Consumers, Plug-in Electric Vehicles, and Renewable Electricity

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Plug-in Electric Vehicles and Clean Energy in California
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Do consumers value plug-in electric vehicles (PEVs) and “green” electricity?

- Is the combination of PEVs and green electricity more highly valued than the sum of their individual values?
- Will more people buy both of them if they are framed together?
- Does the form of green electricity matter (and to whom)?
  - Sources: solar, wind, water,…
  - Rates/tariffs
  - Control/transparency
Green Electricity Program Designs

1. Monthly Tariff-based Programs
   - May be offered by an electric utility or third-party retailer to pay for investments in green electricity production
   - Per kWh premium price for green electricity
   - Consumer may be able to select electricity sources and percent of their monthly consumption

2. Green electricity production lease
   - Household leases an amount of green electricity production capability at a specific production facility
     - For example, 100KW blocks of production at a solar photo-voltaic installation

3. Home green electricity installation
   - Photo-voltaic ((PV) systems
   - Generally do not have electricity storage—so far
Meet the three survey samples

Three national samples of new car buyers
1. Conventional vehicle buyers (CVB); \( n = 1064 \)
2. Hybrid vehicle buyers (HEVB); \( n = 364 \)
3. Plug-in vehicle buyers (PEVB): \( n = 74 \)

We did not sample for green electricity participation

- Much higher self-reported participation in green electricity programs (6 to 8%)
  - NREL estimates for general population (1 to 2%)
- Much higher reported ownership of home solar PV by PEVB and HEVB
Comparing PEVB, HEVB, and CVB samples

- On average, PEVB sample differs from CVB and HEVB:
  - More vehicles per household; more likely to have higher education; more likely to live in a detached home they own
  - Much higher household income
  - Much older
PEV design games

Respondents first select their next anticipated vehicle by type (CV or HEV). The game allows respondents to redesign it (or not) as a hybrid, plug-in hybrid or electric version.

Design options included:
• Conventional Vehicles (CVs)
• Hybrid electric vehicle (HEV): 33% improved fuel economy.
• Plug-in hybrid electric vehicle (PHEV): 10, 20 or 40 miles of electric range, plus 33% improvement in fuel economy.
• Electric vehicle (EV): 75, 100, 125, 150, or 200 miles of pure electric range.
• Game played twice at two price levels.
Green Electricity design games

1. **No green program** (or current “green” program if already enrolled).
2. **Monthly Green Program**: 20 to 100 percent of home electricity use with *selected source*.
3. **Two-year Green Lease**: similar to the Green program, but funding a *specific solar or wind facility* (at a non-residential location); requires a two-year commitment.
4. **Install residential solar**: purchase and install a home solar PV system producing 180 to 900 kWh per month; financed in monthly utility bill for 20 years.

You will be shown two price scenarios:

**This is price scenario #1.**

Which of the following electricity programs would you select?

*Consult other household members if you would normally do so when considering your electricity bill.*

(click [here](#) to see program descriptions)

You can only select ONE of the follow electricity options. When you have explored the designs as much as you want, select your option by choosing the button on the right.

<table>
<thead>
<tr>
<th>Source of Green Electricity</th>
<th>% of Your Home Electricity and Cost</th>
<th>Electricity Savings</th>
<th>Total Electrical Bill</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Program</td>
<td>Your existing sources</td>
<td>Unknown</td>
<td>$100.00/month</td>
</tr>
<tr>
<td>Monthly Green Program</td>
<td>Solar</td>
<td>40% Green: $6.69/month</td>
<td>$106.69/month</td>
</tr>
<tr>
<td>2-Year Green Lease</td>
<td>Click to design</td>
<td>Click to design</td>
<td></td>
</tr>
<tr>
<td>Own Rooftop Solar</td>
<td>Solar</td>
<td>33% Solar: $29/month</td>
<td>-$33.00/month savings</td>
</tr>
</tbody>
</table>

[Next]
Game 1: Vehicle Designs, percent w/in segments

Vehicle Designs
- EV
- PHEV
- HEV
- CV

Segments
- CVB
- HEVB
- PEVB
Game 3: Designing vehicle and electricity

- HEVB/PEVB segments are more likely than CVB to combine PEV design with green-electricity option.
- CVBs/HEVBs tend to combine a PHEV with solar or a green program
- PEVBs most common design combination (38%) is an EV with home solar; none both designed a conventional vehicle and rejected green electricity
- Overall though, all samples are broadly spread across the possible combinations

*NOTE: respondents that already owned home solar did not complete Game 3.
Combining vehicle and electricity: what difference does it make to interest in PEVs?

23% increase in PEV demand
20% increase in PEV demand
5% increase in PEV demand

Game 1: PEV
Game 3: Mixed
CVB (n = 976)*
HEVB (n = 230)*
PEVB (n = 50)*

*Respondents that already owned home solar did not complete Game 3.
Survey Summary

- Many conventional car buyers were interested in some type of vehicle that “plugs-in” (typically a plug-in hybrid) and in some form of green-electricity.
  - HEV buyers and PEV buyers were more likely to inherently connect these ideas, and many already own home solar.
  - The type of green electricity program matters, too.

- Combining the PEVs with green-electricity increased PEV demand in all three segments (conventional, hybrid, and plug-in vehicle owners).
  - The proportional increase is highest among conventional vehicle owners.

- Motivations for the purchase of PEVs, green-electricity and their combination are varied within and across segments.
  - Conventional vehicle buyers are more motivated by cost savings
  - PEV buyers are motivated by technology and the environment.
How do we motivate purchases?

• Focus groups
  - May-June, 2011
  - Los Angeles; New York/New Jersey
  1) MINI-E
  2) MINI
  3) utility or third party green electricity programs

• Differences between and within these groups and our samples of buyers of new conventional, hybrid, and plug-in vehicles
Do MINI E Drivers Value Green e-?

• Mixed responses
  ▪ Maybe
    • “I’d like to know what the [environmental] effects [of recharging an EV from the grid] are so I can answer that when people ask me about my MINI E.”
  ▪ No
    • “Driving an EV has to be better than using gasoline.”
  ▪ Yes
    • Already making large investments in home solar photo-voltaic systems (nearly half the MINI E groups). When they got a PEV, they could “run it off the sun!”
Green e- participants

• They’re worried about PEVs; they have no experience.
  ▪ Recharging; driving range, batteries, politics/equity
    • Unfamiliar and concerned: toxicity, production of the batteries, disposal and recycling, electro-magnetic fields (EMFs), electro magnetic radiation (EMR).
    • Hybrid vehicles are better than PEVs because hybrids don’t allow people to “just plug in and pollute somebody else’s neighborhood in a poorer community.”
• They’re not sold on their own green electricity programs
  ▪ None were certain what they paid for their green energy
  ▪ Nor were any certain what they were buying
  ▪ They were concerned the program was a scam.
• Common Refrain: What is the important thing we can do?
How to stimulate consumer demand for PEV and green-electricity “packages”?

• The largest short-term opportunity exists with the PEV buyers.
  ▪ They are more likely to understand and be willing to invest in a combined package.
  ▪ They are not a monolithic group—appeal to multiple values and motivations

• Current HEV buyers present a similar short-term opportunity.

• Conventional vehicle buyers require more explanation, different motivations, as well as perhaps new social norms.
  ▪ Green electricity program participants should not be assumed to be a pool of easy converts to PEVs.
  ▪ Framing the benefits of combining PEVs and green-electricity: reduced environmental impact, avoidance of oil-related conflict, potential cost savings, cutting-edge technology, and control of fuel/energy sources.