
</tr>
<tr>
<td>Nissan Leaf</td>
<td>1894</td>
<td>93%</td>
<td>2.09</td>
<td>72%</td>
<td>1.97</td>
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<tr>
<td>Tesla Model S</td>
<td>1495</td>
<td>97%</td>
<td>0.97</td>
<td>60%</td>
<td>0.80</td>
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<tr>
<td>Toyota Prius Plug-in</td>
<td>1240</td>
<td>89%</td>
<td>1.53</td>
<td>66%</td>
<td>1.29</td>
</tr>
<tr>
<td>Ford C-Max Energi</td>
<td>818</td>
<td>90%</td>
<td>1.63</td>
<td>56%</td>
<td>1.27</td>
</tr>
<tr>
<td>Ford Fusion Energi</td>
<td>606</td>
<td>88%</td>
<td>1.64</td>
<td>60%</td>
<td>1.18</td>
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<tr>
<td>Fiat 500e</td>
<td>315</td>
<td>100%</td>
<td>2.04</td>
<td>98%</td>
<td>2.00</td>
</tr>
<tr>
<td>Toyota RAV4 EV</td>
<td>204</td>
<td>97%</td>
<td>1.77</td>
<td>94%</td>
<td>1.59</td>
</tr>
<tr>
<td>BMW i3</td>
<td>171</td>
<td>97%</td>
<td>1.91</td>
<td>88%</td>
<td>1.50</td>
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<tr>
<td>Ford Focus Electric</td>
<td>130</td>
<td>98%</td>
<td>2.18</td>
<td>95%</td>
<td>2.14</td>
</tr>
<tr>
<td>Chevrolet Spark EV</td>
<td>87</td>
<td>99%</td>
<td>2.05</td>
<td>95%</td>
<td>1.98</td>
</tr>
<tr>
<td>Honda Fit EV</td>
<td>74</td>
<td>99%</td>
<td>-0.08</td>
<td>74%</td>
<td>1.39</td>
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<tr>
<td><strong>All</strong></td>
<td><strong>9556</strong></td>
<td><strong>92%</strong></td>
<td><strong>1.72</strong></td>
<td><strong>65%</strong></td>
<td><strong>1.48</strong></td>
</tr>
</tbody>
</table>
How Many PEVs Can Be Directly Attributed to Workplace Charging?

• If workplace charging were not available when buying my PEV (or any other plug-in vehicle) I would choose:

- Workplace Charging is not the number one non monetary incentive: 87.0%
- Non plug-in vehicle: 13.0%
- A plug-in vehicle: 4.3%
- Not to buy/lease a vehicle at all: 7.4%
- Other: 1.4%

Only about third of the respondents report a non-monetary incentive i.e. total sales that can be directly attributed to workplace chargers may be lower than 8.8%
Overlapping Incentives

No Need of any Incentives
22%-50%

Monetary Incentives
25%-50%

Non monetary Incentives (HOV)
5%-20%

Public infrastructure
2%-8%
Conclusions Limitations
Policy Implications

• Public infrastructure sells PEV though most buyers will not use it regularly
• For up to 8.8% of our survey, workplace chargers where essential for the vehicle purchase (but it’s highly correlated with free charging)
• Public chargers reduce the purchase barrier when home L2 is not an option
• But if most users will not need public infrastructure, how do we convey that it’s not a barrier for purchasing?
Public Infrastructure may have a critical role in crossing the “chasm” between mix fleet & EV only fleet.

Graph showing transition from PHEVs and second vehicles to ZEV only households.
Policy Question

How to build public infrastructure to:

• Support PEV usage
• Use the infrastructure to promote PEVs

And at the same time

Educate potential buyers that most users will not need it to fully enjoy the benefit of PEVs
Thank You
Questions?

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