Clean Vehicle Rebate Project:
Fuel-Cell Electric Vehicle Data and Lessons Learning

CaFCP Executive Board Meeting, 18 October 2016, West Sacramento
Brett Williams, M.Phil. (cantab), Ph.D. – Principal Advisor, Clean Transportation

Thanks also to John Anderson, Kipp Searles, Clair Johnson, Colin Santulli, and others at CSE
Center for Sustainable Energy (CSE)

- Building Performance
- Clean Transportation
- Distributed Generation
- Energy Efficiency
- Energy Storage
- Renewable Energy
CSE’s Plug-In & Fuel-Cell Electric Vehicle (EV) Activities

Incentives Design & Administration

Consumer & Dealer Outreach

Fleet Assistance & Clean Cities

PEV, Alt.-Fuel, & ZEV Planning & Implementation

Stakeholder Engagement

2nd Life Battery Research & Vehicle-Grid Integration
CSE has processed >163k rebates totaling ~$350M

California (CVRP), 2010–present
- Air Resources Board
- 2007 Legislation (AB118, then AB8) allowing vehicle registration fees
- Greenhouse Gas Reduction Fund

Massachusetts (MOR-EV), 2014–present
- Department of Energy Resources
- Regional Greenhouse Gas Initiative

Connecticut (CHEAPR), 2015–present
- Department of Energy & Environmental Protection
- Utility Settlement
- Vehicle rebate and dealer incentive (consumer can also assign vehicle rebate to dealer)
Outline

• What FCEV incentives are available?
• What FCEV data are available?
• What are we seeing so far?
  – Vehicles
  – Consumers
• What else will we know?
• What are we doing for PEVs that we might do for FCEVs?
• Wrap up
What incentives are available?

Clean Vehicle Rebate Project and other Cash Incentives
# EV Incentive Programs: Rebate Amounts

<table>
<thead>
<tr>
<th>Vehicle Type</th>
<th>Rebate Amounts</th>
<th><strong>MSRP</strong></th>
<th><strong>MSRP</strong></th>
<th><strong>MSRP</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel-Cell Electric Vehicles</td>
<td>$5,000</td>
<td>$2,500</td>
<td>$5,000</td>
<td></td>
</tr>
<tr>
<td>All-Battery Electric Vehicles</td>
<td>$2,500</td>
<td>$2,500</td>
<td>$2,500</td>
<td></td>
</tr>
<tr>
<td>Plug-in Hybrid Electric Vehicles</td>
<td>$2,500 (i³ REx)</td>
<td>$1,500</td>
<td>$2,500 (&gt;10kWh)</td>
<td></td>
</tr>
<tr>
<td>Neighborhood Electric Vehicles</td>
<td>$900</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zero-Emission Motorcycles</td>
<td>$900</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**MSRP > $60k = $1,000**

**Dealer incentive:**

- $300

*MSRP < $60k only

**Fees:**

- $3,000 > 25 kWh
- $1,500 20 to 25 kWh
- $750 < 20 kWh
- $3,000 > 18 kWh
- $1,500 10 to 18 kWh
- $750 < 10 kWh

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*MSRP < $60k only

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California Environmental Protection Agency

Air Resources Board
Increased Rebate Amounts for Low-to-Moderate-Income (LMI) Consumers

- Increased rebate for households with incomes ≤300% of the federal poverty level (FPL)
- As of November 1, 2016:
  - The increased rebate amount will become $2,000
  - Prioritization of rebate payments to low income consumers

<table>
<thead>
<tr>
<th>Persons in household</th>
<th>Max Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$35,640</td>
</tr>
<tr>
<td>2</td>
<td>$48,060</td>
</tr>
<tr>
<td>3</td>
<td>$60,480</td>
</tr>
<tr>
<td>4</td>
<td>$72,900</td>
</tr>
<tr>
<td>5</td>
<td>$85,320</td>
</tr>
<tr>
<td>6</td>
<td>$97,740</td>
</tr>
<tr>
<td>7</td>
<td>$110,190</td>
</tr>
<tr>
<td>8</td>
<td>$122,670</td>
</tr>
</tbody>
</table>
## Statewide Monetary Incentives (as of 1 Nov.)

<table>
<thead>
<tr>
<th>Type of Vehicle</th>
<th>CVRP</th>
<th>CVRP-LMI (≤300% FPL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrogen Fuel-Cell Electric Vehicles</td>
<td>$5,000</td>
<td>$7,000</td>
</tr>
<tr>
<td>Battery Electric Vehicles (&amp; i3 REx)</td>
<td>$2,500</td>
<td>$4,500</td>
</tr>
<tr>
<td>Plug-in Hybrid Electric Vehicles</td>
<td>$1,500</td>
<td>$3,500</td>
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What data are available?

CVRP Transparency Tools
Where can I get the data?: CSE Transparency Tools

- Public, online, interactive dashboards facilitate informed action
  - Data characterizing >163,000 EVs and consumers
  - ~$350M in rebates processed
  - >19,000 survey responses statistically represent >90,000 consumers

Also: zevfacts.com

ct.gov/deep

cleanvehicleredbate.org

mor-ev.org
What are we seeing so far?

Rebated vehicles
Cumulative California EV Sales (New Registrations)

~187,200 registered thru 2015

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Technology Share: CA Sales and Rebates

Sales

PHEV 50%

BEV 50%

Rebates

PHEV 43%

BEV 57%

Overall market data includes vehicles registered thru December 2015 and uses content licensed from and copyrighted by R.L. Polk & Co. Approved rebate applications thru July 2016.
Cumulative California FCEV Rebates

670 rebates thru Q3 2016*

*Approved rebate applications thru September 2016 as of 10 October 2016 (subject to change).
By County: New Clean Vehicle Registrations (thru Dec 2015) & FCEV Rebates (thru Sep 2016*)

Plug-in EV registrations

Fuel-cell EV rebates

Includes content supplied by R.L. Polk & Co.; Copyright © R.L. Polk & Co., 2015. All rights reserved. Approved rebate applications thru 30 September 2016 as of 10 October 2016 (subject to change).
Vehicle Replacement (vs. Additional Vehicle)

<table>
<thead>
<tr>
<th>Type of EV</th>
<th>Percent that Replaced a Previous Vehicle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plug-in hybrid EVs</td>
<td>83%</td>
</tr>
<tr>
<td>All-battery EVs (non-Tesla)</td>
<td>66%</td>
</tr>
<tr>
<td>Fuel-cell EVs</td>
<td>79%</td>
</tr>
</tbody>
</table>

Source: CV Consumer Survey
PHEVs and BEVs: n=9,744, surveyed Jun ’15 thru Mar ’16
FCEVs: n=47, surveyed Jul ’16 thru Sep ’16
What are we seeing so far?

Rebated consumers
Weighted EV Consumer Survey
(CVRP vehicles acquired Sep 2012 thru May 2015)

Survey sample
19,460 individuals responded to the survey**

Vehicles driven by respondents

- Nissan LEAF: 24%
- Chevrolet Volt: 20%
- Tesla Model S: 19%
- Toyota Prius Plug-in: 15%
- FIAT 500e: 13%
- Other: 9%

*Through May 2015, 150,287 new PEVs were adopted in California, 75,748 PHEVs and 74,539 BEVs.
**Results have been weighted to be representative of the entire program with respect to county, vehicle model and whether the vehicle was purchased or leased.

# Data Summary

<table>
<thead>
<tr>
<th></th>
<th>CVRP “EV Consumer Survey”</th>
<th>FCEV responses to CVRP “CV Consumer Survey”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>19,460</td>
<td>47</td>
</tr>
<tr>
<td>Weighted</td>
<td>to represent 91,085 program participants by model, county, and buy vs. lease</td>
<td>Not yet</td>
</tr>
</tbody>
</table>

Caveat emptor! (for now)
## Majority Characteristics of CVRP Consumers

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>CVRP-All (EV Consumer Survey 2014)</th>
</tr>
</thead>
<tbody>
<tr>
<td>40–59 years old</td>
<td>55%</td>
</tr>
<tr>
<td>≥ Bachelor’s</td>
<td>82%</td>
</tr>
<tr>
<td>Postgraduate</td>
<td>49%</td>
</tr>
<tr>
<td>Male</td>
<td>74%</td>
</tr>
<tr>
<td>White/Caucasian</td>
<td>63%</td>
</tr>
<tr>
<td>Detached homes</td>
<td>80%</td>
</tr>
<tr>
<td>$50–200k/y household income</td>
<td>62%</td>
</tr>
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Weighted CHTS data
Majority Characteristics of CVRP Consumers

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<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>40–59 years old</td>
<td>55%</td>
<td>52%</td>
<td>59%</td>
</tr>
<tr>
<td>≥ Bachelor’s Postgraduate</td>
<td>82%</td>
<td>66%</td>
<td>83%</td>
</tr>
<tr>
<td>Male</td>
<td>74%</td>
<td>49%</td>
<td>80%</td>
</tr>
<tr>
<td>White/Caucasian</td>
<td>63%</td>
<td>76%</td>
<td>50%</td>
</tr>
<tr>
<td>Detached homes</td>
<td>80%</td>
<td>75%</td>
<td>78%</td>
</tr>
<tr>
<td>$50–200k/y household income</td>
<td>62%</td>
<td>58%</td>
<td>47%</td>
</tr>
</tbody>
</table>

Weighted CHTS data
FCEV Consumers: Age

Source: Clean Vehicle Consumer Survey
FCEV Respondents: 47
Purchase/lease dates: March 2016- Sept 2016
FCEV Consumers: Ethnicity

Source: Clean Vehicle Consumer Survey
FCEV Respondents: 47
Purchase/lease dates: March 2016-Sept 2016
What were the top three influential information sources when you were deciding whether to acquire a FCEV? (percent of respondents selecting choice as one of top three)

- **Lease**
- **Purchase**

<table>
<thead>
<tr>
<th>Information Source</th>
<th>Lease</th>
<th>Purchase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturer website</td>
<td>22%</td>
<td>2%</td>
</tr>
<tr>
<td>Vehicle test drive</td>
<td>18%</td>
<td>4%</td>
</tr>
<tr>
<td>My employer</td>
<td>15%</td>
<td>36%</td>
</tr>
<tr>
<td>News story</td>
<td>32%</td>
<td>13%</td>
</tr>
<tr>
<td>Third-party vehicle review</td>
<td>32%</td>
<td>11%</td>
</tr>
<tr>
<td>Another FCEV driver</td>
<td>25%</td>
<td>11%</td>
</tr>
<tr>
<td>Dealer/salesperson</td>
<td>25%</td>
<td>9%</td>
</tr>
<tr>
<td>OTHER</td>
<td>11%</td>
<td>4%</td>
</tr>
<tr>
<td>Online discussion forum</td>
<td>9%</td>
<td>3%</td>
</tr>
<tr>
<td>Social media</td>
<td>9%</td>
<td>3%</td>
</tr>
<tr>
<td>Government agency</td>
<td>5%</td>
<td>2%</td>
</tr>
<tr>
<td>Non-FCEV driver</td>
<td>2%</td>
<td>2%</td>
</tr>
</tbody>
</table>

Source: Clean Vehicle Consumer Survey
FCEV Respondents: 47
Purchase/lease dates: March 2016- Sept 2016
FCEV Consumers: Primary Motivation

Which of these factors was the most important reason why you decided to acquire a FCEV?

- Reducing environmental impacts: 32%
  - Lease: 13
  - Purchase: 2
- Saving money: 28%
  - Lease: 12
  - Purchase: 1
- Carpool or HOV lane access: 19%
  - Lease: 7
  - Purchase: 2

- A desire for the newest technology: 6%
  - Lease: 3
  - Purchase: 3
- Other: 6%
  - Lease: 2
  - Purchase: 2
- Increased energy independence: 4%
  - Lease: 2
  - Purchase: 1
- Vehicle performance: 2%
  - Lease: 1
  - Purchase: 0
- Vehicle styling, finish and comfort: 2%
  - Lease: 1
  - Purchase: 0

Source: Clean Vehicle Consumer Survey
FCEV Respondents: 47
Purchase/lease dates: March 2016- Sept 2016
FCEV Consumers: HOV Sticker

Have you already received or applied for a carpool (HOV) lane sticker?

How often do you expect to use this sticker to gain access to the carpool lane?

- 50% Yes, I applied for it
- 30% Yes, it was provided by the dealer
- 20% No, but I plan to apply soon

Daily or almost daily
A few times per week
About once per week
A few times per month
About once per month
N.A.

Source: Clean Vehicle Consumer Survey
FCEV Respondents: 47
Purchase/lease dates: March 2016- Sept 2016
Would you have purchased or leased your FCEV without the state vehicle rebate (CVRP)?

- **No**
  - Lease: 66%
  - Purchase: 5%
  - Total: 26 respondents

- **Yes**
  - Lease: 34%
  - Purchase: 15%
  - Total: 15 respondents

Source: Clean Vehicle Consumer Survey
FCEV Respondents: 47
Purchase/lease dates: March 2016- Sept 2016
What were the top three perceptions about FCEVs that gave you concern about choosing one?
(percent of respondents selecting choice as one of top three)

- **Number of stations**: 81%
  - Lease: 34%
  - Purchase: 4%
- **Vehicle price**: 51%
  - Lease: 22%
  - Purchase: 2%
- **Cost of hydrogen**: 45%
  - Lease: 18%
  - Purchase: 3%
- **Vehicle range**: 32%
  - Lease: 14%
  - Purchase: 3%
- **Station reliability**: 26%
  - Lease: 12%
  - Purchase: 2%
- **New technology**: 23%
  - Lease: 9%
  - Purchase: 4%
- **Fuel-cell durability**: 15%
  - Lease: 3%
  - Purchase: 4%
- **Vehicle safety record**: 6%
  - Lease: 3%
  - Purchase: 4%
- **Enviro benefits**: 4%
  - Lease: 4%
  - Purchase: 4%
- **Vehicle choice**: 4%
  - Lease: 4%
  - Purchase: 4%
- **Repair costs**: 4%
  - Lease: 4%
  - Purchase: 4%

Source: Clean Vehicle Consumer Survey
FCEV Respondents: 47
Purchase/lease dates: March 2016- Sept 2016
FCEV Consumers: Station Usage

How often do you use any hydrogen stations in each of the following areas?

- Within a convenient distance of your home: 10%
  - Daily or almost daily: 10
  - A few times per week: 22
  - About once per week: 9
  - A few times per month: 5
  - About once per month: 12
  - Never: 4

- Along your daily commute: 6%
  - Daily or almost daily: 6
  - A few times per week: 16
  - About once per week: 0
  - A few times per month: 4
  - About once per month: 11
  - Never: 7

- Near other frequent destinations: 3%
  - Daily or almost daily: 3
  - A few times per week: 7
  - About once per week: 11
  - A few times per month: 9
  - About once per month: 14
  - Never: 25

- On the way to or near travel destinations: 4%
  - Daily or almost daily: 4
  - A few times per week: 13
  - About once per week: 11
  - A few times per month: 9
  - About once per month: 14
  - Never: 25

Source: Clean Vehicle Consumer Survey
FCEV Respondents: 47
Purchase/lease dates: March 2016- Sept 2016
FCEV Consumers: Station Usage

How often do you use any hydrogen stations in each of the following areas?

- Convenient distance from home
- Along your daily commute
- Near other frequent destinations
- On the way to travel destinations

Count of Responses

About once per week: 22
- Convenient distance from home: 16
- Along your daily commute: 7
- Near other frequent destinations: 1
- On the way to travel destinations: 5

Never: 25
- Convenient distance from home: 12
- Along your daily commute: 14
- Near other frequent destinations: 14
- On the way to travel destinations: 25

Source: Clean Vehicle Consumer Survey
FCEV Respondents: 47
Purchase/lease dates: March 2016- Sept 2016
What else will we know over time?
Survey topics

• Demographics, attitudes, and housing characteristics
• Household fleet characteristics
• Motivations for adoption
• Fueling situation and preferences
• Vehicle perceptions and barriers to adoption
• Impact of incentives and benefits on adoption
• Experience at the dealership
• Experience while researching a new vehicle
What are we studying for PEVs?
(that we could study for FCEVs)
Consumer research and analysis

- **Target Consumer Segments**: Converts, Rebate Essentials (forthcoming Oct 2016 pres and Jan 2017 paper)
- **Progress in Disadvantaged Communities** (forthcoming pres, Oct 2016)
- **Information Channels** (EV Roadmap pres, 2016)
  - Exposure & importance of various channels, consumer time spent researching various topics
- **Infographics**
  - Overall (CVRP infographic, 2016)
  - Disadvantaged Communities (forthcoming, Oct 2016)
- **Characterization of Participating Vehicles and Consumers** (CVRP research workshop pres, 2015)
- **Program Participation** by Vehicle Type and County (CVRP brief 2015)
- **Dealer services**: Importance and Prevalence (EF pres 2015)
  Also:
  - **Evaluation of the CT Dealer Incentive** (forthcoming pres, Oct 2016)
Wrap Up
Summary

• FCEVs are eligible for a $5,000 rebate ($7,000 for LMI households)
• A wide variety of 3-state program and market data is available online
• Q3 2016 saw more FCEV rebates generated than the entire history of the CVRP combined
• FCEV consumer survey data is now starting to accumulate, highlighting potential differences with plug-in vehicle adopters
  – Early indications, if they prove robust over time with more data, point to the importance of environmental motivations and incentives, as well as concerns about the number of stations and adoption costs
• Ongoing work segmenting and characterizing CVRP participants overall will increasingly shed light on FCEV markets
We work nationally in the clean energy industry and are always open to exploring partnership opportunities.

What would you like to know more about?
What decisions are you facing?
brett.williams@energycenter.org
Data Sources

Program:
• CVRP **EV Consumer Survey** (n=19,460)
  – EV purchase/lease dates 9/2012–5/2015
  – Weights applied to make responses represent 91,085 program participants along the dimensions of vehicle model, county, and buy vs. lease
• CVRP CV Consumer Survey (n=9,744)
• CVRP CV Consumer Survey - FCEV (n=47)
• CVRP **Rebate Applications** (n=164,934)

Market:
• EV Registration Data (Polk, N=187,206)