Growing the Electric Vehicle Market: EV Adopters, “Rebate Essentials,” and “EV Converts”

Roadmap 12 Conference, Portland OR, 19 June 2019

December 2019 version with updates and corrections

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John Anderson – Research Analyst; and Keir Havel – Research Assistant

with thanks to Michelle Jones, Jamie Orose, and Laura Parsons
CSE Areas of Expertise

Clean Transportation
Adoption of electric vehicles and deployment of charging infrastructure

Built Environment
Advancing energy efficiency and renewable resources

Technology Convergence
Interconnecting systems to achieve decarbonization
### State EV Rebate Programs Administered by CSE
(as of Jan. 2019; Oregon pending)

<table>
<thead>
<tr>
<th>Type</th>
<th>Rebate Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel-Cell EVs</td>
<td>$5,000</td>
</tr>
<tr>
<td>All-Battery EVs</td>
<td>$2,500, $1,500 (BEVx only: $1,500)</td>
</tr>
<tr>
<td>Plug-in Hybrid EVs</td>
<td>$2,500 (i3 REx), $1,500</td>
</tr>
</tbody>
</table>
| Zero-Emission Motorcycles | $900, $450

- **≥ 20 e-miles only**
- **Income cap**
- **Increased rebates for lower-income households**
- **Base MSRP ≤ $50k**
- **No fleet rebates**
- **BEVs & PHEVs ≤ $50k base MSRP, FCEVs ≤ $60k**
  - **Point-of-sale option**
  - **$150 dealer incentive**
  - **Base MSRP > $60k = $500 max.**

<table>
<thead>
<tr>
<th>e-miles</th>
<th>Rebate</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥ 120</td>
<td>$2,000</td>
</tr>
<tr>
<td>≥ 40</td>
<td>$1,700</td>
</tr>
<tr>
<td>≥ 20</td>
<td>$1,100</td>
</tr>
<tr>
<td>&lt; 20</td>
<td>$500</td>
</tr>
</tbody>
</table>

**New York State**

- **BEVs & PHEVs ≤ $50k base MSRP, FCEVs ≤ $60k**
- **Point-of-sale option**
- **$150 dealer incentive**

**Zero-Emission Motorcycles**

- **All-Battery EVs**
- **Plug-in Hybrid EVs**
- **Fuel-Cell EVs**
- **Income cap**
- **Increased rebates for lower-income households**
- **Base MSRP ≤ $50k**
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- **Point-of-sale option**
- **$150 dealer incentive**

**Base MSRP > $60k = $500 max.**

**Point-of-sale**
### Consumer Survey Data  (Shows Rebates to Individuals Only)

<table>
<thead>
<tr>
<th>Vehicle Purchase/Lease Dates</th>
<th>Survey Responses (total n)*</th>
<th>Program Population (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dec. 2010 – May 2017</td>
<td>40,438</td>
<td>185,367</td>
</tr>
<tr>
<td>June 2014 – October 2017</td>
<td>2,549</td>
<td>5,754</td>
</tr>
<tr>
<td>May 2015 – June 2017</td>
<td>819</td>
<td>1,583</td>
</tr>
<tr>
<td>March 2017 – Nov. 2017</td>
<td>817</td>
<td>3,937</td>
</tr>
</tbody>
</table>

* Weighted to represent the program population along the dimensions of vehicle category, vehicle model, buy vs. lease, and county (using raking method)
How can research help us grow markets for electric vehicles?

- **Low-Hanging Fruit**: Understand existing adopters to reinforce and scale what is already working.

- **Tough Nuts to Crack**: Understand and break down barriers faced by consumers targeted based on policy priorities.

- **Expanding Market Frontiers**: Go beyond the enthusiastic core of EV markets in order to expand further into the mainstream.
Characterizing (Rebated) EV Market Segments

Existing Adopters: Market Acceleration
Characterize existing, generally enthusiastic and pre-adapted consumers, to target similar consumers who have the highest likelihood of adoption.

“Rebate Essential” Consumers: Minimizing Free Ridership
Characterize adopters most highly influenced by supportive resources to join the EV market, to improve the cost-effectiveness of outreach and program design.

“EV Converts”: Moving Mainstream
Characterize EV consumers with low initial interest in EVs, to look for additional opportunities to expand into the mainstream.
Existing Adopters: Recent Rebate Recipients

Data used:
• CA’s CVRP Consumer Survey, 2016–2017 edition

Subgroup examined:
• Individual consumers
• Purchased/leased PEVs between Nov 2016–May 2017
  –after most recent change to CVRP on Nov. 1st, 2016
• Received $1,500–$4,500 rebates

Additional details are available in the appendix slides
“Rebate Essentials”: Highly Influenced

Would **not** have purchased/leased their EV **without rebate**

2015–2016 edition: weighted, question n=11,457;
2016–2017 edition: weighted, question n=9,261
“EV Converts”: Low Initial Interest

Interest in acquiring a plug-in electric vehicle when started searching for a new vehicle

- 52% Only interested
- 25% Very interested
- 16% Some interest
- 4% No interest
- 2% No knowledge

EV Converts = 23%

Analysis: Description
## Setting an Appropriate Baseline: CA Car Buyers Are Different Than the Population

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Selected Solely White/Caucasian</td>
<td>38%</td>
<td>51%</td>
</tr>
<tr>
<td>Male</td>
<td>50%</td>
<td>50%</td>
</tr>
<tr>
<td>≥ Bachelor’s Degree*</td>
<td>33%</td>
<td>58%</td>
</tr>
<tr>
<td>Own Residence</td>
<td>55%</td>
<td>63%</td>
</tr>
<tr>
<td>≥ 50 Years Old</td>
<td>32%</td>
<td>46%</td>
</tr>
<tr>
<td>≥ $150k HH Income</td>
<td>18%</td>
<td>32%</td>
</tr>
</tbody>
</table>

National Household Travel Survey, California Add-On, 2017, weighted n = 742,702. NHTS weighted to represent population, not new-vehicle subset. New-vehicle buyers identified based on within-100-mile match between odometer and miles driven while owned.

* Census data: individual educational attainment for population 25 or older, NHTS: education of main driver
## EV Consumer Characteristics

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<tr>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>All</td>
</tr>
<tr>
<td><strong>Selected Solely White/Caucasian</strong></td>
<td>38%</td>
<td>51%</td>
<td>&lt;</td>
</tr>
<tr>
<td><strong>Male</strong></td>
<td>50%</td>
<td>50%</td>
<td>&lt;&lt;</td>
</tr>
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*Census data: individual educational attainment for population 25 or older, NHTS: education of main driver, CVRP survey: highest household attainment
### Target Segment Comparisons to Car Buyers

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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>All</td>
<td>Rebate Essentials</td>
</tr>
<tr>
<td>Selected Solely White/Caucasian</td>
<td>38%</td>
<td>51%</td>
<td>58%</td>
</tr>
<tr>
<td>Male</td>
<td>50%</td>
<td>50%</td>
<td>72%</td>
</tr>
<tr>
<td>≥ Bachelor’s Degree*</td>
<td>33%</td>
<td>58%</td>
<td>81%</td>
</tr>
<tr>
<td>Own Residence</td>
<td>55%</td>
<td>63%</td>
<td>79%</td>
</tr>
<tr>
<td>≥ 50 Years Old</td>
<td>32%</td>
<td>46%</td>
<td>50%</td>
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<tr>
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<td>32%</td>
<td>40%</td>
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* Census data: individual educational attainment for population 25 or older, NHTS: education of main driver, CVRP survey: highest household attainment.
Analysis: Explanation
Factors that Increase the Odds of Being an EV Convert*  
(Relative to Other EV Adopters)

EV consumers (both PHEV and BEV) are more likely converts if they:

– are younger, do not have solar
– are not highly motivated by reducing environmental impacts or HOV lane access
– do not spend time researching EVs online

Additionally:

• **PHEV** consumers are more likely converts if they chose PHEVs other than the Volt
• **BEV** consumers are more likely converts if they:
  – are women, do not identify as white/Caucasian, live in the Central Valley or LA/SoCal area, or have lower income
  – are moderately motivated by energy independence
  – Have no workplace charging
  – choose BEVs other than Bolt or Tesla (long-range BEVs?)
  – find the rebate essential to purchase/lease

* Significantly associated factors in binary logistic regression
Analysis: Prioritization
Comparison to Other Plug-in EV Adopters: Rebate Essential Explanatory Factors*

Continuous variables

- Lower price
- Difficulty finding information online
- More importance: carpool
- Younger age
- More importance: save on fuel costs

Categorical variables

- Central (vs. Bay Area)
- Central (vs. South)
- Lower-income Increased Rebate
- Did not hear about CVRP from the dealer
- Postgraduate degree (vs. Associate degree or less)

For more info, see:
- 2016 BECC talk
- 2017 TRR paper and TRB poster
- 2018 EVS 31 talk...

X-Standardized Rebate Essentiality Odds Ratios

* Significantly associated factors in binary logistic regression.
Note: standardized odds ratios for categorical and continuous variables are not directly comparable.
How can we help?

We work with governments, regulators, utilities, CCAs, businesses, property owners, and consumers as a trusted and objective implementation partner and technical advisor.

For more information:
https://cleanvehiclerebate.org/eng/program-reports
https://energycenter.org/thought-leadership/research-and-reports
brett.williams@energycenter.org

- Statewide incentive programs
- Region-specific solutions
- Tackling issues of national importance
Appendix
Public dashboards and data facilitate informed action

- >300,000 EVs and consumers have received >$675 M in rebates
- >45,000 survey responses being analyzed so far, statistically represent >200,000 consumers
- Reports, presentations, and analysis growing

- **Responses** from individual PEV consumers
  - Weighted to represent applicant population
  - \( n = 8,957 \)
  - \( N = 46,839 \)

- **After filtering**
  - Current program era: purchase dates Nov 2016–May 2017
  - Other analytical factors
    - Weighted \( n = 5,327 \)

### CVRP Eligibility

<table>
<thead>
<tr>
<th>Filing Status</th>
<th>Gross Annual Income</th>
<th>FCEV</th>
<th>BEV</th>
<th>PHEV</th>
<th>ZEM</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Income Cap</strong></td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Individual</td>
<td>&gt; $150,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Head of Household</td>
<td>&gt; $204,000</td>
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<tr>
<td>Joint</td>
<td>&gt; $300,000</td>
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<tr>
<td><strong>Standard Rebate</strong></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Individual</td>
<td>300% FPL to $150,000</td>
<td></td>
<td></td>
<td></td>
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### Increased Rebate for Low-Income Applicants*

<table>
<thead>
<tr>
<th>Household Income ≤ 300 percent of the federal poverty level (FPL)</th>
<th>FCEV</th>
<th>BEV</th>
<th>PHEV</th>
<th>ZEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>$7,000</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>$4,500</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$3,500</td>
<td></td>
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*Household Income ≤ 300 percent of the federal poverty level (FPL)
CSE: A Nonprofit With Billion Dollar Program Management Experience

• **Five Statewide Electric Vehicle Rebate Programs**
  > $700 million
  > 300,000 rebated vehicles
  > 200,000 consumers characterized

• **Statewide EV Charging Incentives**
  > $100 million
  367 DC fast chargers, 211 Level 2 chargers and growing
  Diverse: urban, rural, mountains, deserts, plains

• **Solar On Multifamily Affordable Housing Program**
  $1 billion
  300 MW + virtual net energy metering
Contact Us
EnergyCenter.org

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