I Am Not An Environmentalist Wacko!  
Getting From Early Plug-in Vehicle Owners to Potential Later Buyers

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Purpose of this Study

• What is the role of PEV charging infrastructure in shaping consumer demand for PEVs in California; what is the role of consumer demand in shaping PEV charging infrastructure?

• Assumption: After three years of PEV sales, ICEV owners will be sufficiently aware of PEVs to work with PEV owners to explore these issues.  
  – Oops.
Purpose of this Study

- Pervasive lack of awareness on the part of ICEV owners—even that PEVs are for sale
  - Other issues are more fundamental and prior to charging infrastructure in ICEV drivers minds
- Research tasks were re-purposed to explore how owners of non-PEVs respond to the accounts of PEV owners
- Plus, a little we did learn about infrastructure from the PEV owners

Study Design

- Interviews and workshop
- In home interviews prior to workshop
  - PEV driver interviews
    - Purchase and use of PEV
    - Possible changes to infrastructure
  - ICEV driver interviews
    - Household vehicle history
    - Conditions and situations they acquired their vehicles
Study Design

• Workshops
  – Brought together all participants in each region
  
  – Takes the ICEV owners from their day-to-day world in which they may not know anyone who drives a PEV to a discussion with PEV owners
  
  – PEV drivers serve as a resource of behavior, information, and values for drivers without experience of PEVs

Study Regions

• Sacramento, San Jose, Fresno
• Why these three?
  – Differences in the uptake of PEVs and deployment of charging infrastructure
  – Differences between socio-demographic measures of early PEV buyers and the populations of all vehicle buyers
  – Variation in availability and likely valuation of incentives for PEV purchase and use
### PEVs, Infrastructure, Socio-Demographics

<table>
<thead>
<tr>
<th>Region:</th>
<th>“Fresno”</th>
<th>“Sacramento”</th>
<th>“San Jose”</th>
<th>California</th>
</tr>
</thead>
<tbody>
<tr>
<td>PEVs per 1,000 people</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.49</td>
<td>0.97</td>
<td>5.54</td>
<td>1.80</td>
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<tr>
<td>Public Level 2 and Quick charge infrastructure: number of locations and total chargers</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Level 2:</td>
<td>5 locations 8 chargers</td>
<td>Level 2:</td>
<td>74 locations 222 chargers</td>
<td>Level 2:</td>
</tr>
<tr>
<td>Quick charge:</td>
<td>0 locations 8 chargers</td>
<td>Quick charge:</td>
<td>4 locations 8 chargers</td>
<td>Quick charge:</td>
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<td></td>
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<tr>
<td>Median household income, 2008-2012</td>
<td>$45,741</td>
<td>$55,846</td>
<td>$90,747</td>
<td>State: $61,400</td>
</tr>
<tr>
<td>Homeownership rate, 2008-2012, %</td>
<td>54.2 PEV owners: 92</td>
<td>57.6 PEV owners: 93</td>
<td>58.1 PEV owners: 89</td>
<td>State: 56.0 PEV owners: 87</td>
</tr>
<tr>
<td>Bachelor’s degree or higher, % of persons age 25+, 2008-2012</td>
<td>19.4 PEV owners: 71</td>
<td>27.9 PEV owners: 81</td>
<td>46.0 PEV owners: 90</td>
<td>State: 30.5 PEV owners: 83</td>
</tr>
<tr>
<td>Female, %</td>
<td>50.0 PEV owners: 23</td>
<td>51.1 PEV owners: 24</td>
<td>49.7 PEV owners: 24</td>
<td>State: 50.3 PEV owners: 24</td>
</tr>
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### PEV Incentives

<table>
<thead>
<tr>
<th>California</th>
<th>“Fresno”</th>
<th>“Sacramento”</th>
<th>“San Jose”</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Federal income tax credit: $2,500 to $7,500</td>
<td>California, plus:</td>
<td>California, plus:</td>
<td>California, plus:</td>
</tr>
<tr>
<td>2. California Clean Vehicle Rebate: $1,500 (PHEV) or $2,500 (EV)</td>
<td>San Joaquin Valley Air Pollution Control District PEV purchase rebate: $2,000 (PHEV) or $3,000 (EV)</td>
<td>City of Sacramento: free parking and charging in a city-operated parking garage downtown. Parking: $200 per month Charging: variable</td>
<td>Home EVSE purchase and installation rebate: up to $1,500. (Available during the period these PEV owners acquired their PEVs. This program is now over.)</td>
</tr>
<tr>
<td>3. California HOV lane access to single occupant vehicles: Individual valuation of time savings</td>
<td>Home EVSE purchase and installation rebate: up to $1,500. (Available during the period these PEV owners acquired their PEVs. This program is now over.)</td>
<td></td>
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</tr>
</tbody>
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<tr>
<th>HOV definition</th>
<th>2 or more people</th>
<th>3 or more people</th>
</tr>
</thead>
<tbody>
<tr>
<td>HOV lane miles</td>
<td>1,552.7</td>
<td>69.8</td>
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</table>
**PEV Drivers**

- Sampled for maximum variety
  - Type of PEV
  - Income
  - Age
  - Gender
  - Children in the home or not
  - Employed or retired
  - *Sacramento only, if they commuted in their PEV to downtown Sacramento and whether or not they had a home charger*

**ICEV drivers**

- Sampled to be similar, as a group, to the sample of PEV drivers in the same city/region
- Gender
  - The target population was buyers of all vehicles, thus the samples are balanced on gender rather than being predominantly men
Sample

- Sacramento
  - 11 PEV and 10 ICEV, 11 male and 10 female, age 23-73, 10 didn’t have kids in the house and 11 did
- San Jose
  - 11 PEV and 11 ICEV, 12 male and 10 female, age 29-67, and 14 didn’t have kids in the house and 8 did
- Fresno
  - 8 PEV and 9 ICEV, 9 male and 8 female, age 27-66, and 8 didn’t have kids in the house and 10 did

PEV driver’s vehicles

- 20 EVs
  - Mitsubishi i-MiEV, Fiat 500E, Ford Focus EV, Nissan Leaf, Toyota RAV4EV, and Tesla S
    - Span the presently available spectrum of price, performance, luxury, driving range, and charging power
- 10 PHEVs
  - Honda Accord Plug-in, Toyota Prius Plug-in, and Chevrolet Volt
    - More nearly similar to each other than the EVs
    - Most pertinent difference: electric driving range
Despite living in the same geographic region, PEV and ICEV drivers experience a different landscape

- PEV drivers see PEVs and signs of them everywhere; ICEV drivers don’t see them anywhere
  - Some San Jose ICEV drivers were aware of HOV lane access—but don’t know what vehicles qualify

Introduced to PEVs and PEV drivers, what do ICEV drivers want to talk about?

- ICEV Drivers’ questions include:
  - Purchase costs; benefits of driving a PEV
  - No questions about incentives as they didn’t know any were available
  - Few questions about infrastructure
  - Both topics of incentives and infrastructure had to be introduced by PEV drivers
PEV drivers respond to ICEV questions

• 1) Accounts of saving money
  – Incentives and rebates
  – Free public charging
  – The cost of electricity is less than the cost of gasoline

• 2) Social benefits
  – Reducing air pollution
  – Reducing dependence on foreign oil
  – Some separate their motivations from those who claim environmental motivations
ICEV drivers could not participate in discussions of charging infrastructure due to a complete lack of awareness, knowledge, and consideration

- PEV drivers were prompted to explain
  - How they charge their PEV, Locations and cost of chargers

- ICEV drivers responded with questions
  - Home charger requirements, Battery depletion away from home, Benefits of using solar to charge a PEV, Locations of chargers outside their region

Home charging

- Level of charging
  - Level 1: 110v vs. Level 2: 220v
  - Level 2 charger installation. Or not.

- Frequency
  - From nearly never to daily—even for Evs

- Time of use rates
Charging while away from home

– Work-end charging
  • It’s free!
  • Availability can be challenging.
  • Etiquette is useful.
  • Communication between drivers is helpful

Charging while away from home

– Public charging in general
  • Around town vs. long trips
  • Congestion
  • Lack of chargers, especially in Fresno,
  • How much they are willing to pay
Where PEV drivers will and want to go

- Some only commute, others it is everyday-most-everything vehicle,
- They want more chargers on long trips to extend range and be able to go to the coast, mountains, and major metropolitan areas
  - For now, many take a gasoline car on these trips instead of their PEV

Where do we go from here?

- For ICEV drivers, crank up the (social) marketing machine
- For PEV drivers, the topics of range and infrastructure are correlated
  - Shorter range; want more daily charging away from home
  - Longer range; want to facilitate very long trips
- Research
  - Social-network sampling
    - Talk to ICEV owners recruited via PEV owners