Identifying Plug-in Electric Vehicle Consumers and the Role of Incentives

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Michael Nicholas

Public Workshop on Development of a Long-term Plan for the Clean Vehicle Rebate Project and Light-Duty Vehicle Incentives
• 11 states plus DC survey N=4,000 (EPRI 2014)
• California PEV owners N=5000 (ARB 2015)
• California used PEV buyers (ARB 2015)

• Neighborhood charging, EV infrastructure plan city of Davis (CEC 2014-2016)
• Street charging, MUDs infrastructure plan city of San Francisco (CEC 2015-2017)
• EV planning GIS Toolbox (CEC 2011-2015, Lead Mike Nicholas)

• BEV Households usage patterns N=70 LEAF HH (CEC, 2013)
• PEV Household Usage Project (CARB 2014-2016 Lead Mike Nicholas)
• Cellular data -long trips (STEPS 2015)

• PEV global projections (STEPS 2015 with Lew Fulton)
• China-U.S. ZEV Policy Lab (CATARC 2015-2016 Lead Yunshi Wang)
Plug in Electric Vehicle (PEV) Purchase Motivations

- Not using gas
- Performance
- Range
- Electric experience

MPG
NEW CAR BUYERS AND PEV BUYERS: PEV BUYERS ARE COMING BACK FOR SECONDS

- 4% of the households are responsible for almost one third of the market over the last 3 years 2010-2012
- Up to 15% of PEV buyers are on their second PEV
Federal Tax Credit

The credit is equal to $2,500 plus, for at least 5 kilowatt hours of capacity, plus an additional $417 for each kilowatt hour. The total amount of the credit allowed for a vehicle is limited to $7,500.
PEV Owner Survey (N=4600, December 2014)

- CHEVROLET VOLT: 1510, 33%
- NISSAN LEAF: 466, 10%
- TESLA MODEL S: 471, 10%
- TOYOTA PRIUS PLUG-IN: 284, 6%
- FORD C-MAX ENERGI: 919, 20%
- FORD FUSION ENERGI: 984, 21%

Bar charts show the distribution of PEV households by state for each model year from 2011 to 2014.
How Important was the Federal Tax Credit in the Decision to Buy a PEV?

In the next set of questions we will ask about the decision you made when buying/leasing your car. Please try to answer the following questions based on the knowledge you had when making your car purchase.

Plug-in cars are eligible for different local, state, and federal incentives. How important were those incentives in your decision to buy the TESLA MODEL S? (If the incentive was not available for you please move the slider bar to "Not Applicable")

### Federal Tax Credit

<table>
<thead>
<tr>
<th>Not Important</th>
<th>Important</th>
<th>Not Applicable</th>
<th>No answer</th>
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</table>

**What is the dollar value of this incentive for your household?**

$7500

### State Rebate

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<th>No answer</th>
</tr>
</thead>
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**What is the dollar value of this incentive for your household?**

$1000

### Local Rebate

<table>
<thead>
<tr>
<th>Not Important</th>
<th>Important</th>
<th>Not Applicable</th>
<th>No answer</th>
</tr>
</thead>
</table>

**What is the dollar value of this incentive for your household?**

$XXX.XX
BEVs Importance vs Value
Will They Buy the Same Car Without the Federal Incentive?

*Please mark your decision assuming that your most important incentive is not available.*

- Federal Tax Credit: $7500.00
- Workplace Charging
- Dedicated Parking
- State Rebate: $1000.00
- Subsidy for Installing Home Charger: $250.00
- High Occupancy Vehicle (HOV) Lane Access

I would like to go back to the vehicle selection page

Choose one of the following answers

- TESLA MODEL S: I will buy this car
- 2014 Sedan (4-door): I will buy this car
- BMW 650i xDrive Gran Coupe: I will buy this car
- Nissan Leaf: I will buy this car
- I will not buy a new car
Vehicle Choice Without the Federal Tax Credit

- **ALL**: 71.5%
- **TESLA MODEL S**: 86.1%
- **TOYOTA PRIUS PLUG-IN**: 84.7%
- **FORD FUSION ENERGI**: 82.3%
- **FORD C-MAX ENERGI**: 76.2%
- **CHEVROLET VOLT**: 59.7%
- **NISSAN LEAF**: 50.9%

Legend:
- Blue: will buy a PEV
- Gray: Will buy an ICE
- Yellow: I will not buy a new car
The Impact of $1000 per vehicle Federal Tax Credit (Actual Incentive $2,500-$7,500)

<table>
<thead>
<tr>
<th></th>
<th>What is the Impact of $1000 per vehicle Federal Incentive?</th>
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<tbody>
<tr>
<td></td>
<td>Additional PEV sales</td>
</tr>
<tr>
<td>NISSAN LEAF</td>
<td>0.068</td>
</tr>
<tr>
<td>FORD C-MAX ENERGI</td>
<td>0.062</td>
</tr>
<tr>
<td>TOYOTA PRIUS PLUG-IN</td>
<td>0.061</td>
</tr>
<tr>
<td>CHEVROLET VOLT</td>
<td>0.057</td>
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<tr>
<td>FORD FUSION ENERGI</td>
<td>0.047</td>
</tr>
<tr>
<td>TESLA MODEL S</td>
<td>0.019</td>
</tr>
</tbody>
</table>
2013 US Market by Segment and Price

100% = 16 million vehicles
The Impact of $1000 price Change on the Potential Market

- 6.47% (about 377,000 vehicles)
- 1.55% (about 90,000 vehicles)
- 0.06% (about 260 vehicles)
Interim Conclusions

• Almost half of the BEV 80 vehicle sales in the US can be attributed to the federal tax credit.
• The credit has a higher impact when applied at the maximum rate for both the Volt PHEV and the LEAF BEV (both in term of sales and in terms of additional eVMT).
• The impact on Tesla Model S sales is relatively low reflecting the share of the incentive of both the vehicle cost and the buyer’s income.
Non Monetary Incentives

The Case of HOV access in California
Most Important Non Monetary Incentives in California
Single Occupancy Vehicle HOV Access Permits in California

1. White stickers, available to an unlimited number of qualifying federal inherently-low-emission vehicles, which are mostly 100% battery electric vehicles (BEVs) and compressed natural gas vehicles and

2. Green stickers, available to the first 75,000 applicants that purchase or lease cars meeting California's transitional zero emission vehicle (TZEV) requirement, which are mostly plug-in hybrid electric vehicles (PHEVs).

- The expiration date for both the green and white stickers is 2019.
- HOV stickers save time and money (On bridge tolls, access tolls and HOT lanes)
What Will a PHEV Driver Buy Without the Green Sticker?

<table>
<thead>
<tr>
<th>Model</th>
<th>phev</th>
<th>BEV</th>
<th>ICE</th>
<th>Not to Buy</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMW i3 REX</td>
<td></td>
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<tr>
<td>Chevrolet Volt</td>
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<tr>
<td>Ford C-Max Energi</td>
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<tr>
<td>Ford Fusion Energi</td>
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<tr>
<td>Toyota Prius Plug In</td>
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<tr>
<td><strong>Total</strong></td>
<td></td>
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</tbody>
</table>
What a BEV Driver Buy Without HOV Access?
BEV to PEV Ratio (N=100,211)
Policy Options

• Limit the stickers to vehicles with longer EV range or BEVs only
  • Up to 50% of the potential “sticker buyers” will go for a BEV (or a long range PHEV?)
  • Will they plug in more?

• Limit the sticker to three years instead of a fixed sunset date
  • Open question:
    • What is the cost of enforcing this system?
    • How it will influence the incentive?
    • What about two sunset terms instead of one?

• Reduce or Cancel monetary rebate (state rebate) for sticker takers
Non-Monetary Incentives

The Case of Commute Charging
Where/do they Charge?

- **BMW i3**
  - Home: 80%
- **Ford Focus Electric**
  - Public: 90%
- **Toyota RAV4 EV**
  - Both: 95%
- **Tesla Model S 85**
  - Home: 75%
- **Honda Fit EV**
  - Public: 85%
- **Nissan LEAF**
  - Public: 90%
- **BMW i3 REX**
  - Both: 95%
- **Fiat 500e**
  - Public: 90%
- **Chevrolet Spark EV**
  - Both: 95%
- **Chevrolet Volt**
  - Both: 95%
- **Ford C-Max Energi**
  - Public: 90%
- **Ford Fusion Energi**
  - Public: 90%
- **Toyota Prius Plug In**
  - Both: 95%

Legend:
- Yellow: Both home and Public
- Gray: Only at Home
- Orange: Only at Public
- Blue: Not plug in
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.*

- **Ford Fusion downtown household:**
  - *I couldn’t charge at home, the free chargers a block from home are my main option, but now they are occupied even at night.*

- **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.*

- **Nissan LEAF household:**
  - *There are no public chargers that I can use, the few available are always in use.*

- **Toyota Prius household:**
  - *I planed on using 120v at home and all the public chargers in Berkeley, but I’m not using it anymore.*

- **Toyota Prius household:**
  - *My next car will be a BEV, but I’m waiting for the electric highway to be finished.*
How Important is it for Purchase?

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

Importance of Workplace Charging to Purchase
65%-70% of Households Commute with PEV

Do You Commute With Your PEV?

%-Do You Commute With Your PEV?

0% Yes
100% No

CA CO CT DC FL GA MA MI NJ NY TN TX VA Total

UC DAVIS PLUG-IN HYBRID & ELECTRIC VEHICLE RESEARCH CENTER of the Institute of Transportation Studies
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:

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

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 6.0%
Overlapping Incentives

No Need of any Incentives
22%-50%

Monetary Incentives
25%-50%

Non monetary Incentives (HOV)
5%-20%

Public infrastructure
2%-8%
Conclusions

• Monetary incentives work, but can be optimized based on sales price
• Non-monetary incentives work but may be correlated with less desired eVMT results.
• What is the measure for success? Green HOV stickers sell more PHEVs but white stickers may create more EVMT.
• Not all buyers need all incentives. Allow a selection of one incentives over the other (HOV access or CVRP for example) may reduce public cost with very low impact on sales.
Thank You

Questions?