

Supporting EV Commercialization with Rebates: Statewide Programs, Vehicle & Consumer Data, and Select Findings

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Yale Center for Business
and the Environment

BLUEPRINT FOR CLEAN ENERGY

20 April, 2017

Outline

- Electric vehicle market update
- Statewide Rebate Programs in CA, MA, CT & NY
 - Design & Implementation
- Program Tracking
 - Rebated Vehicle & Consumer Data
- Program Evaluation
 - Select Findings: Impact, Design, Participation, Strategy, etc.
- Online Resources



Electric Vehicle (EV) Market Update

Questions to be explored

Electric vehicle market update

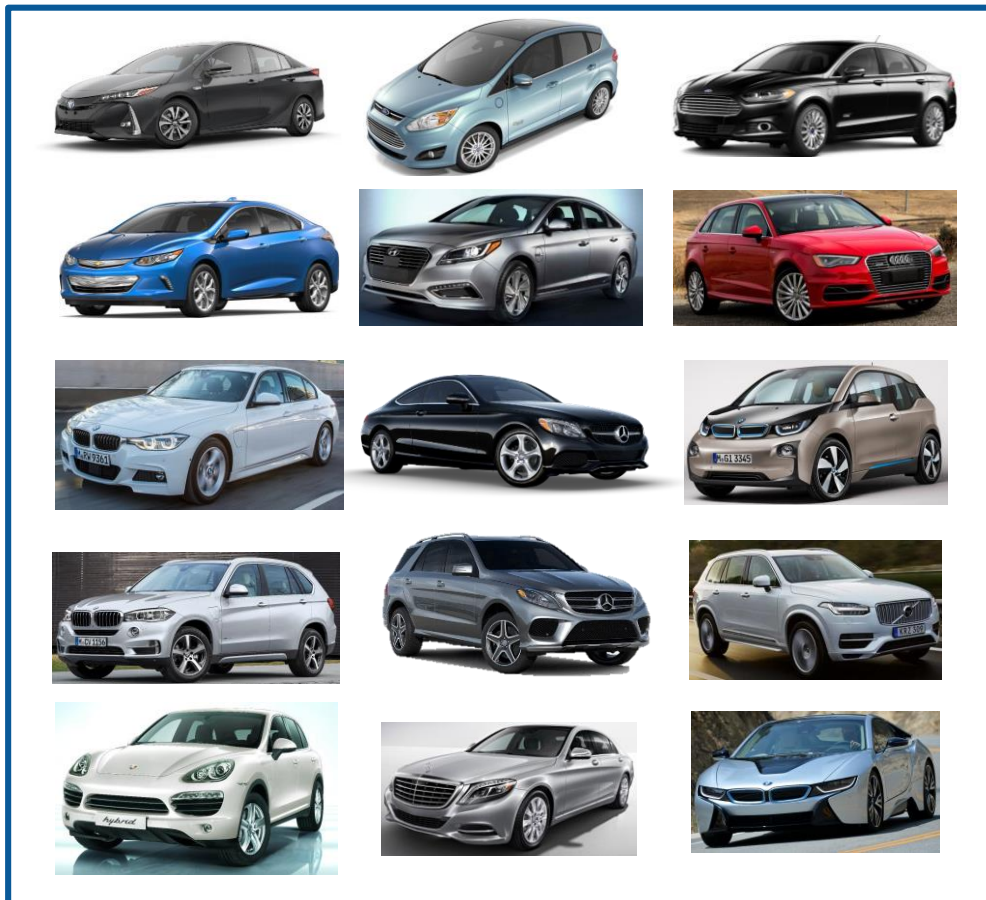
- What electric cars are now available?
- How are they selling?
- Which are right for me?



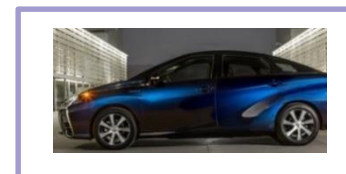
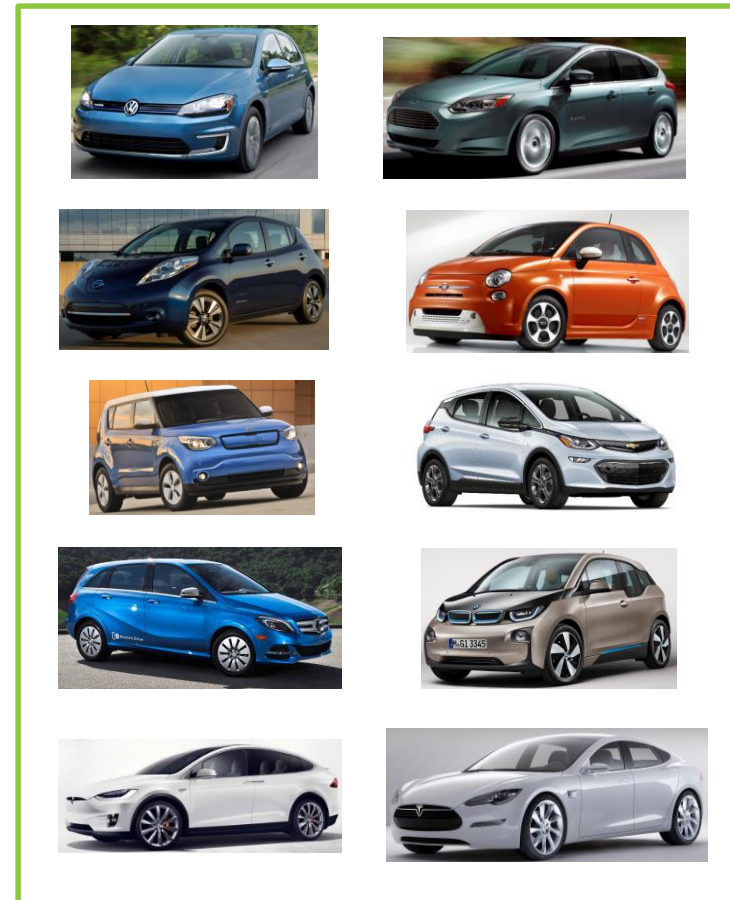
What electric cars are now available?

More Choice: Electric Vehicle (EV) Models

Plug-in hybrid EVs



All-battery EVs

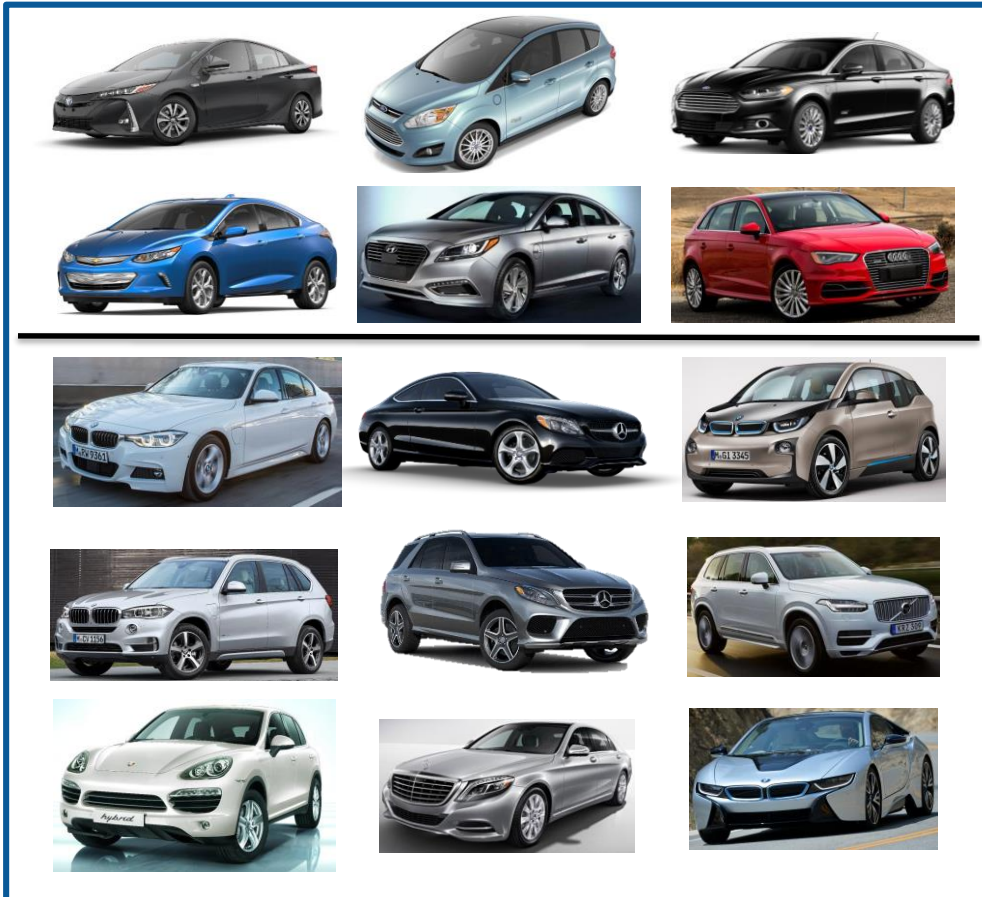


Fuel-cell EVs



Plug-in Hybrid Electric Vehicles (PHEVs)

Plug-in hybrid EVs



Depending on the model...

- Range: 180–640 miles total
 - 10–97 mi. on electricity plus
 - 83–615 on gasoline
- If forget to charge, acts like efficient gasoline hybrid
- If charge frequently driving can be electric
 - U.S. avg. commute: ~15 mi.
 - U.S. avg. daily driving: ~30 mi.
- MSRP: \$27,100–\$140,700

All models pictured had > 100 national sales in Q1 2017 (<http://insideevs.com/monthly-plug-in-sales-scorecard/>)

Range specs: FuelEconomy.gov

Daily driving: <https://www.aaafoundation.org/sites/default/files/AmericanDrivingSurvey2015FS.pdf>

All-Battery Electric Vehicles (BEVs)







Depending on the model...

- Range: 81–315 electric miles
- 0 to 60 mph: 2.3–10.1 seconds
- Full torque when stoplight turns green
- No shifting, smooth acceleration to maximum speed
- MSRP: \$28,995–\$137,800

All-battery EVs



Select Recent Releases

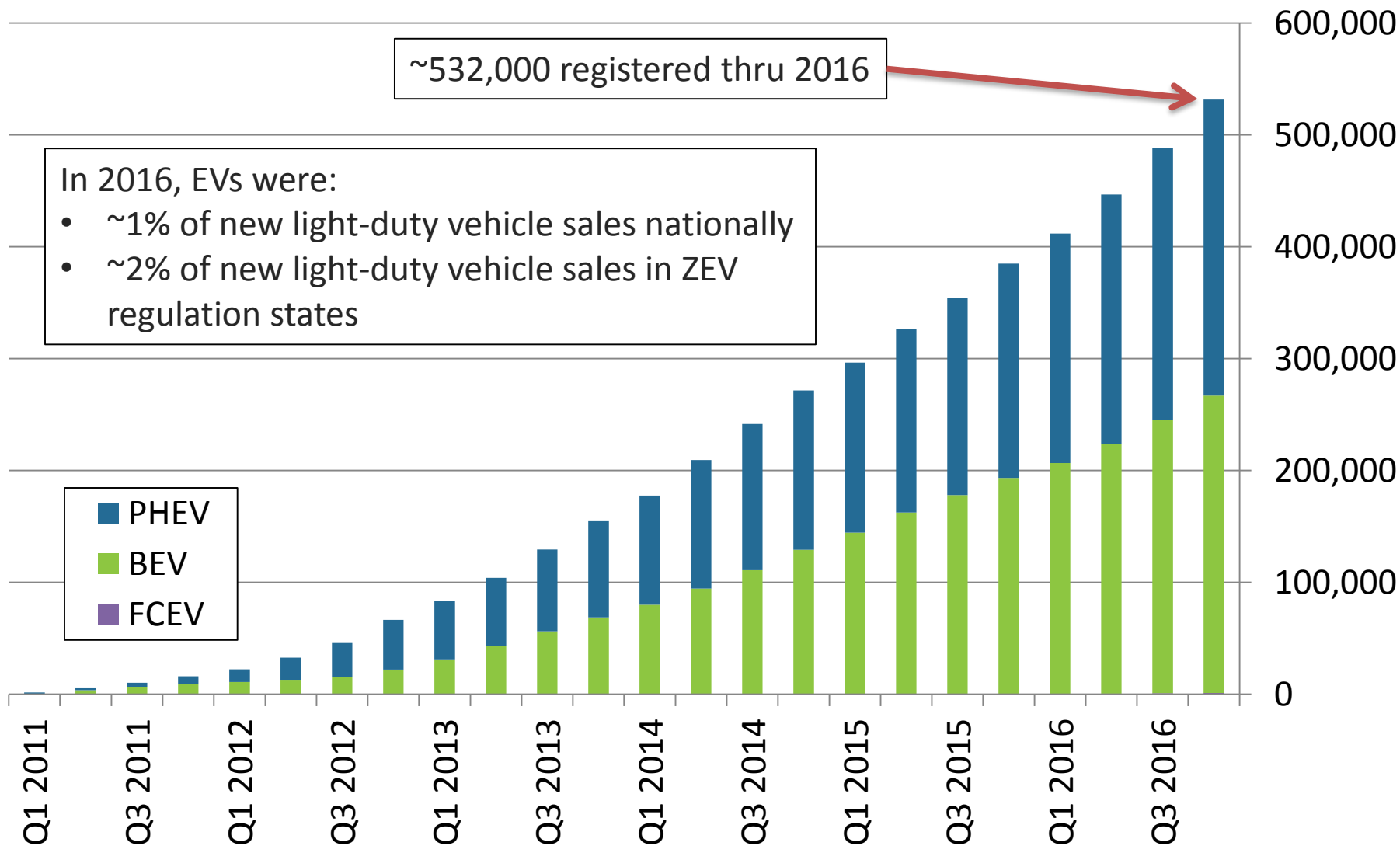
	Vehicle	Vehicle Category	Base MSRP	EPA Fuel Economy	EPA Range
	Prius Prime	Midsize PHEV	\$27,100	133 MPGe	25 e-mi 640 total mi
	Kia Optima Plug-in Hybrid	Midsize PHEV	\$35,210	103 MPGe	29 e-mi 610 total mi
	Chevrolet Bolt	Small wagon BEV	\$36,620	119 MPGe	238 e-mi
	Chrysler Pacifica Hybrid	Minivan PHEV	\$41,995	84 MPGe	33 e-mi 570 total mi
	BMW 330e	Compact PHEV	\$44,100	71 MPGe	14 e-mi 350 total mi
	Mercedes-Benz GLE 550e	SUV PHEV	\$66,300	43 MPGe	10 e-mi 460 total mi

e-mi = electric miles
Specs from fueleconomy.gov

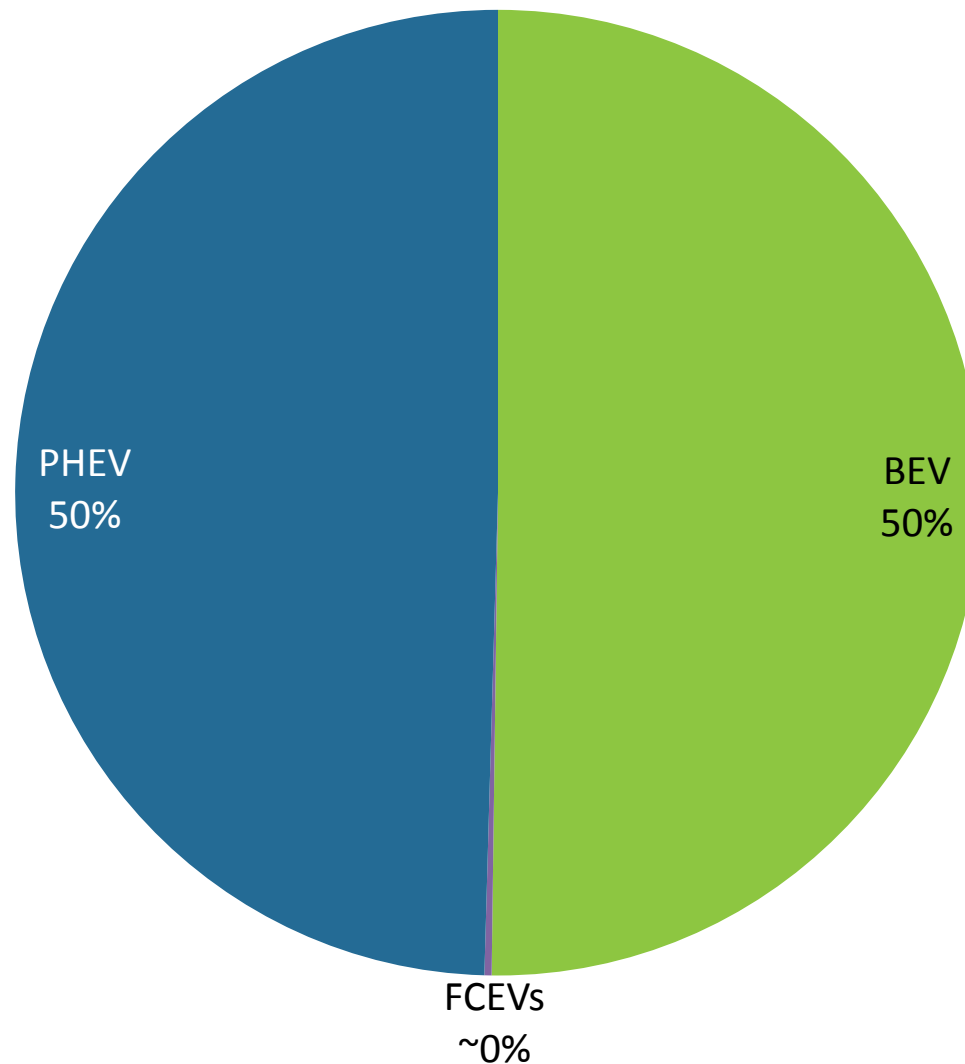
A car salesman in a white shirt and tie is handing a set of keys to a smiling couple. The man is wearing a light blue button-down shirt and white pants, and the woman is wearing a grey blazer over a pink top and white pants. They are standing in a modern dealership with large windows in the background. The text "How are they selling?" is overlaid on the image in a blue font.

How are they selling?

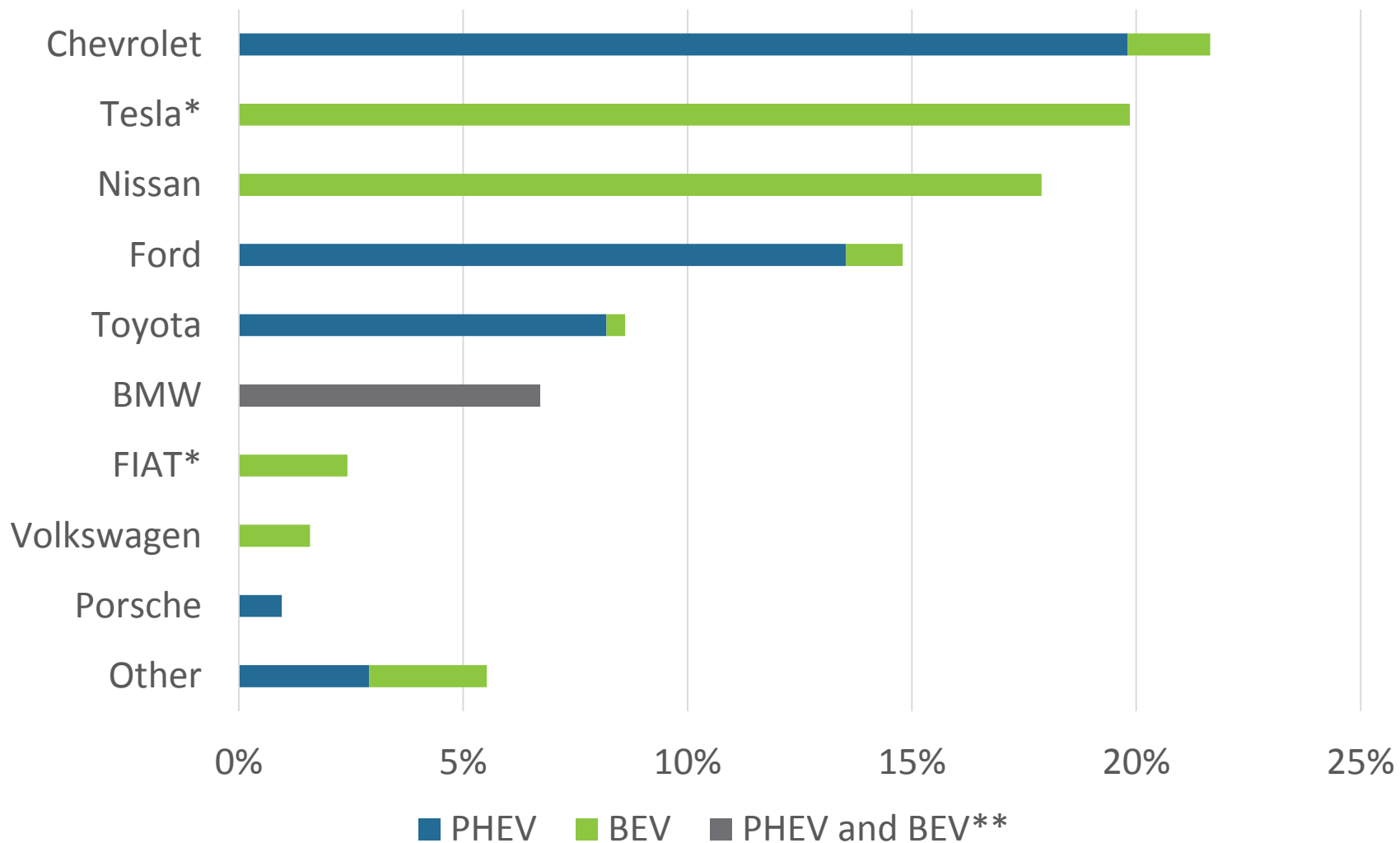
Cumulative New EV Registrations in U.S.



New U.S. EV Registrations by Vehicle Category (thru Jan 2017)



New U.S. EV Sales by Make (thru Mar 2017)

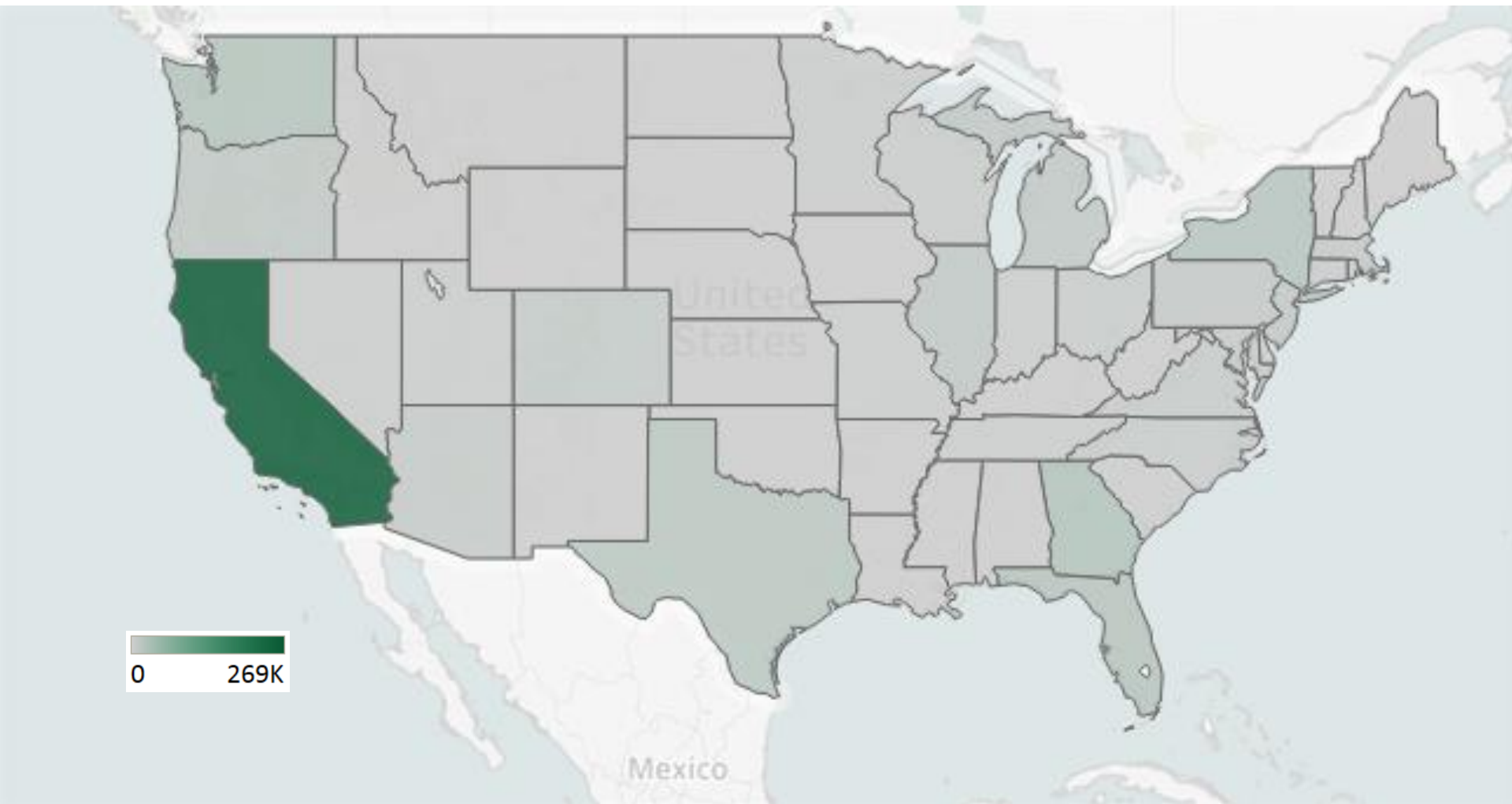


* Tesla and Fiat-Chrysler do not report EV sales, which are estimated

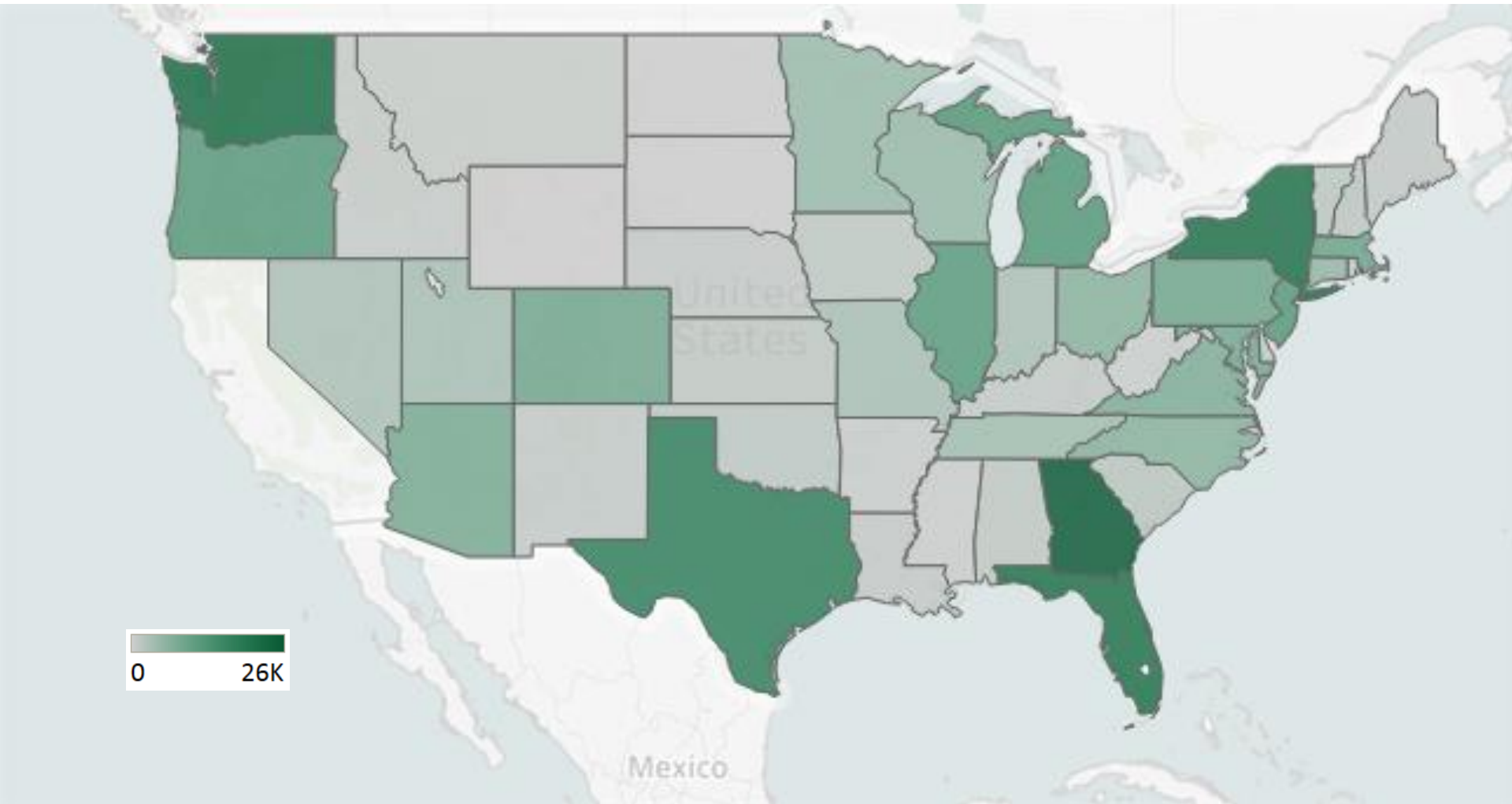
**BMW i3 and i3 REx are grouped

Calculated from data at <http://insideevs.com/monthly-plug-in-sales-scorecard/>

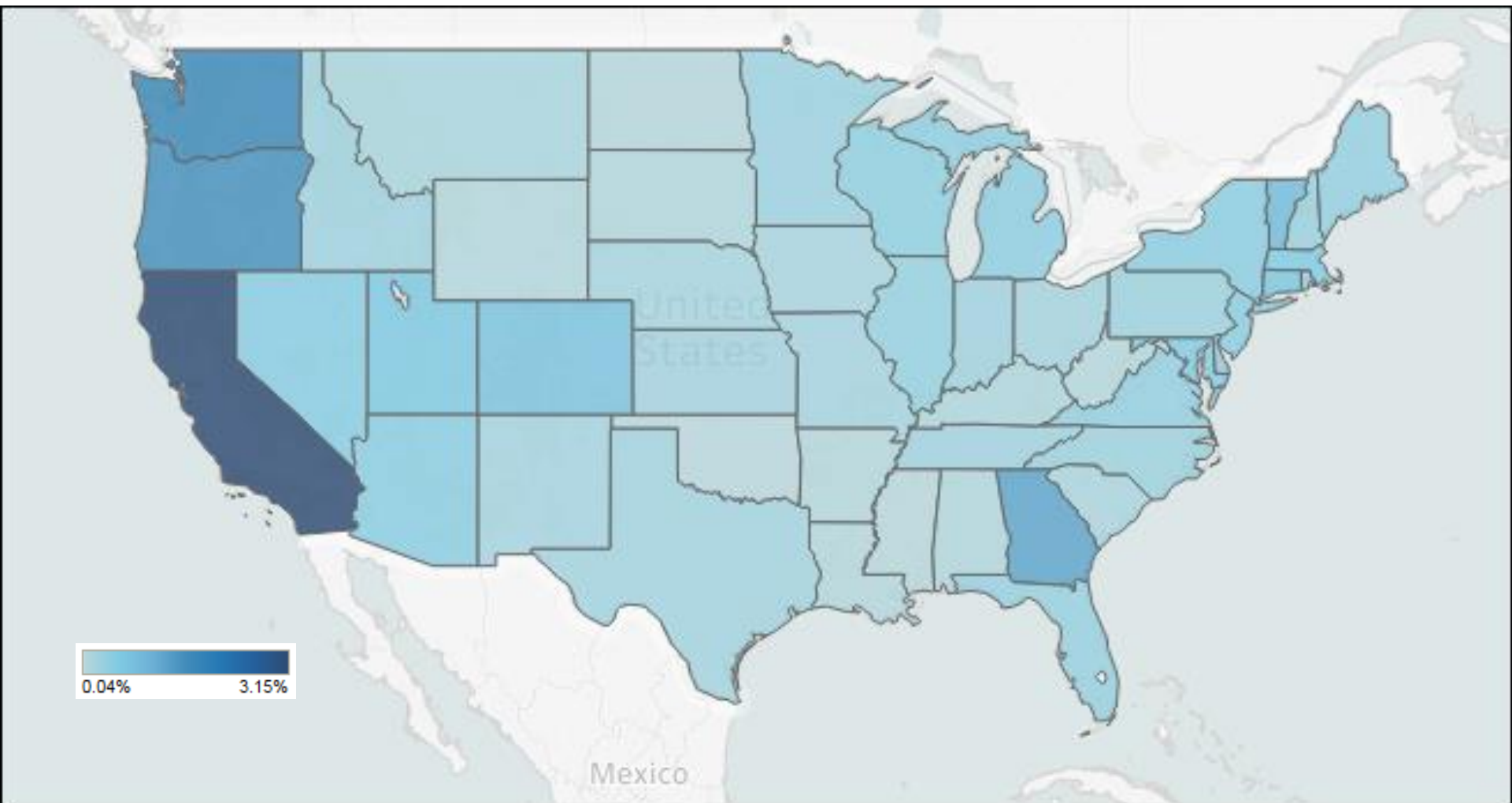
New EV Registrations by State (thru Jan 2017)



New EV Registrations by State, Less CA (thru Jan 2017)



EV Share of New LDV Market by State (thru Jan 2017)





Which EVs are right for me?

Power Search the Right Vehicle for You

Power Search

Expand any feature by selecting its title. Choose as many or as few features as you like.

Model Year

From: To:

Make

Market Class

<input type="checkbox"/> Small Cars	<input type="checkbox"/> Large Sedans	<input type="checkbox"/> Sports/Sporty Cars	<input type="checkbox"/> Minivans
<input type="checkbox"/> Family Sedans	<input type="checkbox"/> Hatchbacks	<input type="checkbox"/> Station Wagons	<input type="checkbox"/> Vans
<input type="checkbox"/> Upscale Sedans	<input type="checkbox"/> Coupes	<input type="checkbox"/> Pickup Trucks	
<input type="checkbox"/> Luxury Sedans	<input type="checkbox"/> Convertibles	<input type="checkbox"/> SUVs	

Market class is unavailable for models prior to 1994.

MSRP

Minimum: Maximum:

MSRP is only available for model year 2010 and newer vehicles.

Fuel Economy

Transmission

Drive

Cylinders

Fuel Type

Vehicle Type

<input type="checkbox"/> Conventional Gasoline	<input checked="" type="checkbox"/> Hybrid ?	<input type="checkbox"/> Dedicated CNG
<input type="checkbox"/> Diesel	<input checked="" type="checkbox"/> Plug-in Hybrid ?	<input type="checkbox"/> Bifuel CNG
<input type="checkbox"/> Flex-Fuel (E85)	<input checked="" type="checkbox"/> All Electric ?	<input type="checkbox"/> Bifuel LPG

- Try the power search at: <http://fueleconomy.gov/feg/powerSearch.jsp>
- Select Vehicle Types: Hybrid, Plug-in Hybrid, All Electric
- Add your personal preferences: Market Class (body style), Maximum MSRP
- Consider the one highest on the efficiency list that is right for you.

Example: Top 6 most fuel efficient *plug-in hybrids*

Vehicle	EPA Fuel Economy↓	Driver MPG	Annual Fuel Cost
<input type="checkbox"/> 2017 BMW i3 REX (94 Amp-hour battery) 0.6 L, 2 cyl, Automatic (A1), Premium Gas or Electricity	<div style="display: flex; justify-content: space-between;"> <div> <p>Electricity</p> <p>111 MPGe</p> <p>combined city/hwy</p> <p>30 kWh/100 mi</p> </div> <div> <p>Prem. Gas</p> <p>35 MPG</p> <p>combined city/hwy</p> <p>2.9 gal/100 mi</p> </div> </div>	NA	\$650
<input type="checkbox"/> 2017 Toyota Prius Prime 1.8 L, 4 cyl, Automatic (variable gear ratios), Gas and Electricity	<div style="display: flex; justify-content: space-between;"> <div> <p>Gas & Electric</p> <p>133 MPGe</p> <p>combined city/hwy</p> <p>.0 gal/100 mi of gas + 25 kWh/100 mi</p> </div> <div> <p>Reg. Gas</p> <p>54 MPG</p> <p>combined city/hwy</p> <p>1.9 gal/100 mi</p> </div> </div>	67.7	\$550
<input type="checkbox"/> 2017 Chevrolet Volt 1.5 L, 4 cyl, Automatic (variable gear ratios), Regular Gas or Electricity	<div style="display: flex; justify-content: space-between;"> <div> <p>Electricity</p> <p>106 MPGe</p> <p>combined city/hwy</p> <p>31 kWh/100 mi</p> </div> <div> <p>Reg. Gas</p> <p>42 MPG</p> <p>combined city/hwy</p> <p>2.4 gal/100 mi</p> </div> </div>	132.0	\$650
<input type="checkbox"/> 2017 Kia Optima Plug-in Hybrid 2.0 L, 4 cyl, Auto(AM6), Gas and Electricity	<div style="display: flex; justify-content: space-between;"> <div> <p>Gas & Electric</p> <p>103 MPGe</p> <p>combined city/hwy</p> <p>.0 gal/100 mi of gas + 33 kWh/100 mi</p> </div> <div> <p>Reg. Gas</p> <p>40 MPG</p> <p>combined city/hwy</p> <p>2.5 gal/100 mi</p> </div> </div>	NA	\$750
<input type="checkbox"/> 2017 Hyundai Sonata Plug-in Hybrid 2.0 L, 4 cyl, Auto(AM6), Gas and Electricity	<div style="display: flex; justify-content: space-between;"> <div> <p>Gas & Electric</p> <p>99 MPGe</p> <p>combined city/hwy</p> <p>.0 gal/100 mi of gas + 34 kWh/100 mi</p> </div> <div> <p>Reg. Gas</p> <p>39 MPG</p> <p>combined city/hwy</p> <p>2.6 gal/100 mi</p> </div> </div>	NA	\$750
<input type="checkbox"/> 2017 Ford Fusion Energi Plug-in Hybrid 2.0 L, 4 cyl, Automatic (variable gear ratios), Gas and Electricity	<div style="display: flex; justify-content: space-between;"> <div> <p>Gas & Electric</p> <p>97 MPGe</p> <p>combined city/hwy</p> <p>.0 gal/100 mi of gas + 35 kWh/100 mi</p> </div> <div> <p>Reg. Gas</p> <p>42 MPG</p> <p>combined city/hwy</p> <p>2.4 gal/100 mi</p> </div> </div>	66.1	\$750

Best conventional gasoline vehicle:

MPG	Energy & Environment	Costs	Vehicle	EPA Fuel Economy↓	Driver MPG	Annual Fuel Cost
<input type="checkbox"/>			<input type="checkbox"/> 2017 Mitsubishi Mirage 1.2 L, 3 cyl, Automatic (variable gear ratios), Regular Gasoline	<div style="display: flex; justify-content: space-between;"> <div> <p>39 MPG</p> <p>combined city/hwy</p> <p>2.6 gal/100 mi</p> </div> <div> <p>37 city</p> <p>43 hwy</p> </div> </div>	NA	\$900

Select Takeaways

Electric vehicle market update

- Two fundamentally different products:
 - Plug-in hybrid EVs
 - No worries about range or access to charging
 - All-battery EVs
 - No combustion
- The diversity of choices is increasing
 - Body type: 22 mid-sized or larger (including a minivan)
 - Price: ~16 models < \$30,000 after incentives
 - New product class: Chevy Bolt = sedan with 238-mile electric range
- EV consumers are no longer guinea pigs
 - ~600,000 now on the roads
 - Some models on 2nd or 3rd third generation

A close-up photograph of a person's hand plugging a charging cable into the port of an electric vehicle. The scene is set outdoors at sunset, with a bright sun in the upper right corner creating a lens flare effect. The background is slightly blurred, showing a city street with a building and a bicycle rack.

Statewide EV Rebate Programs

Design & Implementation

Questions to be explored

Statewide Rebate Programs

- Why rebates?
- How do statewide rebate programs compare?
- What program components lead to success?

Center for Sustainable Energy (CSE)



Building
Performance



Clean
Transportation



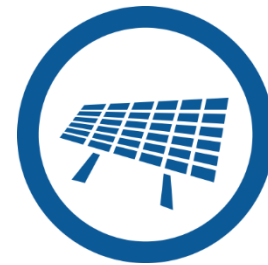
Distributed
Generation



Energy
Efficiency



Energy
Storage



Renewable
Energy

CSE Electric Vehicle Activities



Incentives Design & Administration



Consumer & Dealer Outreach



Stakeholder Engagement



Fleet Assistance & Clean Cities



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



2nd Life Battery Research & Vehicle-Grid Integration

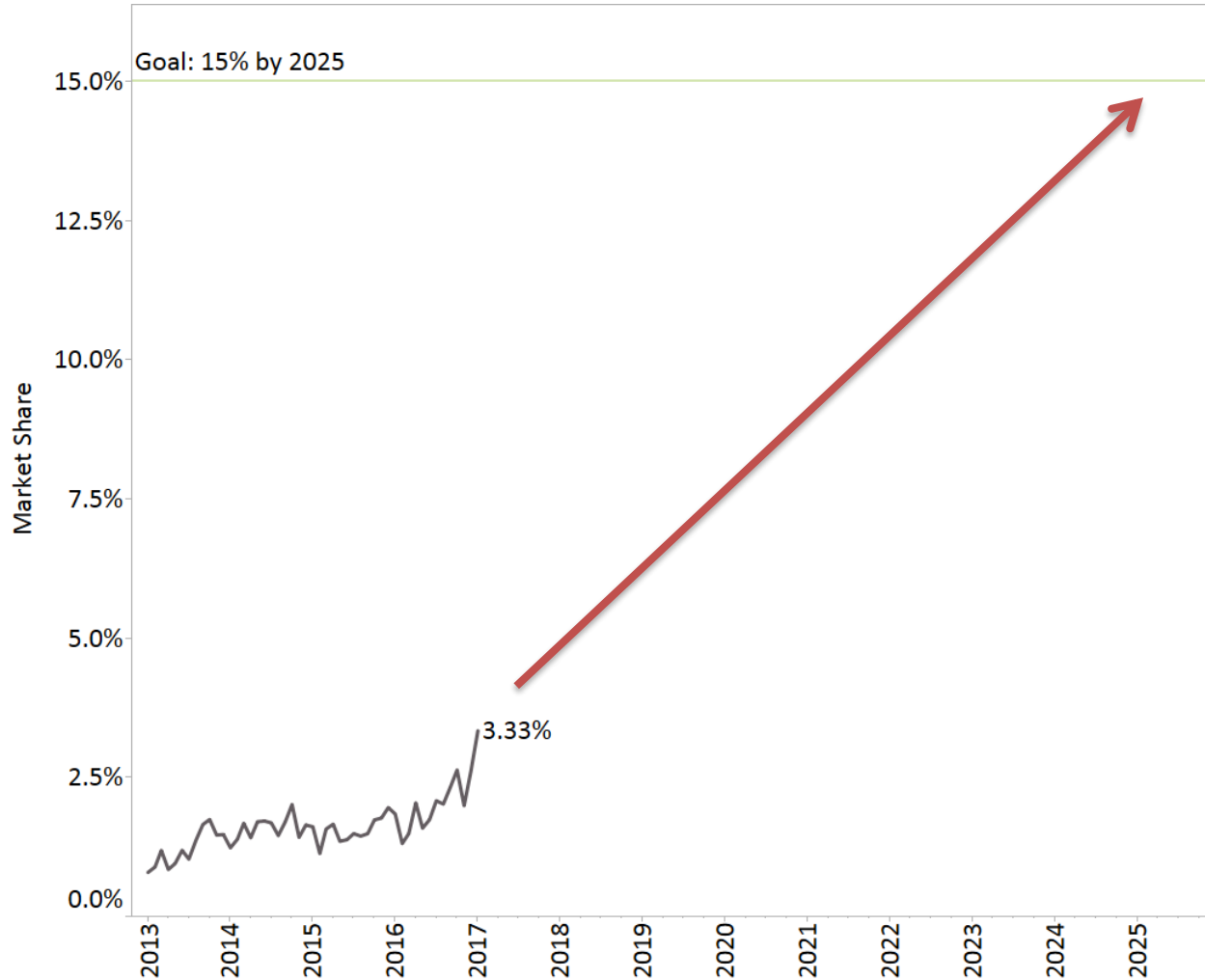


Why rebates?



Progress toward 15% ZEV market share by 2025

Monthly ZEV Market Share: All 10 ZEV States



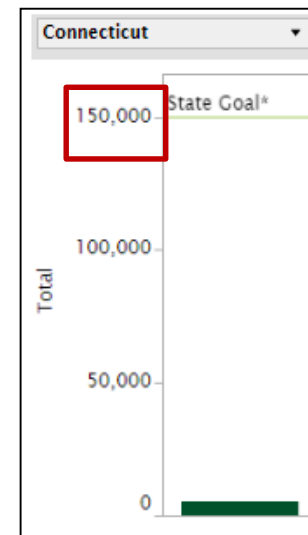
From <https://autoalliance.org/energy-environment/zev-sales-dashboard/>
(including content supplied by R.L. Polk & Co, ©2017)

CT EV Sales & Goal (zevfacts.com, thru 2016)

Sales:

ZEV Sales by Category	
BEV	1,903
FCEV	1
PHEV	3,235
All	5,139

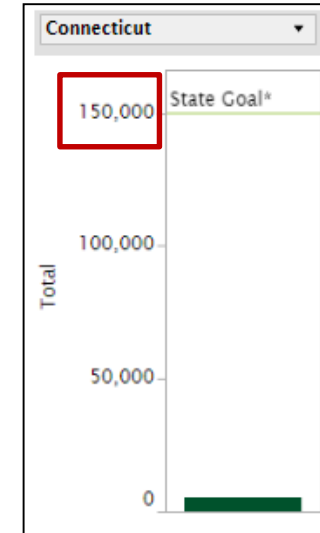
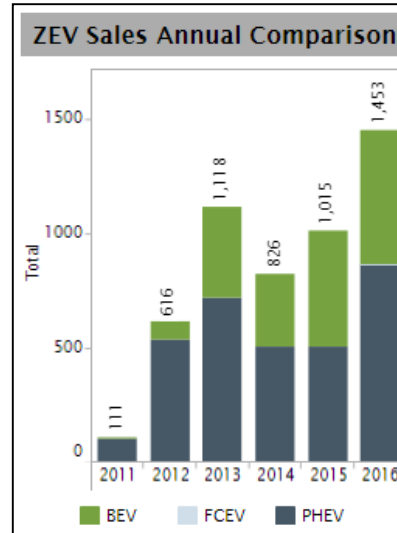
Goals:



CT EV Sales, Market Share & Goals (zevfacts.com, thru 2016)

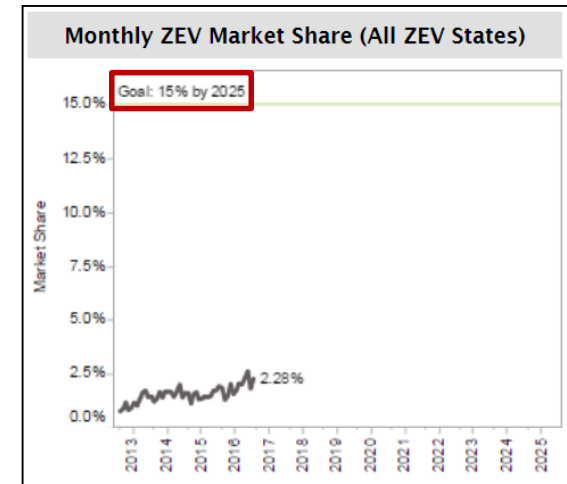
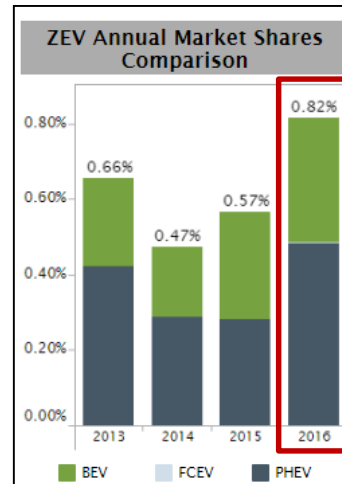
Sales:

ZEV Sales by Category	
BEV	1,903
FCEV	1
PHEV	3,235
All	5,139



Market Share:

Market Shares by ZEV Category	
BEV	0.26%
FCEV	0.00%
PHEV	0.37%



A man in a white shirt and dark tie is handing a set of keys to a smiling couple. The man is wearing a light blue button-down shirt and white pants. The woman is wearing a grey blazer over a white top and white pants. They are standing in front of a large window with a view of a city. The scene is set in a car dealership, with the front of a silver car visible on the left.

How do state EV rebate programs compare?

EV Incentive Programs: Rebate Amounts



Fuel-Cell EVs



\$5,000

\$2,500

All-Battery EVs



\$2,500

\$2,500

Plug-in Hybrid EVs



\$2,500 (i3 REx)
\$1,500

≥10 kWh \$2,500
<10 kWh \$1,500

Zero-Emission Motorcycles



\$900

\$750

e-miles ≥ 20 only;
Consumer income cap and increased rebates

MSRP ≥ \$60k =
\$1,000 max.

EV Incentive Programs: Rebate Amounts



MOR-EV
Massachusetts Offers Rebates
for Electric Vehicles



**Fuel-Cell
EVs**



\$5,000

\$2,500

\$3,000

e-miles

≥ 120 \$2,000

**All-Battery
EVs**



\$2,500

\$2,500

> 25 kWh \$3,000

≥ 20 kWh \$1,500

> 0 kWh \$750

≥ 40 \$1,700

**Plug-in Hybrid
EVs**



\$2,500 (i3 REx)
\$1,500

≥10 kWh \$2,500

<10 kWh \$1,500

> 18 kWh \$3,000

≥ 10 kWh \$1,500

> 0 kWh \$750

≥ 20 \$1,100

< 20 \$500

**Zero-Emission
Motorcycles**



\$900

\$750

e-miles ≥ 20 only;
Consumer income
cap and increased
rebates

MSRP ≥ \$60k =
\$1,000 max.

MSRP ≤ \$60k
only; dealer
assignment;
\$300 dealer
incentive

MSRP > \$60k =
\$500 max.;
point-of-sale

CHEAPR Rebate Design Implications

Product Category	Battery size (kWh)	Rebate
PHEVs (incl. BEVx)	< 10	\$750
	10 to 18	\$1,500
	> 18	\$3,000
BEVs	< 20	\$750
	20 to 25	\$1,500
	> 25	\$3,000
FCEVs	all	\$5,000

Product Category	Brand	Model	Electric Range (EPA e-mi)	Rebate	Battery Size (kWh)
PHEV	Mercedes-Benz	C350e	10	\$750	6.2
PHEV	BMW	330e iPerformance	14	\$750	7.6
PHEV	Ford	C-MAX Energi	20	\$750	7.6
PHEV	Ford	Fusion Energi	21	\$750	7.6
PHEV	Audi	A3 e-tron	16	\$750	8.8
PHEV	Toyota	Prius Prime	25	\$750	8.8
PHEV	Hyundai	Sonata Plug-In	27	\$750	9.8
PHEV	Kia	Optima Plug-In	29	\$750	9.8
PHEV	Chrysler	Pacifica Plug-In	33	\$1,500	16
PHEV	Chevrolet	Volt	53	\$3,000	18.4
PHEV	BMW	i3 REx	97	\$3,000	33
BEV	Mitsubishi	i-MiEV	59	\$750	16
BEV	smart	electric drive	68	\$750	17.6
BEV	BMW	i3 60 Ah	81	\$1,500	21.6
BEV	FIAT	500e	84	\$1,500	24
BEV	Kia	Soul EV	93	\$3,000	27
BEV	Mercedes-Benz	B250e (B-Class Electric Drive)	87	\$3,000	28
BEV	Hyundai	Ioniq Electric	124	\$3,000	28
BEV	Nissan	LEAF	107	\$3,000	30
BEV	BMW	i3 94 Ah	114	\$3,000	33
BEV	Ford	Focus Electric	115	\$3,000	33.5
BEV	Volkswagen	e-Golf	125	\$3,000	35.8
BEV	Chevrolet	Bolt	238	\$3,000	60
FCEV	Hyundai	Tucson Fuel Cell	265	\$5,000	N/A
FCEV	Toyota	Mirai	312	\$5,000	N/A
FCEV	Honda	Clarity	366	\$5,000	N/A

NY Rebate Design Implications

Product Category	Range (EPA e-mi)	Rebate
All	< 20 or MSRP >\$60k	\$500
	≥ 20	\$1,100
	≥ 40	\$1,700
	≥ 120	\$2,000

Product Category	Brand	Model	Electric Range (EPA e-mi)	Rebate	Battery Size (kWh)
PHEV	Mercedes-Benz	GLE550e	10	\$500	8.8
PHEV	Mercedes-Benz	C350e	10	\$500	6.2
PHEV	Mercedes-Benz	S550e	12	\$500	8.7
PHEV	Volvo	XC90 T8	13	\$500	9.2
PHEV	BMW	330e iPerformance	14	\$500	7.6
PHEV	BMW	i8	14	\$500	7.1
PHEV	BMW	X5 xDrive40e	14	\$500	9
PHEV	Porsche	Cayenne S E-Hybrid	14	\$500	10.8
PHEV	BMW	740e xDrive	14	\$500	9.2
PHEV	Porsche	Panamera S E-Hybrid	15	\$500	9.4
PHEV	Audi	A3 e-tron	16	\$500	8.8
PHEV	Ford	C-MAX Energi	20	\$1,100	7.6
PHEV	Ford	Fusion Energi	21	\$1,100	7.6
PHEV	Toyota	Prius Prime	25	\$1,100	8.8
PHEV	Hyundai	Sonata Plug-In	27	\$1,100	9.8
PHEV	Kia	Optima Plug-In	29	\$1,100	9.8
PHEV	Chrysler	Pacifica Plug-In	33	\$1,100	16
PHEV	Chevrolet	Volt	53	\$1,700	18.4
BEV	Mitsubishi	i-MiEV	59	\$1,700	16
BEV	smart	electric drive	68	\$1,700	17.6
BEV	BMW	i3 60 Ah	81	\$1,700	21.6
BEV	FIAT	500e	84	\$1,700	24
BEV	Mercedes-Benz	B250e (B-Class Electric Drive)	87	\$1,700	28
BEV	Kia	Soul EV	93	\$1,700	27
PHEV	BMW	i3 REx	97	\$1,700	33
BEV	Nissan	LEAF	107	\$1,700	30
BEV	BMW	i3 94 Ah	114	\$1,700	33
BEV	Ford	Focus Electric	115	\$1,700	33.5
BEV	Hyundai	Ioniq Electric	124	\$2,000	28
BEV	Volkswagen	e-Golf	125	\$2,000	35.8
BEV	Chevrolet	Bolt	238	\$2,000	60
BEV	Tesla	Model S	210-315	\$500	60-100
BEV	Tesla	Model X	238-289	\$500	75-100

EV Rebate Program Features

	CVRP (CA)	MOR-EV (MA)	CHEAPR (CT)	DRIVE CLEAN (NY)
Agency	ARB	DOER	DEEP	NYSERDA
Inception	2010	2014	2015	2017
Rebates thru January 2017	\$399,774,533 184,569 vehicles	\$7,330,750 3,486 vehicles	\$2,630,250 1,141 vehicles	Launched March 2017
Funding sources	Vehicle registration fees, cap-and-trade revenues	Regional Greenhouse Gas Initiative (RGGI)	Utility settlement	Clean Energy Fund (CEF) and RGGI
Funding cycle	Annual with frequent disruptions	On demand, subject to availability	\$1 million increments; seeking long-term	\$55 million (multi-year) commitment
Misc.	Complex income-eligibility criteria; Pre-qual. in 2017	Soft MSRP cap	Dealer assignment option; \$300/EV dealer incentive; hard MSRP cap	Dealer applies for consumer; Soft MSRP cap
Payment	Check	Check	Dealer or consumer ACH	Dealer ACH

A photograph of two men in business attire standing next to a white car with a red interior. The man on the left is wearing a black suit and a red tie, and the man on the right is wearing a light blue shirt. They are both looking at the car. The car's door is open, and the interior is visible, showing red leather seats and a black dashboard. The background is a bright, modern setting, possibly a car dealership.

What program components lead to success?

EV Incentive Programs: Key Components

- ***Create awareness:*** Coordinated and strategic outreach & education
- ***Facilitate access & participation:*** Customer-service-oriented application processing
- ***Provide intelligence:*** Sophisticated program transparency, including tracking & evaluation



Outreach: Dealers

Target Audience:

- EV sales people

Activities:

- Webinars
- In-person trainings
- Collateral development and distribution
- Partnerships
 - OEMs
 - Dealer associations
 - Auto groups



NEW CAR DEALERS ASSOCIATION
SAN DIEGO COUNTY

Outreach: New Car Shoppers

Target Audience:

- Lowest barriers to EV adoption

Activities:

- Branded event booths and marketing materials
- Digital marketing & social media
- Cross-program collaboration
 - Collateral distribution
 - Cross-promotion



Outreach: Underserved Communities

Target Audience:

- Disadvantaged communities (DACs)
- Non-DAC low-to-moderate income consumers

Activities:

- Collaborate with **community-based organizations** and other agencies
- Increase access
 - Targeted content
 - Multi-lingual resources



Project Website: Simplicity & Accessibility

CALIFORNIA CLEAN VEHICLE REBATE PROJECT™

Administrado por CSE en nombre de la Junta de Recursos del Aire de California

English

Dónde Empezar Herramientas y Recursos Ayuda **Iniciar sesión**

Maneje limpio y ahorre

Los residentes de California pueden recibir hasta \$7000 para la compra o el alquiler de un vehículo nuevo elegible, que puede ser un vehículo de cero emisiones o un vehículo híbrido enchufable liviano.






¿Es su primera vez en el CVRP? **Solicite un reembolso**

¿Ya hizo una solicitud? **Ver el estado de su solicitud**

California Environmental Protection Agency
Air Resources Board

Vehículos y elegibilidad

Presente su solicitud dentro de los 18 meses posteriores a la compra o el alquiler de un vehículo elegible y antes de que se agoten los fondos para reembolsos. Consulte [los lineamientos de elegibilidad completos](#).

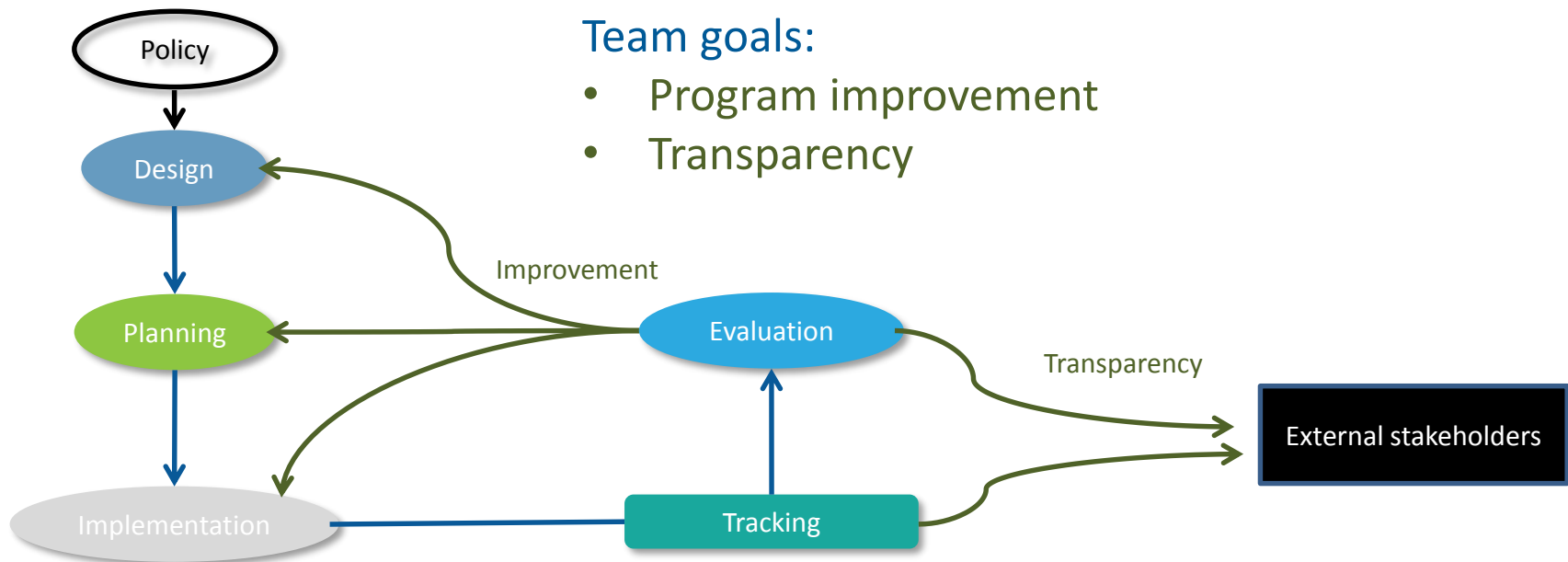
Vehículo	Rebato
 Toyota Prius Prime	\$1,500
 Hyundai Tucson Fuel Cell	\$5,000
 Nissan LEAF S	\$2,500
 Chevrolet Spark EV	\$2,500
 Chevrolet Volt	\$1,500

Ver todos los vehículos elegibles

Transparency: Mission Statement

...to educate and empower internal and external stakeholders through the design, creation, and communication of evidence-based products that provide program and market intelligence.

Transparency: Goals, Activities & Roles



Team goals:

- Program improvement
- Transparency

Internal roles:

- Program *Design*
- Program *Planning*
- Program *Strategy*

Team activities:

- *Program tracking*
- *Program evaluation*
- Program advisement

External roles

- Policy and market support and intelligence

Select Takeaways

Statewide Rebate Programs

- Programs demonstrate considerable variation
 - can be tailored to regional conditions and needs
- Lack of consistent, multi-year funding dramatically reduces program effectiveness and efficiency
- Common components that lead to success:
 - **Create awareness:** Coordinated and strategic outreach & education
 - **Facilitate participation:** Customer-service-oriented application processing
 - **Provide intelligence:** Sophisticated program transparency, including tracking & evaluation

A close-up photograph of a person's hand holding a charging cable connected to an electric vehicle. The scene is set outdoors at sunset, with a bright sun in the upper right corner creating a lens flare effect. The background shows a blurred city street with buildings and other vehicles.

Program Tracking

Rebated Vehicle & Consumer Data

Questions to be explored

Program Data

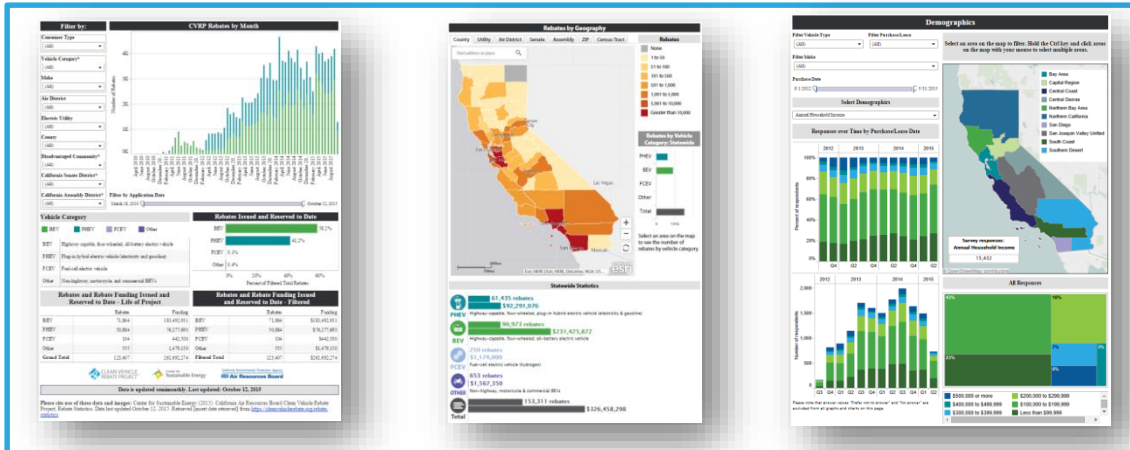
- What data are these programs producing and making publicly available?

Where can I get the data?: CSE Multi-State Transparency Tools

- Public, online, interactive dashboards facilitate informed action

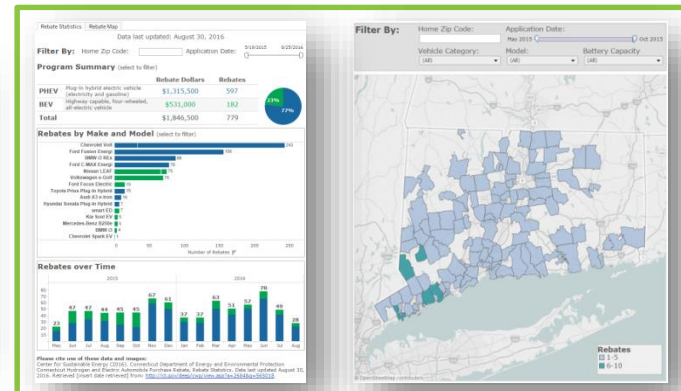
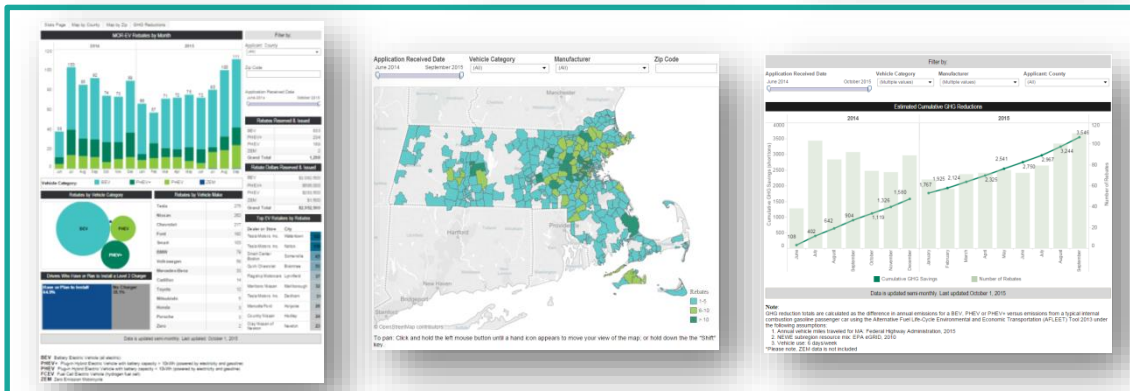
Also: zevfacts.com

- Data characterizing >189,000 EVs and consumers
- ~\$410M in rebates processed
- >19,000 survey responses statistically represent >91,000 consumers



cleanvehicle.org

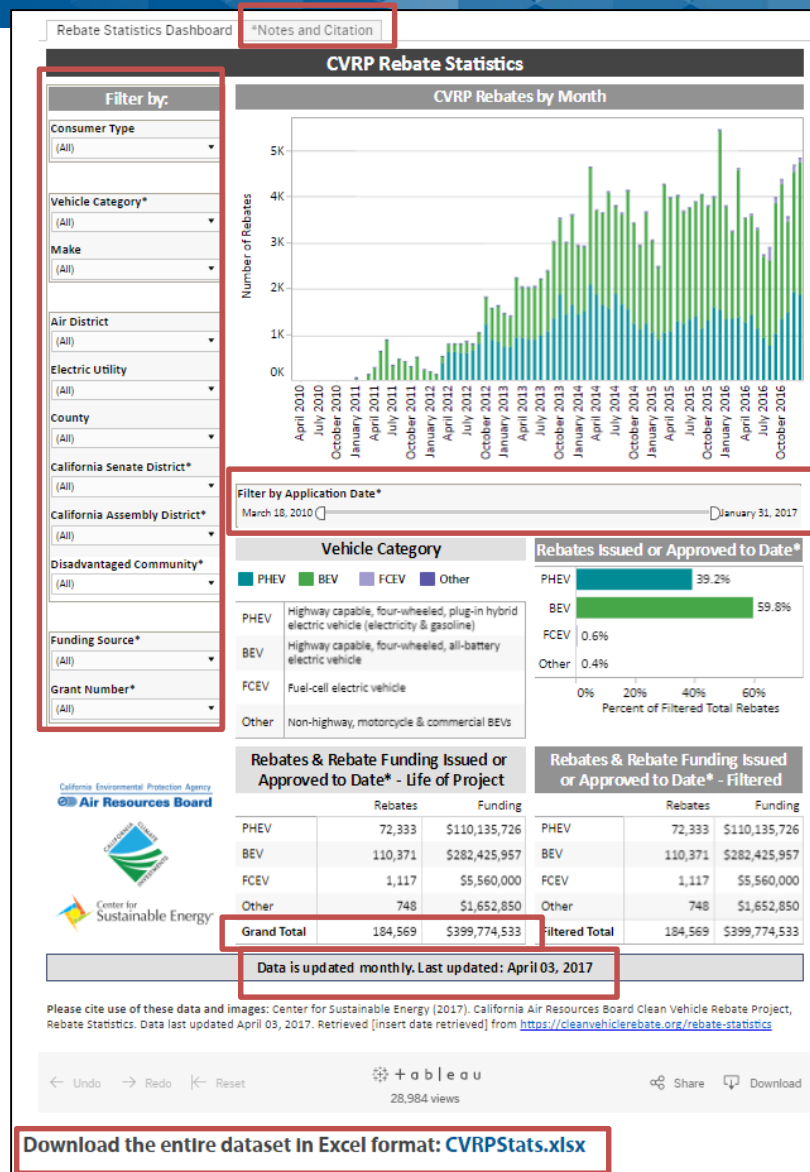
ct.gov/deep



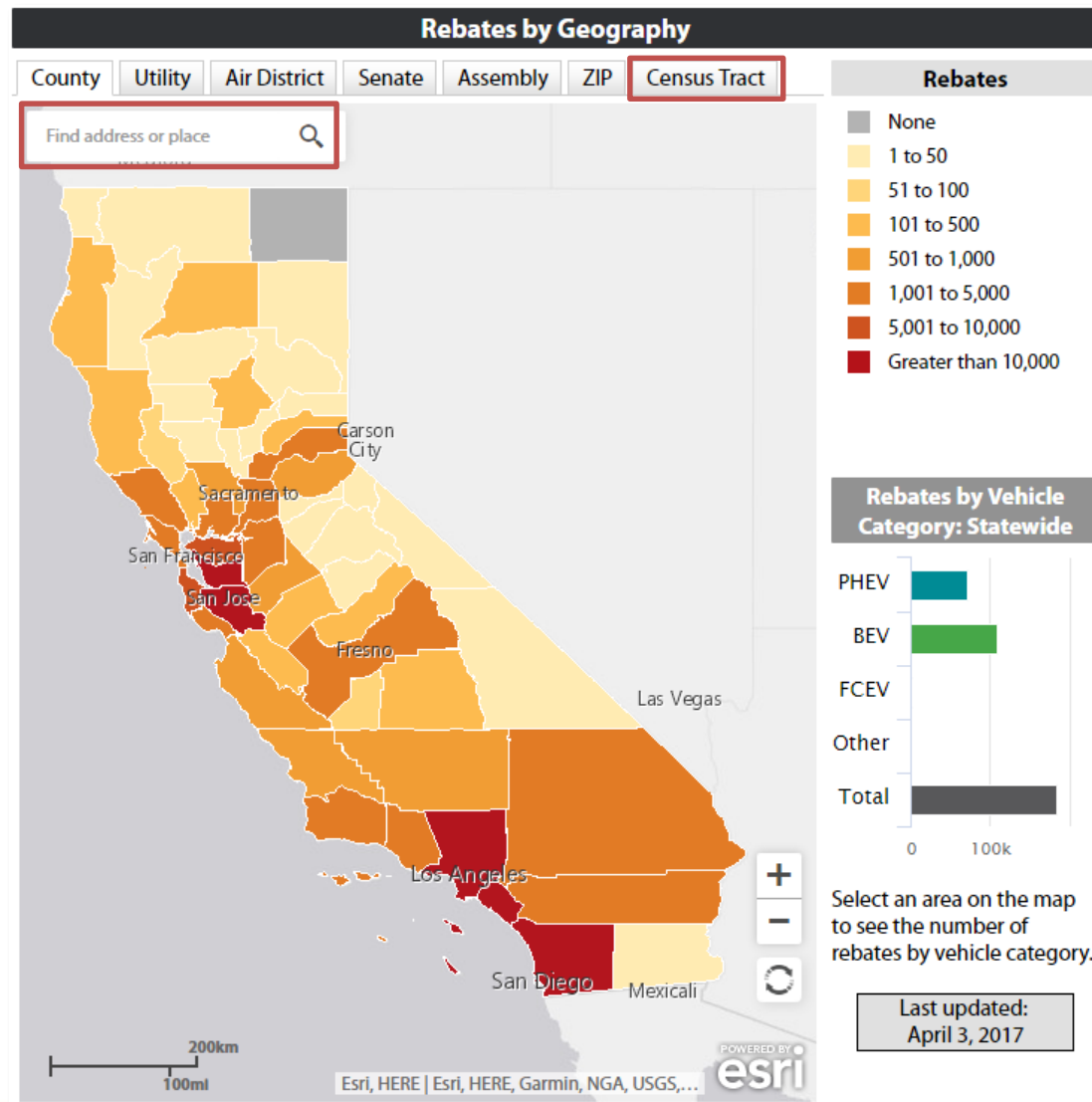
mor-ev.org

Rebate Dashboard

- >184,000 rebates totaling >\$399 million through January 2017
- Filter by:
 - time period
 - consumer type
 - vehicle type
 - a variety of geographies (e.g., utility territory, legislative district)
 - funding source
- Notes tab provides more information
- Updated monthly
- Download:
 - Images
 - raw data for Excel

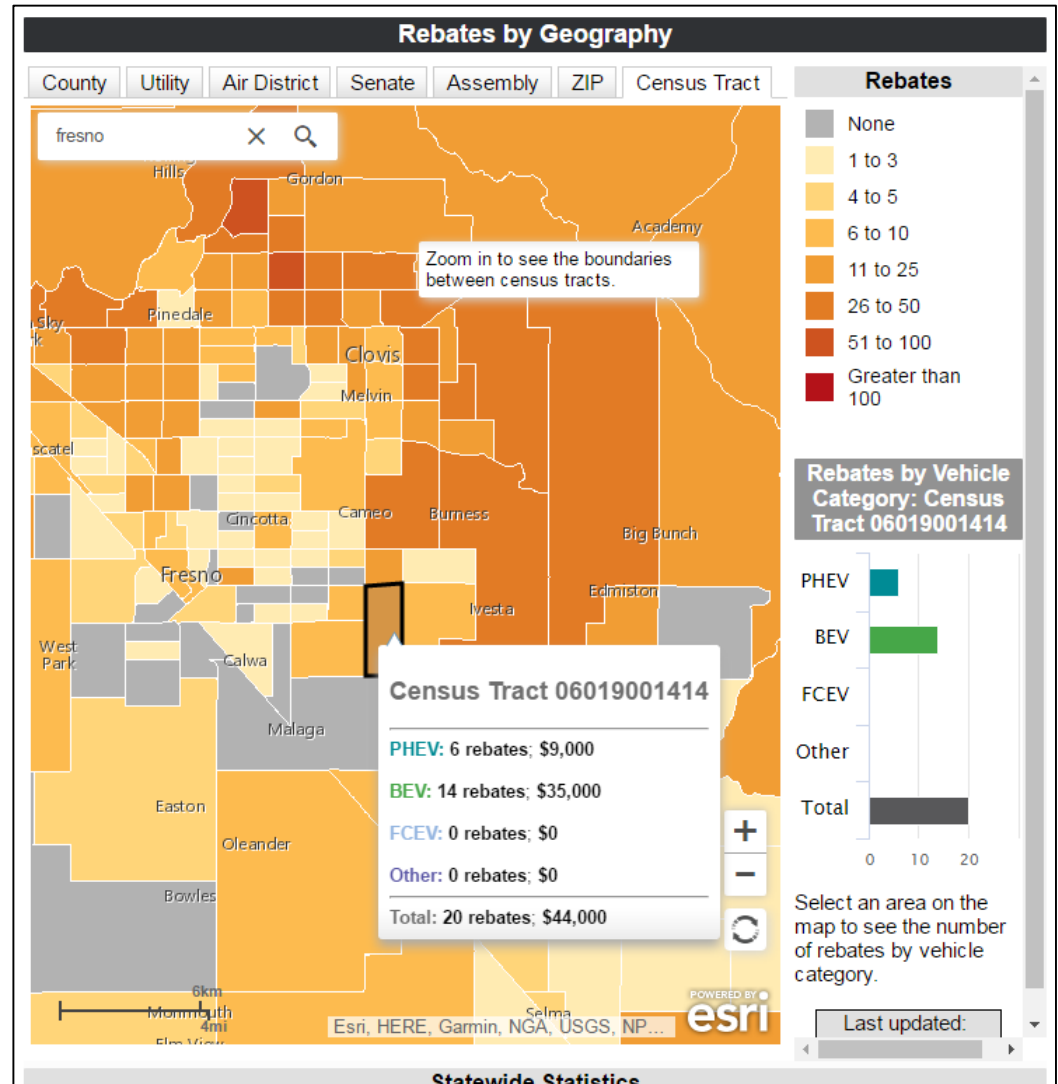


Rebate Map



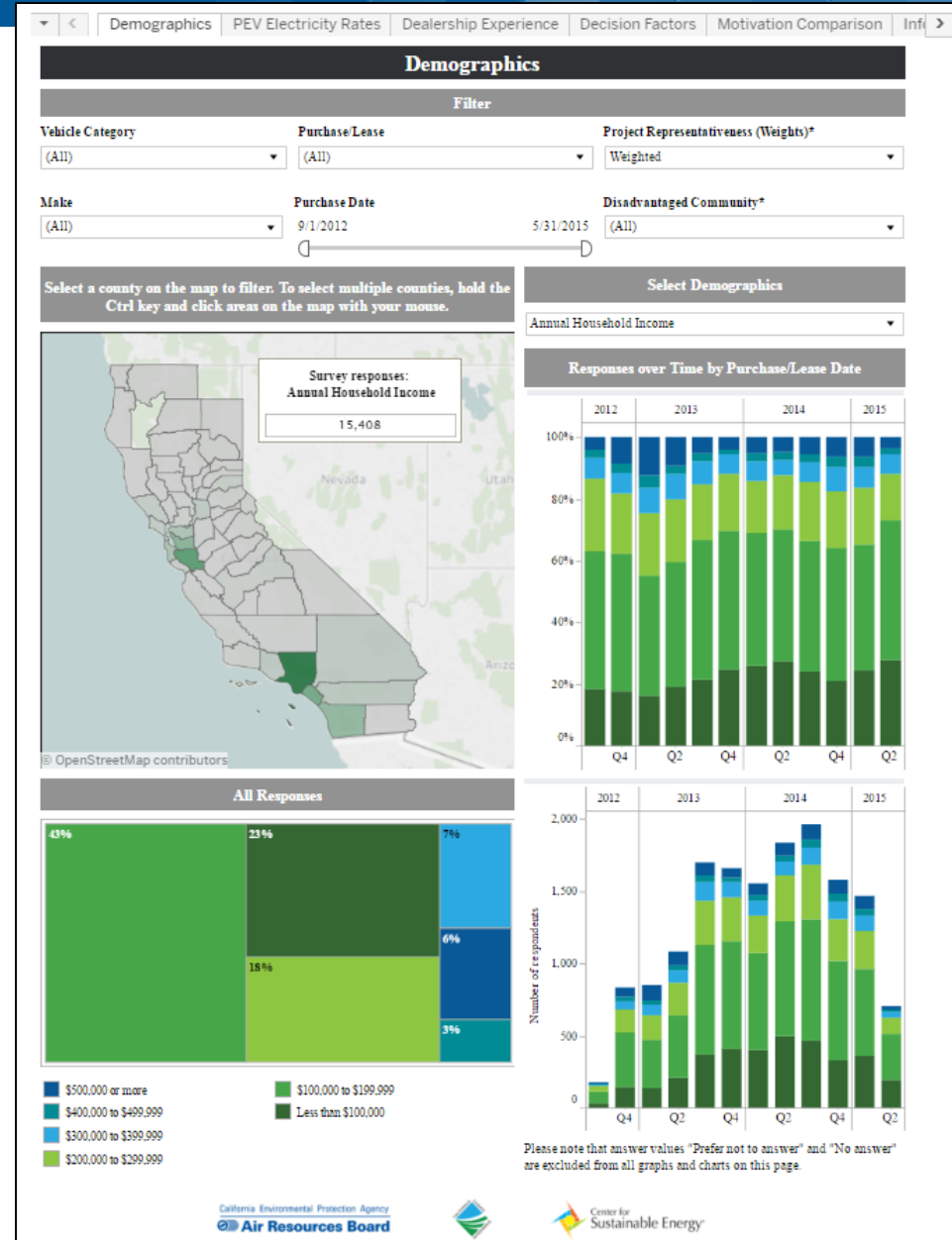
Rebate Map: Detail

- Search for place of interest
- View details down to the Census tract (neighborhood) level
- Need additional details/filters?
 - The map, rebate dashboard, and rebate data download share the same data.



EV Consumer Survey Dashboard

- 19,460 survey responses weighted to represent 91,085 program participants
 - by county, model, and purchase/lease
- Purchase/lease dates: 9/2012–5/2015
- Topics include:
 - Demographics
 - Information channels
 - Purchase motivations and enablers
 - Dealership experience
 - Utility rate awareness
- Filter by: vehicle category, buy/lease, make, region
- Download data



Program Surveys: Ongoing

Rebated EV Consumer Surveys

1. CVRP: ~35,000
2. MOR-EV: ~1,000
3. CHEAPR: ~500

Incentivized Dealer Survey

4. CHEAPR: ~100

Rebated Consumer EV Ownership Survey

5. CVRP: 2 rounds

Consumer Awareness Polling

6. CA: 2 rounds

Select Takeaways

Program Data and Intelligence

- Applications and participant surveys are valuable source of large amounts of program and market data
- Free, regularly updated, high-resolution data access promotes program Transparency and Evaluation and enables a variety external stakeholders to support market transformation in their own ways
- Learnings accumulating in reports and presentations...

A close-up photograph of a person's hand holding a charging cable connected to an electric vehicle. The scene is set outdoors in a city street during sunset, with a bright sun creating a lens flare effect. In the background, a bicycle is parked on the sidewalk, and a building is visible. The overall atmosphere is warm and modern.

Program Evaluation

Questions exploring

Program Evaluation

- What is program evaluation?

Evaluation Questions:

- Impact: Do rebates work? What impact are the programs having? How is the dealer incentive working?
- Design: What sorts of rebate design features are recommended?
- Outreach: How can the program help grow EV markets? Who is participating? What are the most important information channels to them? How can the program help expand the frontiers of the EV market? Who needs rebates the most?
- Equity: Are the programs equitable? What is the impact of an income cap? Are the CVRP income criteria working?



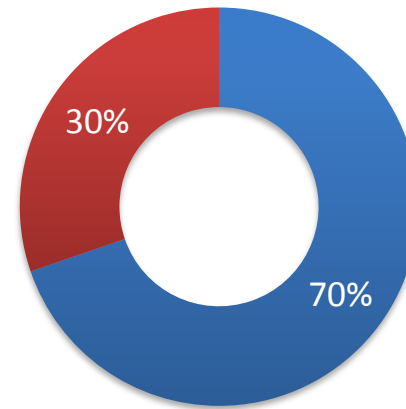
Rebate Impact



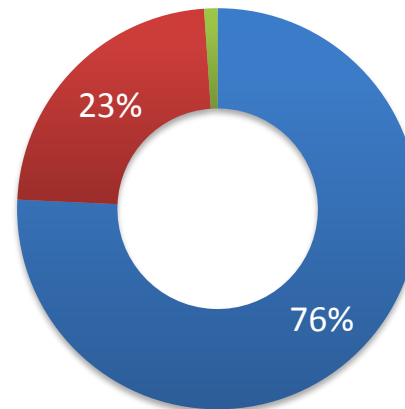
EVs are replacing older, more polluting vehicles

- Replacement vehicle
- Additional vehicle
- First vehicle

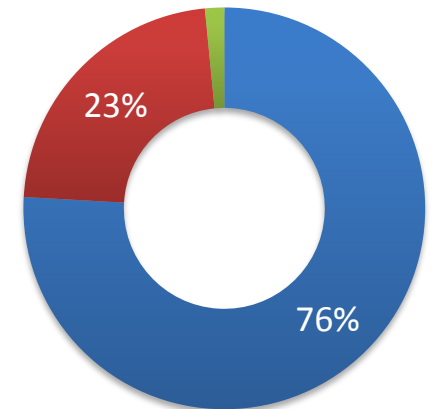
Massachusetts



California



Connecticut

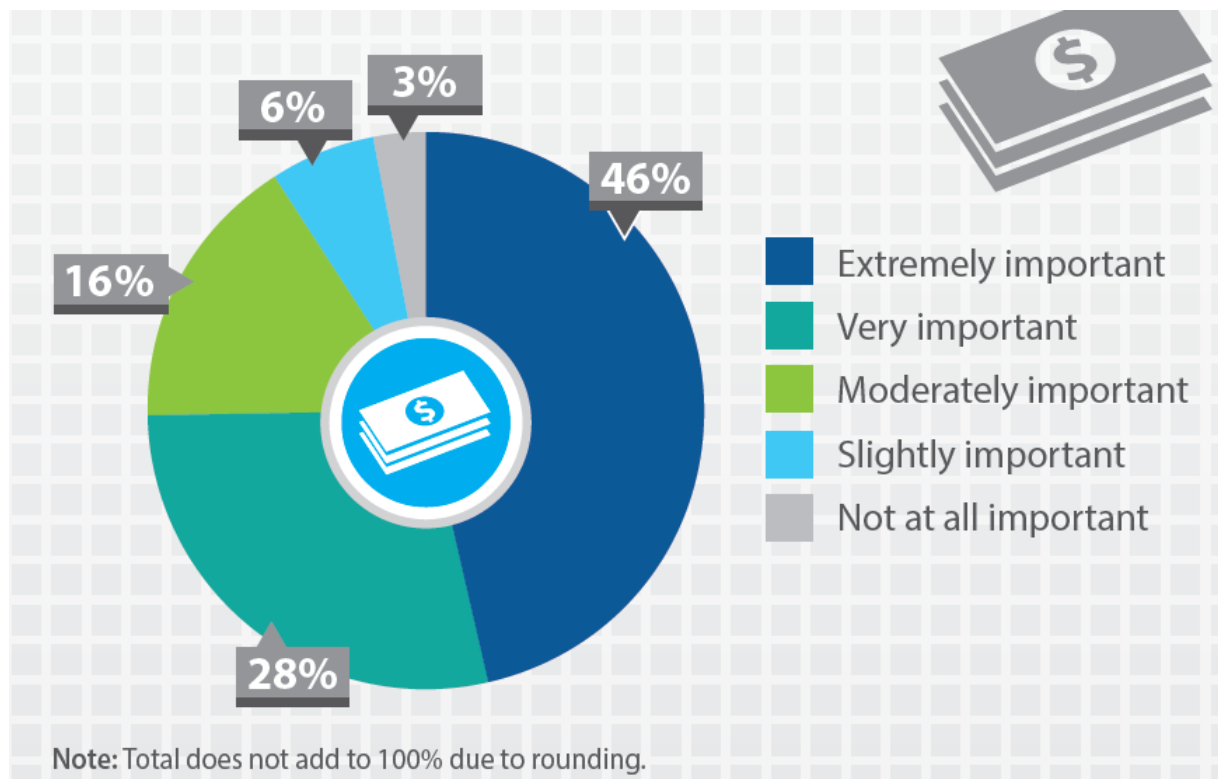


EVs, in particular PHEVs, replace vehicles at a high rate

	EV Replaced Previous Vehicle
MOR-EV survey (Jun '14 thru Feb '16)	
PHEVs	76%
non-Tesla BEVs	64%
CHEAPR survey (May '15 thru Jun '16)	
PHEVs	81%
non-Tesla BEVs	62%
CVRP CV Survey (Jun '15 thru Mar '16)	
PHEVs	83%
non-Tesla BEVs	66%

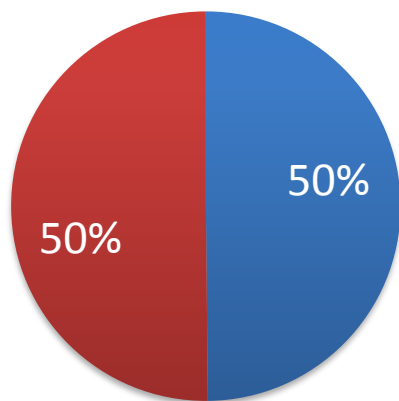
Rebate importance is rated highly

How important was the state rebate in making it possible for you to acquire an EV?

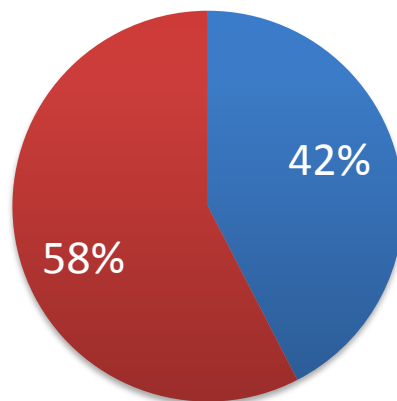


Impact of Incentive: Market Additions

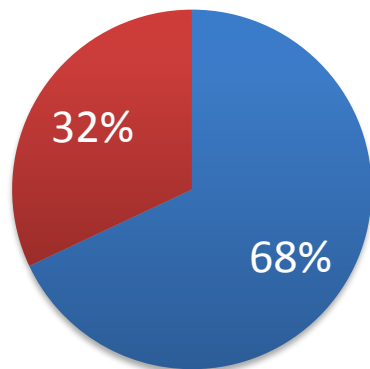
California





Massachusetts



Connecticut



-  Would not have purchased/leased an EV without rebate
-  Would have purchased/leased an EV without rebate



A man in a white shirt and tie is handing a set of car keys to a smiling couple. The man is on the left, and the couple is on the right. The man is wearing a white shirt, a dark tie, and dark trousers. The couple consists of a man in a light blue button-down shirt and white trousers, and a woman in a grey blazer and white trousers. They are standing in front of a large window with a view of a city. The background is slightly blurred, showing a modern building with large windows.

Illustrative Rebate Design Recommendations*

* Optimal design depends on program priorities and market context

Illustrative Rebate Design Recommendation

Product Category	Brand	Model	Electric Range (EPA e-mi)	Rebate
PHEV	Mercedes-Benz	GLE550e	10	\$0
PHEV	Mercedes-Benz	C350e*	11	\$0
PHEV	Mercedes-Benz	S550e	12	\$0
PHEV	Volvo	XC90 T8	13	\$0
PHEV	BMW	330e iPerformance	14	\$0
PHEV	BMW	i8	14	\$0
PHEV	BMW	X5 xDrive40e	14	\$0
PHEV	Porsche	Cayenne S E-Hybrid	14	\$0
PHEV	BMW	740e xDrive	14	\$0
PHEV	Porsche	Panamera S E-Hybrid	15	\$0
PHEV	Audi	A3 e-tron ultra	16	\$2,000
PHEV	Ford	C-MAX Energi	20	\$2,000
PHEV	Ford	Fusion Energi	21	\$2,000
PHEV	Mitsubishi	Outlander*	22	\$2,000
PHEV	Toyota	Prius Prime	25	\$2,000
PHEV	Hyundai	Ioniq PHEV*	27	\$2,000
PHEV	Hyundai	Sonata Plug-In	27	\$2,000
PHEV	Kia	Optima Plug-In	29	\$2,000
PHEV	Chrysler	Pacifica Plug-In	33	\$3,000
PHEV	Chevrolet	Volt (2016)	53	\$3,000
PHEV	BMW	i3 REx (2017)	97	\$3,000

Product Category	Brand	Model	Electric Range (EPA e-mi)	Rebate
BEV	Mitsubishi	i-MiEV	59	\$0
BEV	smart	electric drive	68	\$0
BEV	BMW	i3 60 Ah	81	\$2,000
BEV	Chevrolet	Spark EV	82	\$2,000
BEV	Volkswagen	e-Golf	83	\$2,000
BEV	FIAT	500e	84	\$2,000
BEV	Mercedes-Benz	B250e	87	\$2,000
BEV	Kia	Soul EV	93	\$2,000
BEV	Nissan	LEAF	107	\$3,000
BEV	BMW	i3 94 Ah	114	\$3,000
BEV	Ford	Focus Electric	115	\$3,000
BEV	Hyundai	Ioniq Electric	124	\$3,000
BEV	Tesla	Model X 60D	200	\$0
BEV	Tesla	Model 3*	215	\$3,000
BEV	Tesla	Model S 60D	218	\$0
BEV	Chevrolet	Bolt	238	\$3,000
FCEV	Hyundai	Tucson Fuel Cell	265	\$3,000
BEV	Audi	Q6 e-tron*	310	\$0
FCEV	Toyota	Mirai	312	\$3,000
FCEV	Honda	Clarity	366	\$3,000

Product Category	Minimum EPA Electric Range	Rebate
PHEVs (incl. BEVx)		
	15	\$2,000
	30	\$3,000
BEVs & FCEVs		
	70	\$2,000
	100	\$3,000
MSRP > \$60k	0	\$0

- Minimum eligibility threshold is 15 electric miles (average commute distance)
- Supports market stimulation and acceleration into mainstream consumers with a signal for capable PHEVs (30 miles = average daily driving)
- Introduces MSRP cap to increase program effectiveness and equity without complexity of income criteria

*Forthcoming products; numbers may change

Goals

Program *design* goals:

- Maximize rebate effectiveness
- Promote of a variety of ZEV products and brands
- Maximize environmental and energy benefits
- Maximize market stimulation and acceleration into mainstream consumers
- Maintain simplicity & consistency
- Provide return on investment of public dollars

Program *planning* goals:

- Reduce budgetary impact

Others?

Sample Recommendations: Rebate Amount

Keep incentive levels for impactful vehicles as high as possible for as long as possible

- avoid prematurely phasing down

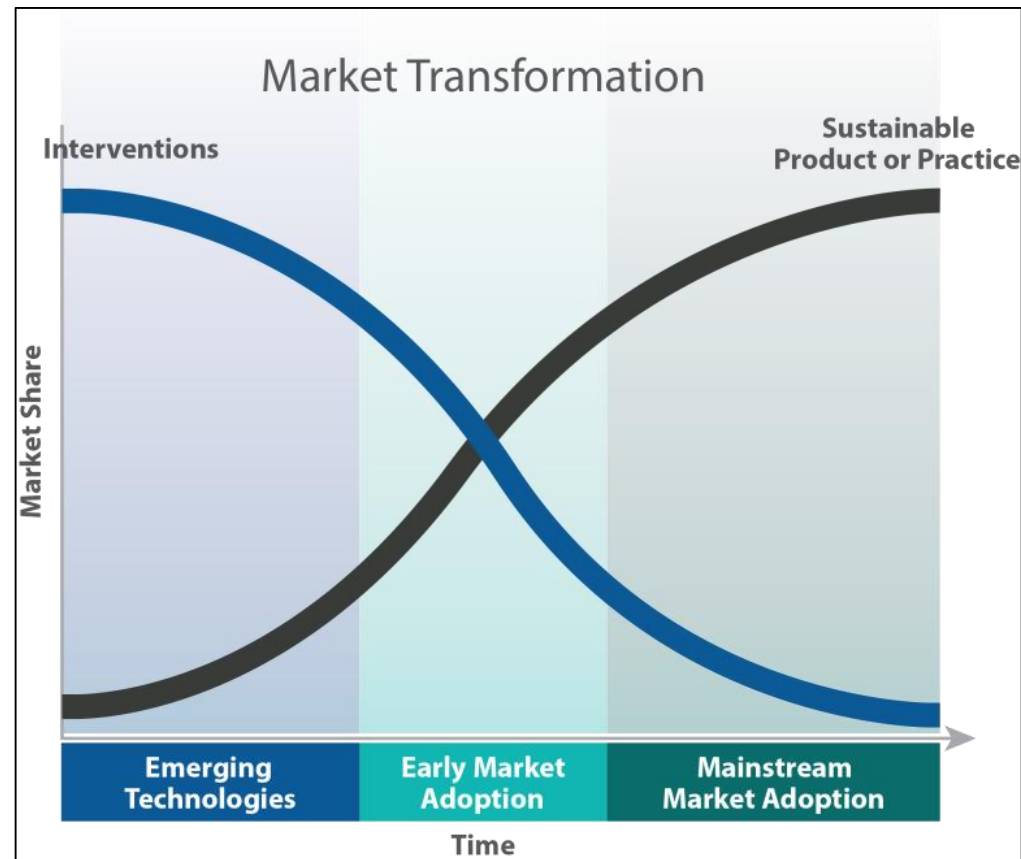
	% of CHEAPR participants that would have not purchased/leased without rebate	
Rebate	PHEV	BEV
\$ 750	44%*	N/A
\$ 1,500	61%	44%*
\$ 3,000	76%	71%

* Sample size small

Sample Recommendations: Rebate Phase Out?

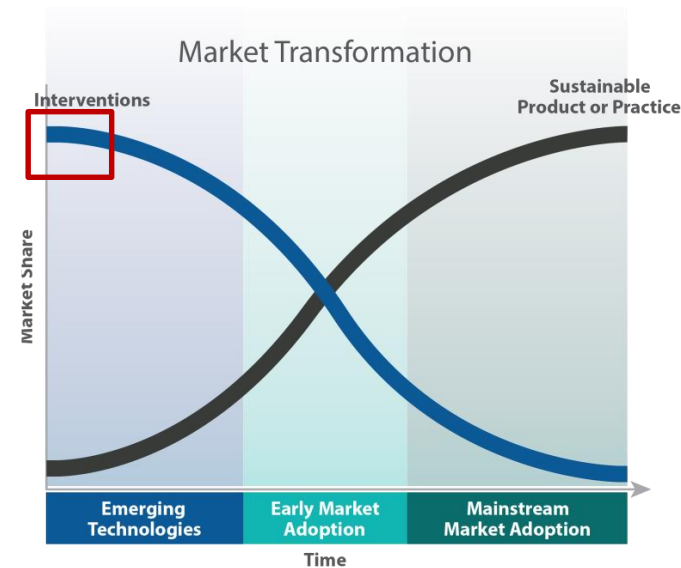
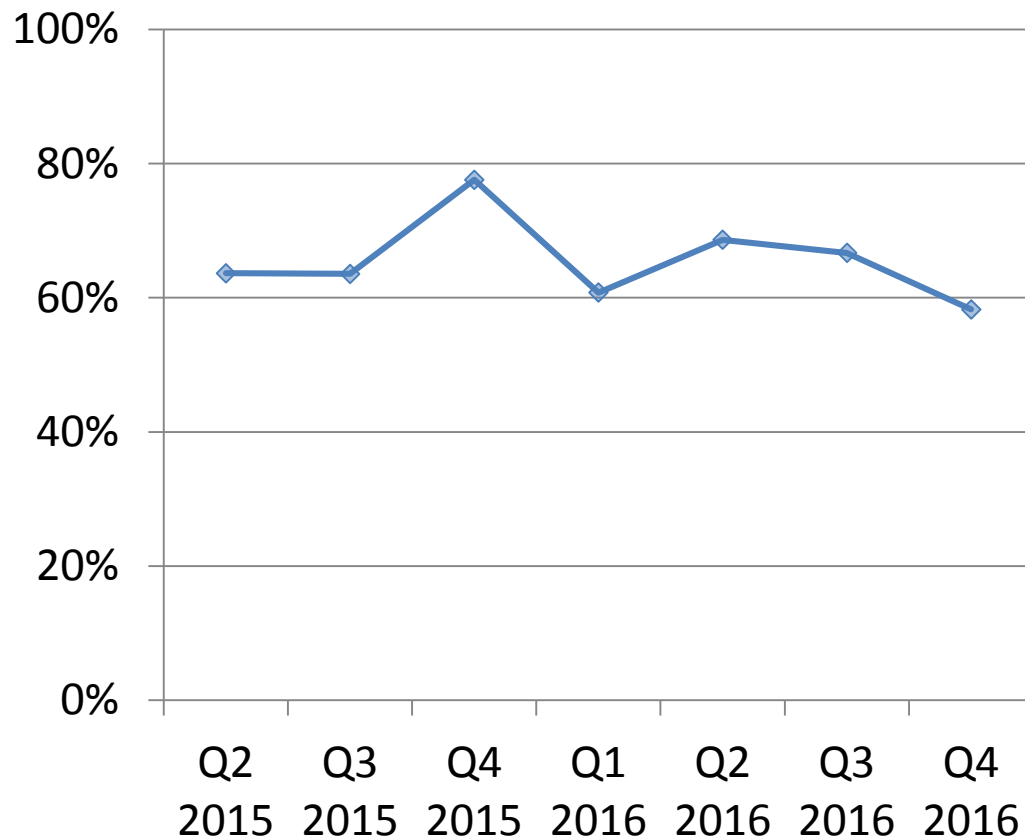
Keep incentive levels for impactful vehicles as high as possible for as long as possible; avoid premature phase-out

Common paradigm:



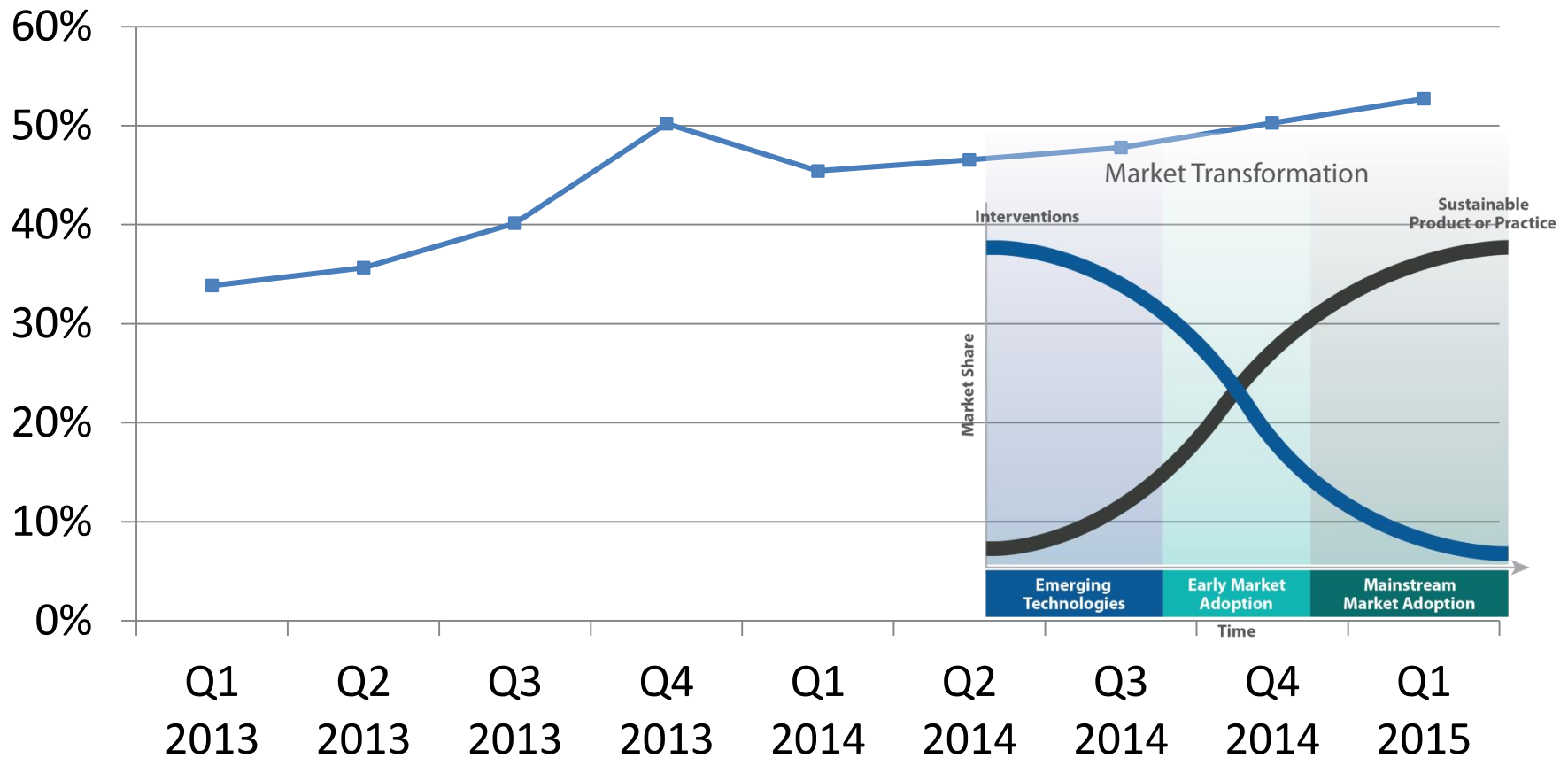
Current Reality: Rebate Essentials (CT)

% of CHEAPR participants that would not have purchased/leased their EV without the rebate



Current Reality: Rebate Essentials (CA)

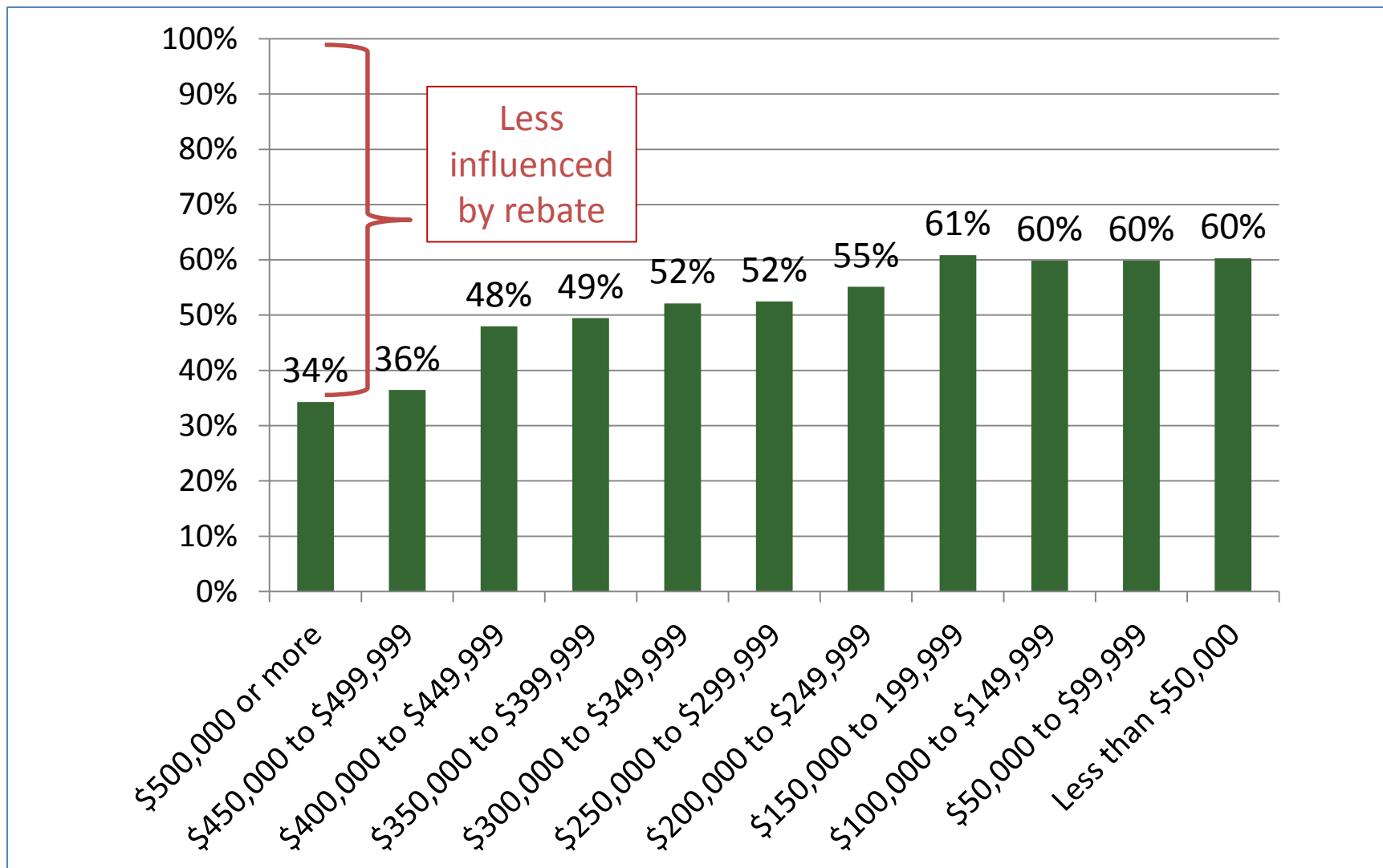
% of CVRP Participants that would not have purchased/leased their EV without the rebate



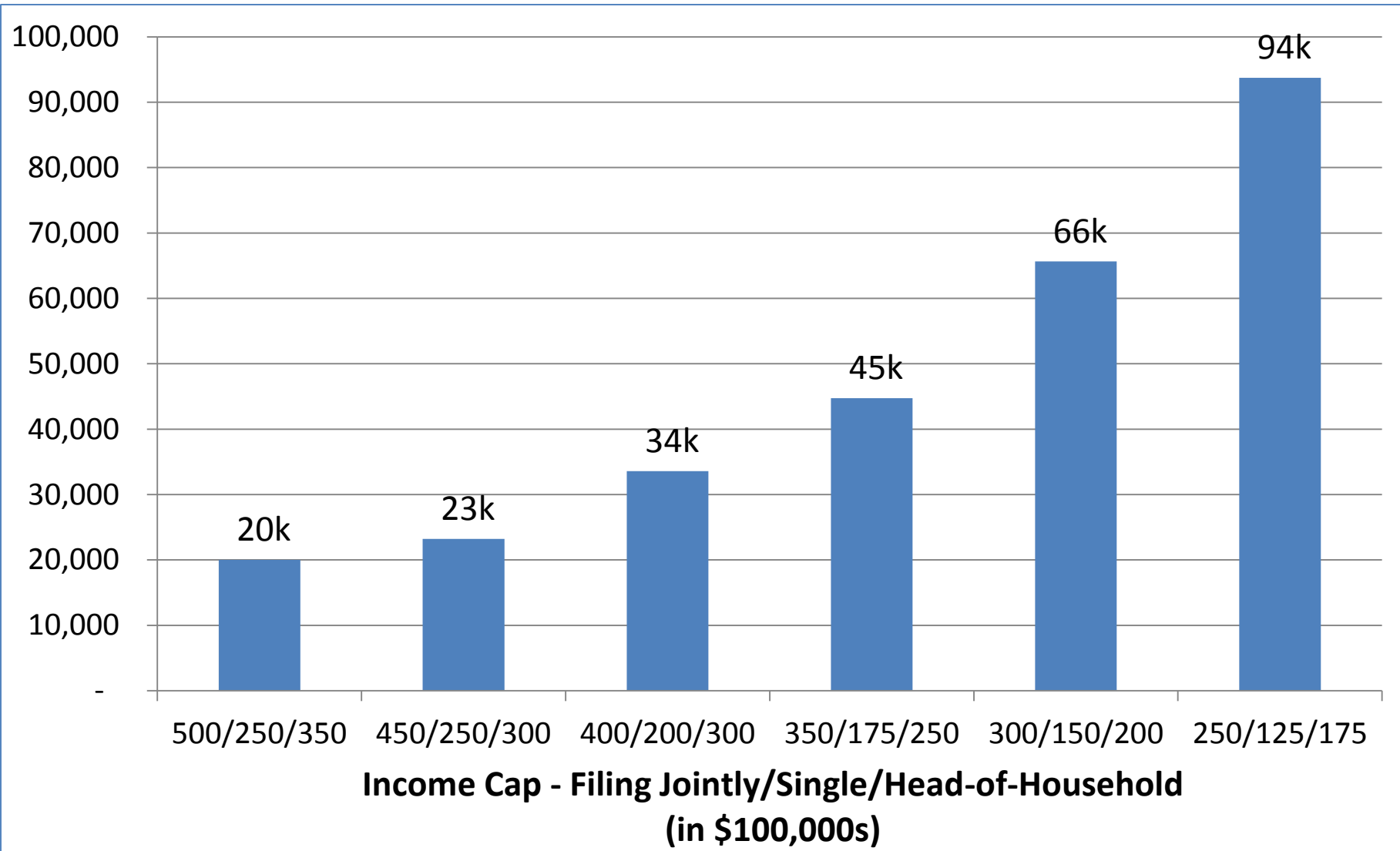
Sample Recommendations: Equity thru Eligibility

- Vehicle eligibility limits are much easier and less intrusive to implement than consumer eligibility limits
 - Consider making eligibility caps “hard” to reserve funds for more effective rebates

Percent Rebate Essential by Income



Estimated Vehicles Lost from ZEV Market thru 2022



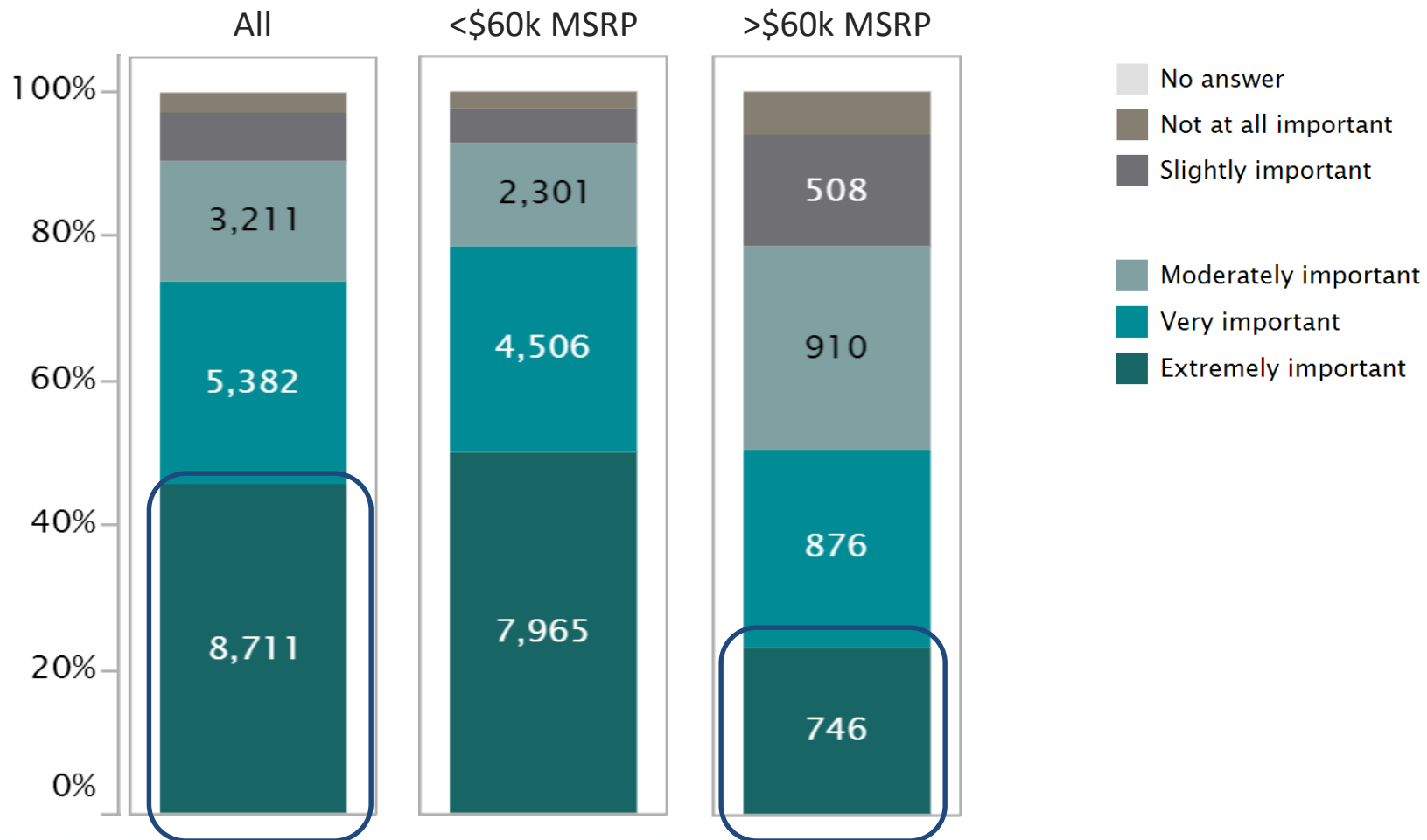
Rebate Importance

Importance of the rebate in making it possible to acquire a PEV.



Rebate importance is lower for consumers of expensive vehicles

Importance of the rebate in making it possible to acquire a PEV.



Sample recommendations: Range, PHEVs

- Support impactful PHEVs (e.g., that provide significantly more e-range than average daily driving) with maximum rebate
 - PHEVs represent an anxiety-free, infrastructure-independent, and cold-weather-robust gateway into ZEV markets
 - for a diversity of risk-adverse and/or constrained mainstream consumers.
 - Marginal social ***return on public investment*** in vehicle e-range diminishes above average daily driving distances
- Brett's *rough* rule-of-thumb for “equating” PHEVs and BEVs:
(BEV range ÷ 2) – 20 = PHEV e-range
 - Accounts for cold-weather losses (MIT) and emergency-trip buffer (UCD)

Illustrative Rebate Design Recommendation

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PHEV	Mercedes-Benz	C350e*	11	\$0
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PHEV	Volvo	XC90 T8	13	\$0
PHEV	BMW	330e iPerformance	14	\$0
PHEV	BMW	i8	14	\$0
PHEV	BMW	X5 xDrive40e	14	\$0
PHEV	Porsche	Cayenne S E-Hybrid	14	\$0
PHEV	BMW	740e xDrive	14	\$0
PHEV	Porsche	Panamera S E-Hybrid	15	\$0
PHEV	Audi	A3 e-tron ultra	16	\$2,000
PHEV	Ford	C-MAX Energi	20	\$2,000
PHEV	Ford	Fusion Energi	21	\$2,000
PHEV	Mitsubishi	Outlander*	22	\$2,000
PHEV	Toyota	Prius Prime	25	\$2,000
PHEV	Hyundai	Ioniq PHEV*	27	\$2,000
PHEV	Hyundai	Sonata Plug-In	27	\$2,000
PHEV	Kia	Optima Plug-In	29	\$2,000
PHEV	Chrysler	Pacifica Plug-In	33	\$3,000
PHEV	Chevrolet	Volt (2016)	53	\$3,000
PHEV	BMW	i3 REx (2017)	97	\$3,000
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BEV	Kia	Soul EV	93	\$2,000
BEV	Nissan	LEAF	107	\$3,000
BEV	BMW	i3 94 Ah	114	\$3,000
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- Minimum eligibility threshold is 15 electric miles (average commute distance)
- Supports market stimulation and acceleration into mainstream consumers with a signal for capable PHEVs (30 miles = average daily driving)
- Introduces MSRP cap to increase program effectiveness and equity without complexity of income criteria

*Forthcoming products; numbers may change

How is the dealer incentive working?

Evaluating the Connecticut Dealer Incentive for Electric Vehicle Sales

April 2017

Prepared by
Center for Sustainable Energy



What is CHEAPR?



- The Connecticut Hydrogen and Electric Automobile Purchase Rebate (CHEAPR) program offers rebates for new, eligible electric vehicles purchased/leased since May 2015
- The CHEAPR program includes two types of incentives for each eligible vehicle:
 - Vehicle Rebate (up to \$5,000)
 - Dealer Incentive (\$300)

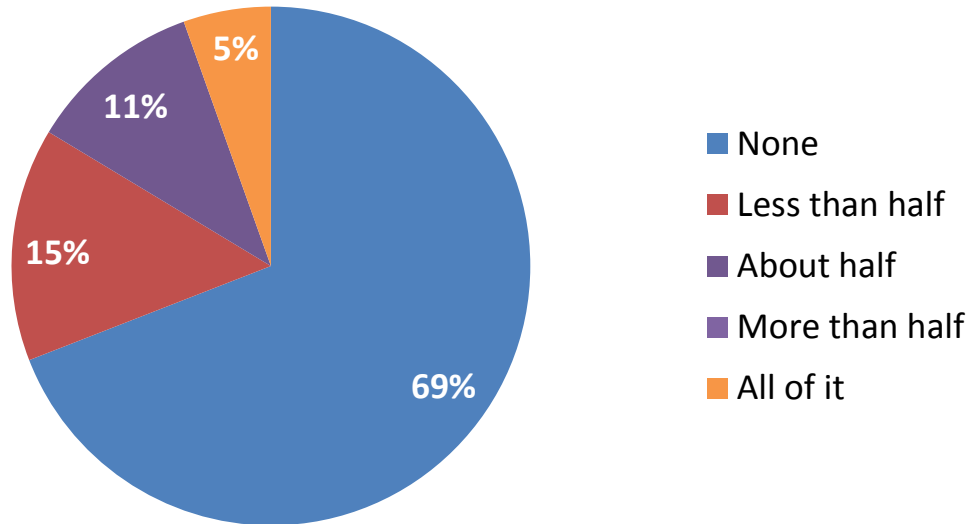


EVERSOURCE

CAAR
ASSOCIATION

How is the dealer incentive being distributed within dealerships?

At your dealership, how much of the dealer incentive does the salesperson responsible for the sale receive?†



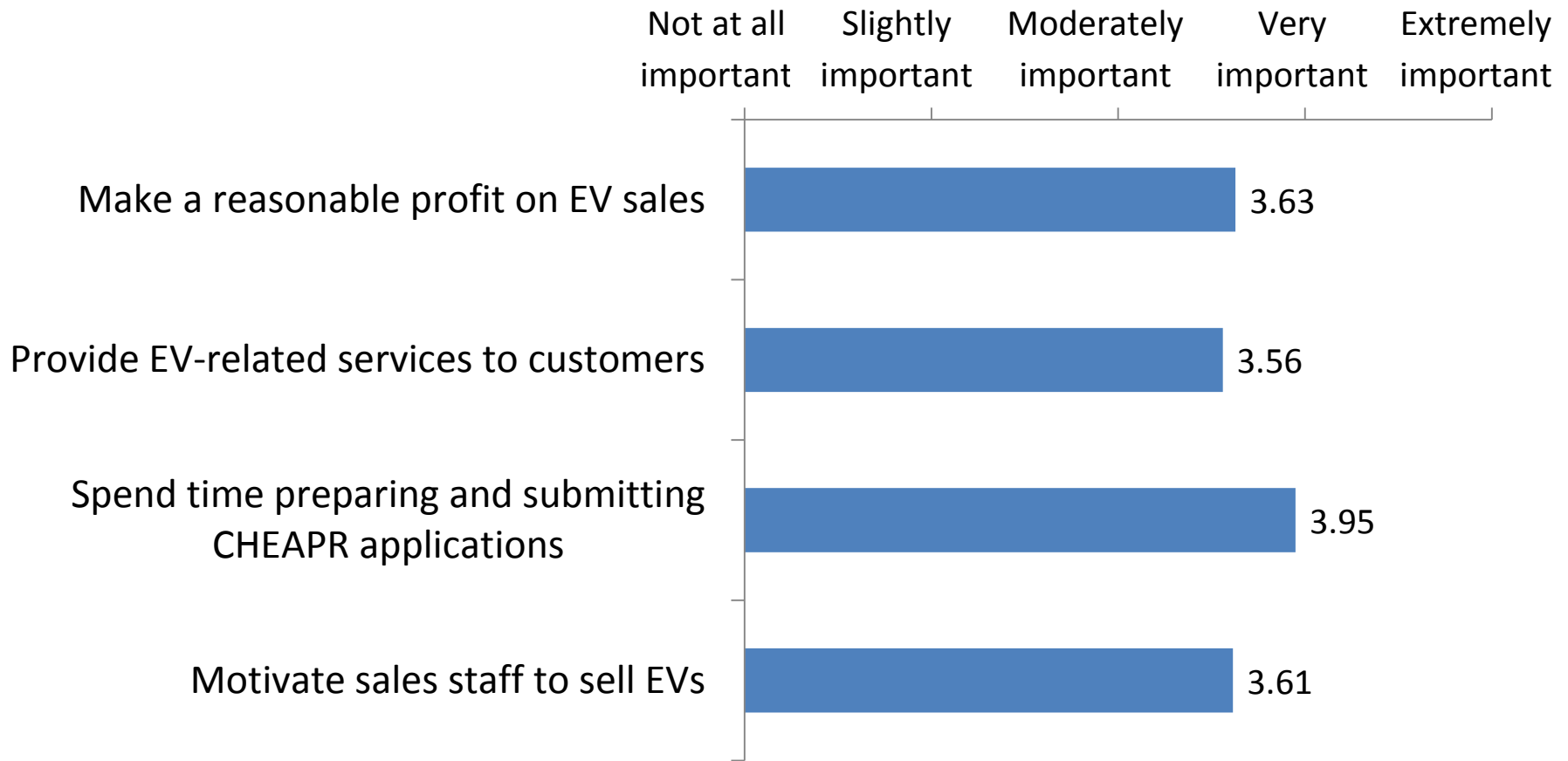
Though **95%** of respondents said they were **at least moderately familiar** with CHEAPR, **27%** of all respondents and **31%** of sales employees were **not aware of the dealer incentive** at the time of the survey.

†Respondents=55

Question only asked of respondents who said they were aware of the dealer incentive

“I don’t know” responses excluded

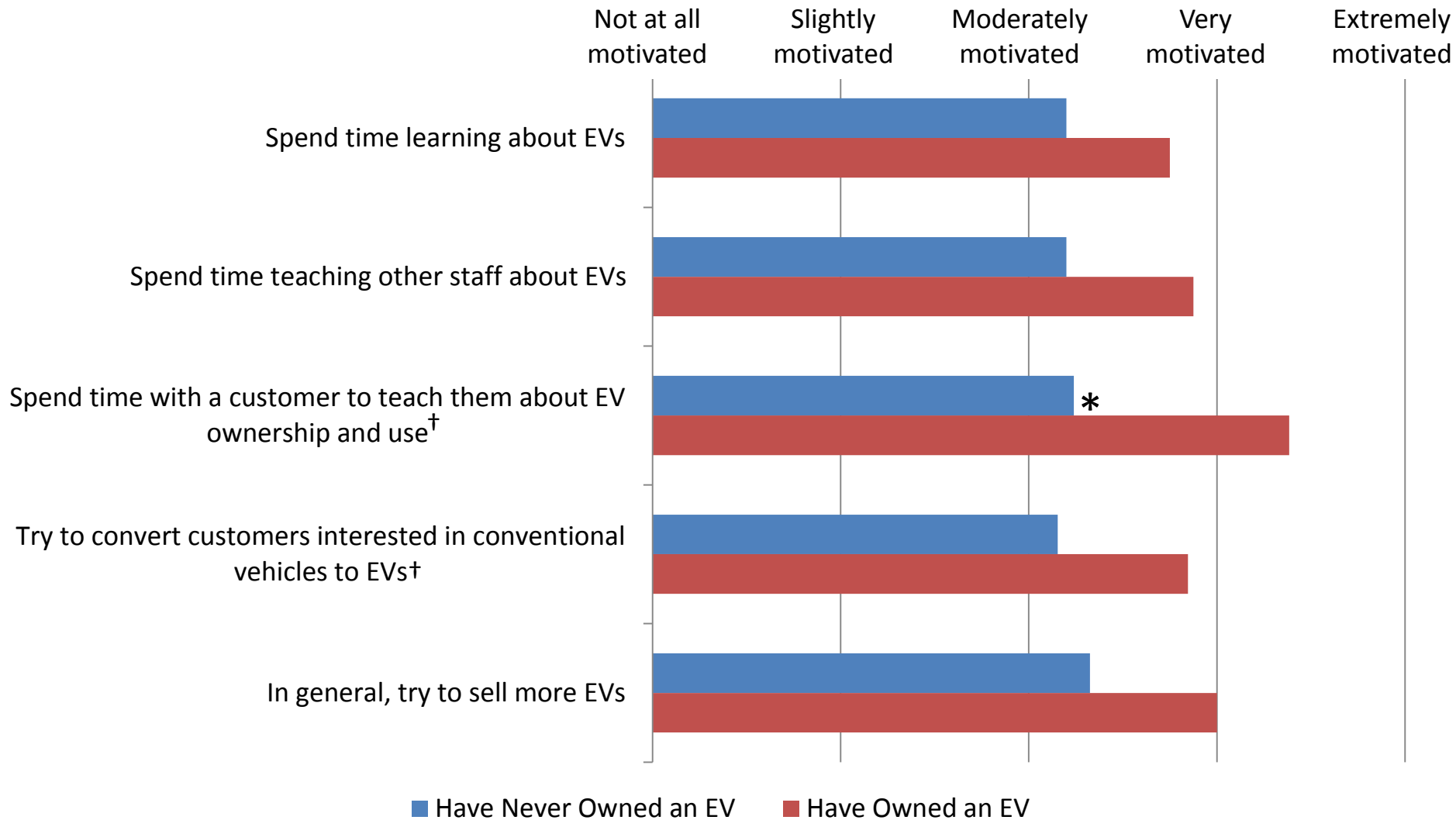
How important is the dealer incentive in making it possible for your dealership to do each of the following?



Respondents = 59

Note: Question only asked of respondents who said they were aware of the dealer incentive

To what extent are you motivated by the current dealer incentive to do each of the following? –All Employees



Respondents=57; only those who were aware of dealer incentive

†Sales employees only; respondents=39

*Statistically significant difference ($p < 0.05$)

A photograph of two men in a car dealership. One man, wearing a black suit and a red tie, is standing next to a white car with its door open, showing a red interior. The other man, wearing a light blue shirt, is standing next to him, looking at the car. The background is a bright, modern dealership interior.

What are the most important information channels?

Who is participating?



Weighted EV Consumer Survey

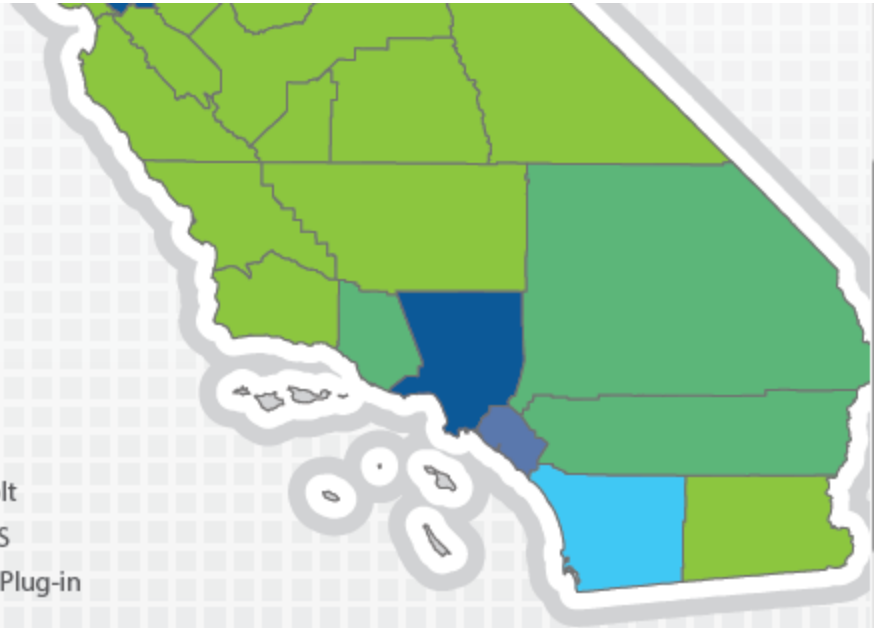
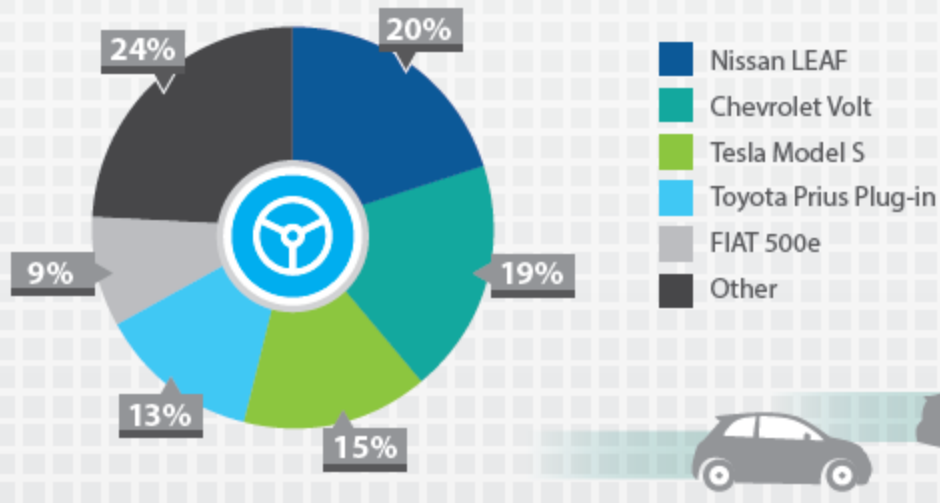
(CVRP vehicles acquired Sep 2012 thru May 2015)

Survey sample

19,460

individuals responded to the survey**

Vehicles driven by respondents



* 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.

Majority Characteristics of CVRP Consumers

CVRP-All (EV Consumer Survey 2014)	
40–59 years old	55%
≥ Bachelor's	82%
Postgraduate	49%
Male	74%
White/Caucasian	63%
Detached homes	80%
\$50–200k/y household income	62%

Majority Characteristics of CVRP Consumers

	CVRP-All (EV Consumer Survey 2014)	New-vehicle “intenders” (CHTS 2012)
40–59 years old	55%	52%
≥ Bachelor’s	82%	66%
Postgraduate	49%	34%
Male	74%	49%
White/Caucasian	63%	76%
Detached homes	80%	75%
\$50–200k/y household income	62%	58%

A photograph of two men in business attire standing next to a white car with a red interior. The man on the left is wearing a black suit and a red tie, and the man on the right is wearing a light blue shirt. They are both looking at the car. The car's door is open, and the interior is visible. The background is a bright, modern setting, possibly a car dealership.

How can the program expand the market for EVs through targeted outreach?

Who needs the rebate the most?

How can consumer research help us grow markets for electric vehicles?

1. **“Adding fuel to the fire”**: understand existing, generally enthusiastic adopters to target similar consumers

- Segment: all-battery vs. plug-in hybrid EVs
- Characteristics, motivations, and trends
- Who is “pre-adapted” to adopt? (e.g., Williams and Kurani 2006)

2. **“Tough nuts to crack”**: understand and break down barriers faced by consumers targeted based on policy priorities

- Multi-unit dwellers
- Disadvantaged Communities
- Low-to-moderate income consumers

3. **“Expand market frontiers”**: understand the margins of the market to target consumers who can be induced to join

- Adopters most influenced by incentives -- “rebate essentials”
- Adopters with low initial interest in EVs -- “converts”



Target Consumers: “Rebate Essential” Segment

Characteristics statistically associated with being rebate essential:

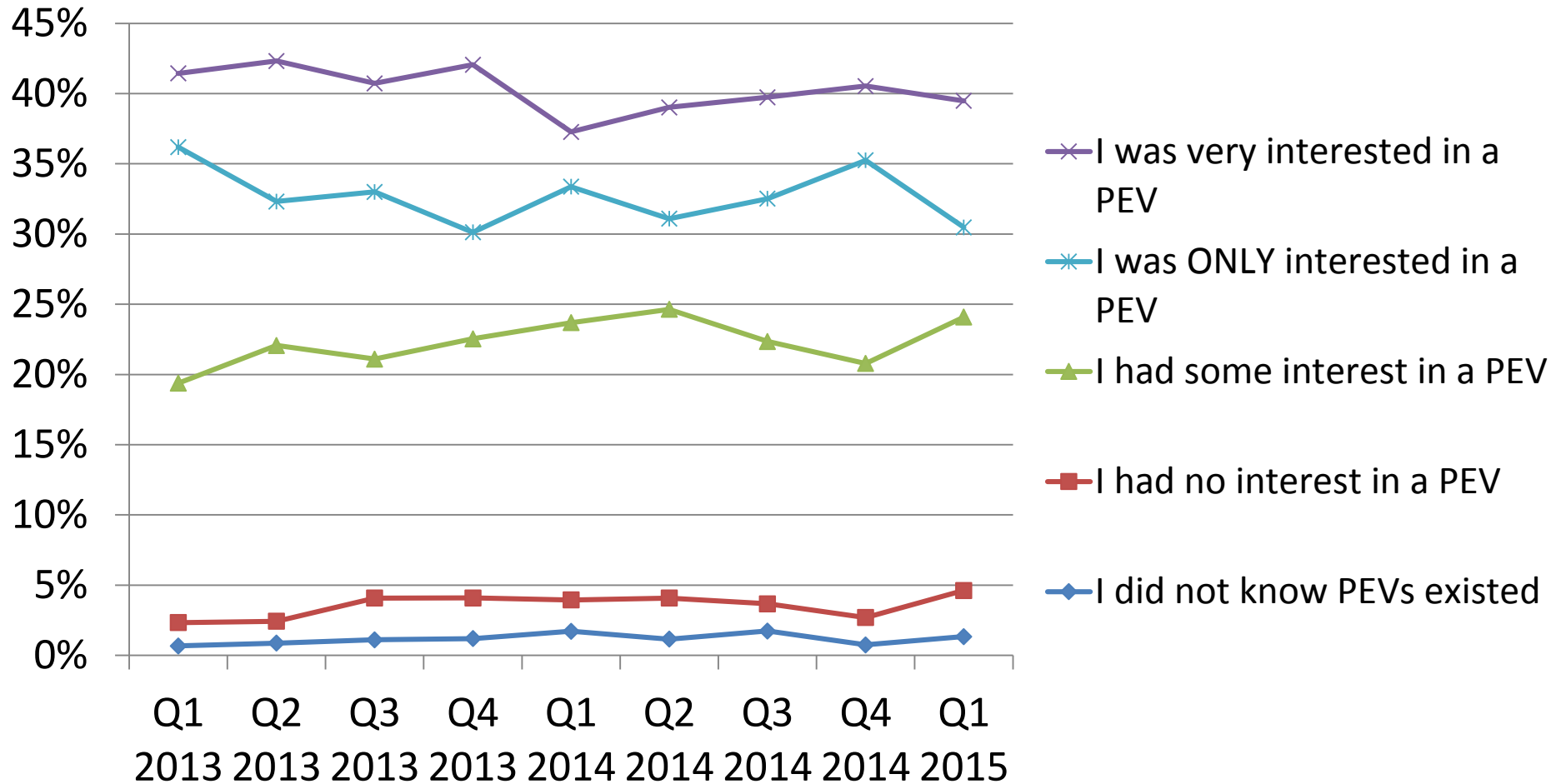
- **Vehicle characteristics:** lower price, bought (vs. lease)
- **Demographics:** younger, male, non-white, lower HH income, higher education
- **Motivations and interest:** less motivated by environmental impacts, more motivated by saving money on fuel and energy independence, lower initial interest in EVs
- **Information gathering:** found it more difficult to find info on EVs, spent more time researching online, learned about the rebate before going to the dealership

The rebate is more essential to consumers:

- focused on **“financial and practical”** aspects of adoption
 - saving money on vehicle price and fuel costs, being fully exposed to a purchase rather than a lease, being constrained by lower household income, carpool lane access
- who face **“greater contextual constraints”** or are otherwise less easily able to adopt
 - lower household income, perhaps younger and less established, perhaps more risk adverse and thus looking to an established hybrid brand, perhaps with less cultural exposure to EVs
- whose adoption is **driven less by “green enthusiasm”** than other values
 - less motivated by reducing environmental impact and more motivated by increased energy independence and saving money on fuel costs; and
- with **“challenging informational environments”**
 - low initial interest in EVs, greater difficulty finding information on EVs, who did more research online, but who perhaps benefitted from higher education to navigate these complex informational environments and have found out about the rebate before showing up at the dealership for their acquisition

Which of the following statements best describes your interest in a PEV when you started your search for a new vehicle?"

California Clean Vehicle Rebate Project



Source: EV Consumer Survey
Respondents: 19,460
Purchase dates 9/1/12-5/31/15
Sampling weights applied

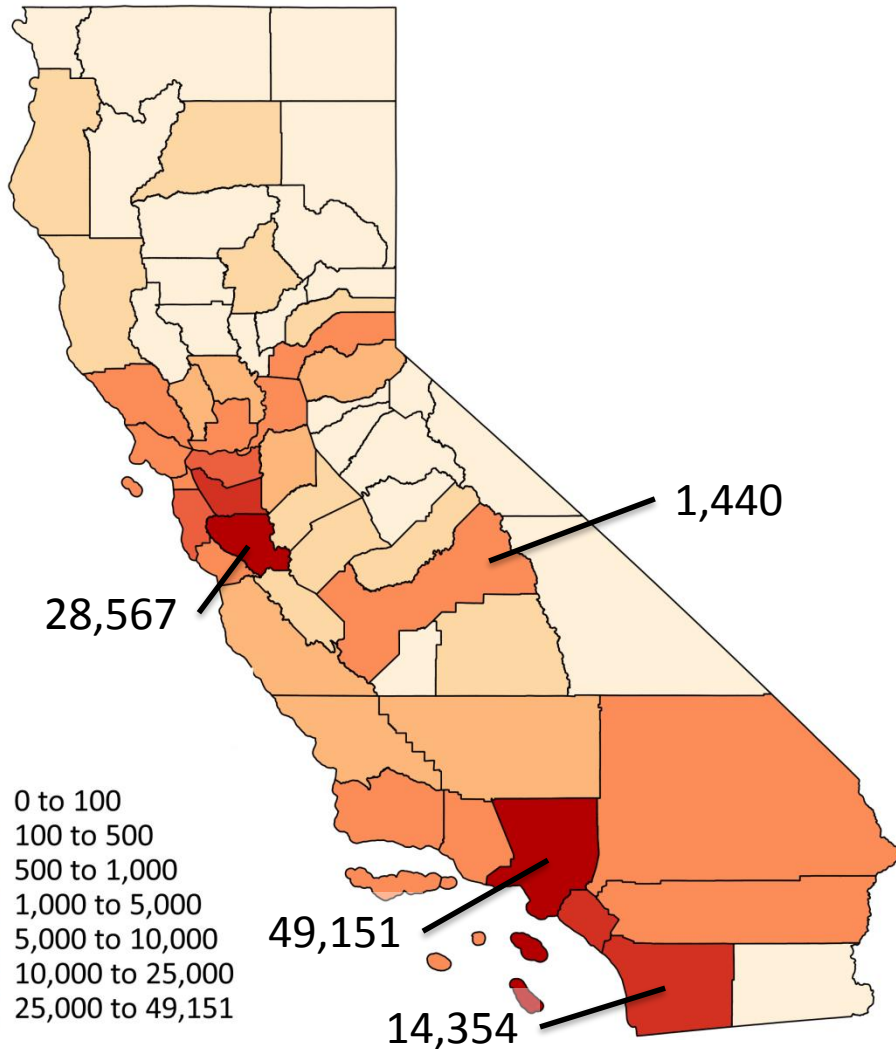
The convert is more likely:

- **less demographically specific/constrained**
 - May or may not be constrained by income, have postgraduate degrees, or be male
- **driven less by “energy and the environment” than traditional vehicle-operation reasons**
 - less motivated by reducing environmental impact and energy independence, and carpool lane access, and more by saving money and perhaps vehicle performance
 - No solar, perhaps no workplace charging
- **with “challenging informational environments”**
 - low initial interest in EVs, perhaps with less cultural exposure to EVs, greater difficulty finding information on EVs, who did *less* research online, and may learn about the rebate from the dealer
- **“switching from old to new”**
 - Leasing their first EV as a replacement vehicle

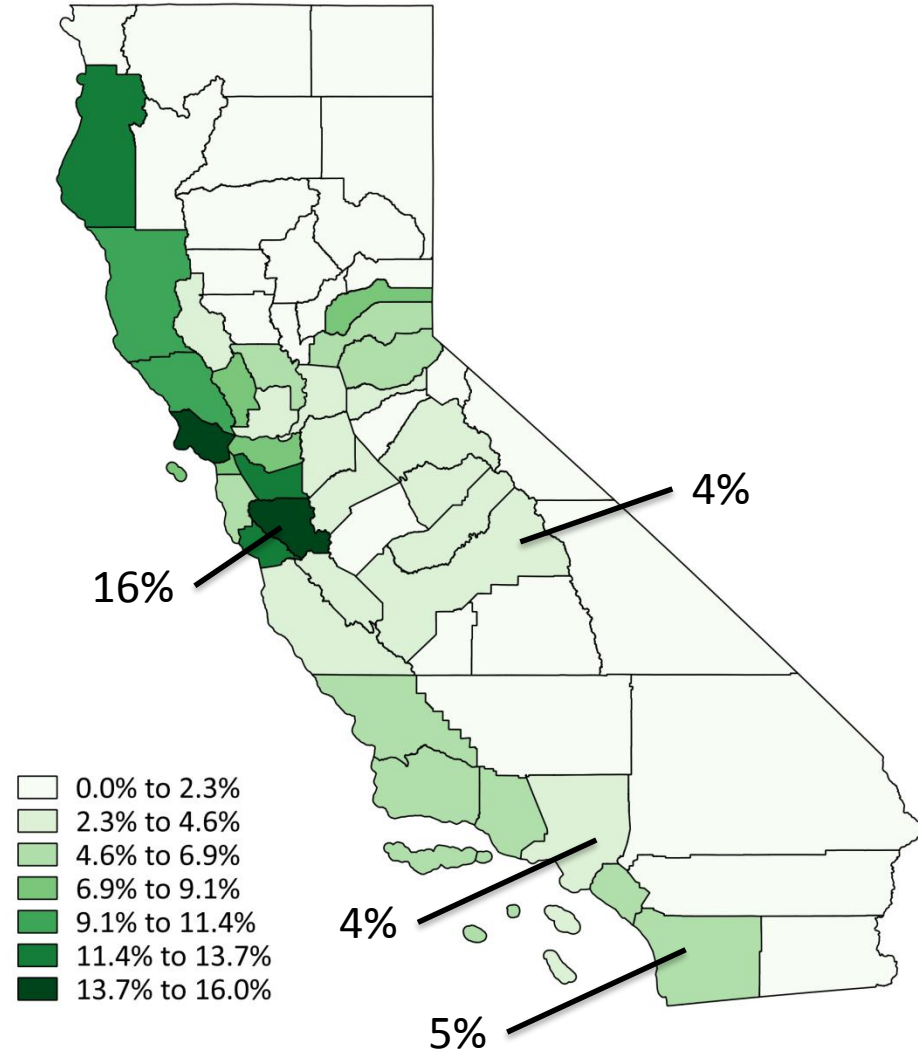
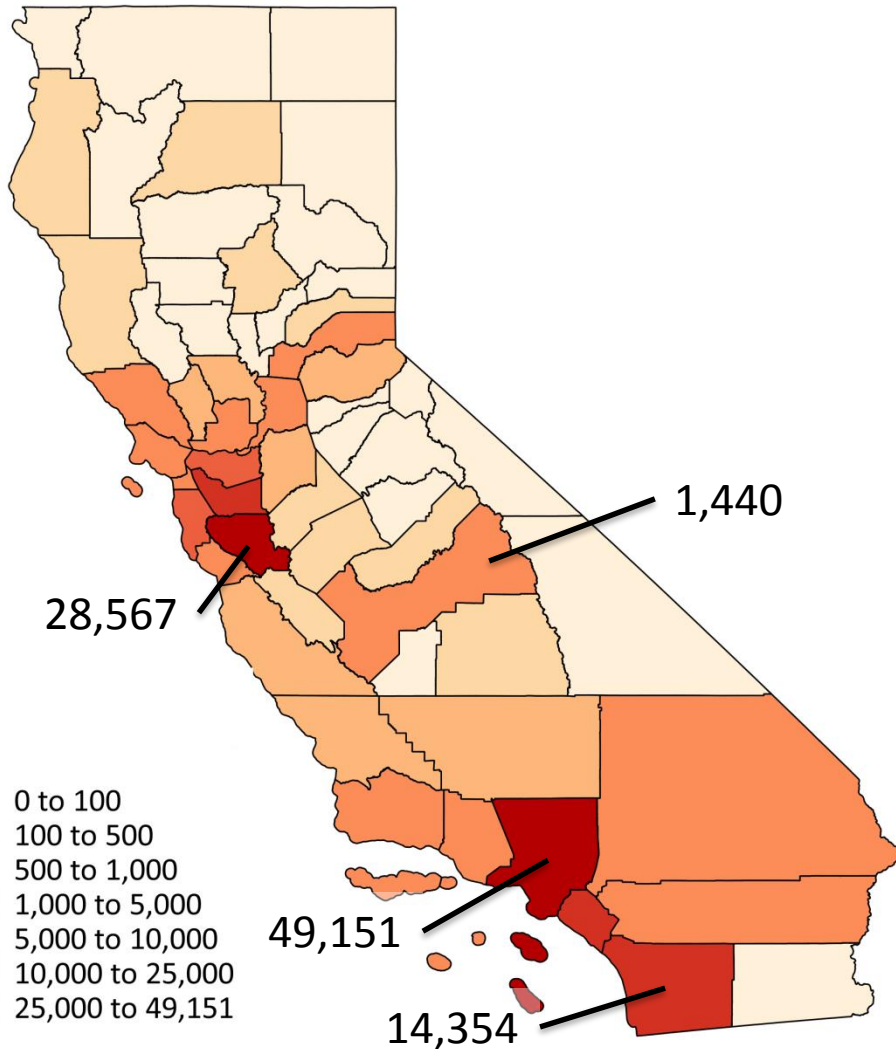
A man in a white shirt and dark tie is handing a set of car keys to a smiling couple. The man is on the left, and the couple is on the right. The man in the white shirt is also holding a pair of glasses. The couple consists of a man in a light blue shirt and white pants, and a woman in a grey blazer and white pants. They are standing in front of a large window with a view of a city. The text "Are the programs equitable?" is overlaid in the center of the image.

Are the programs equitable?

New Registrations by County (thru Dec 2015)

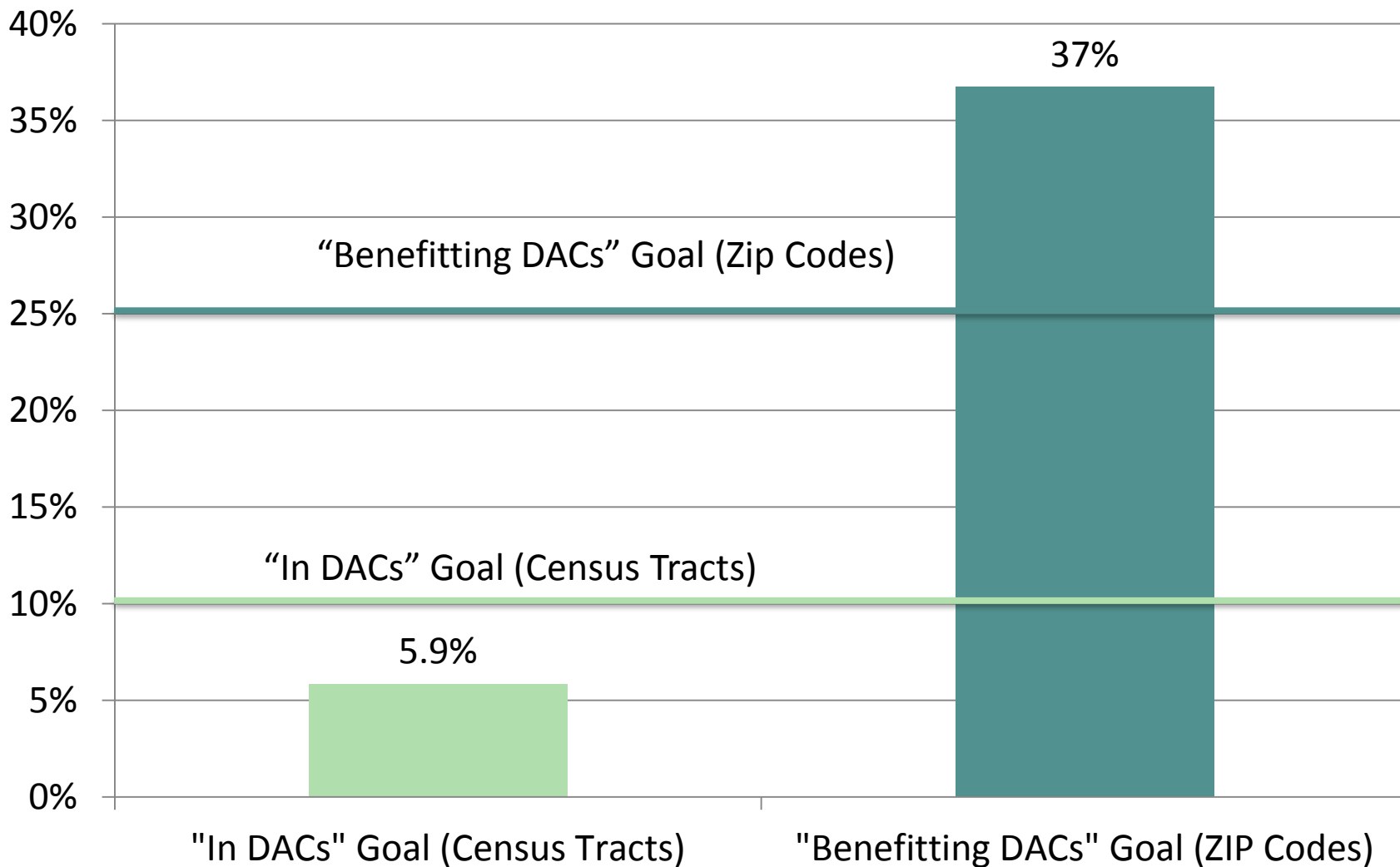


New Registrations by County & Normalized to Comparable Sales (2015)

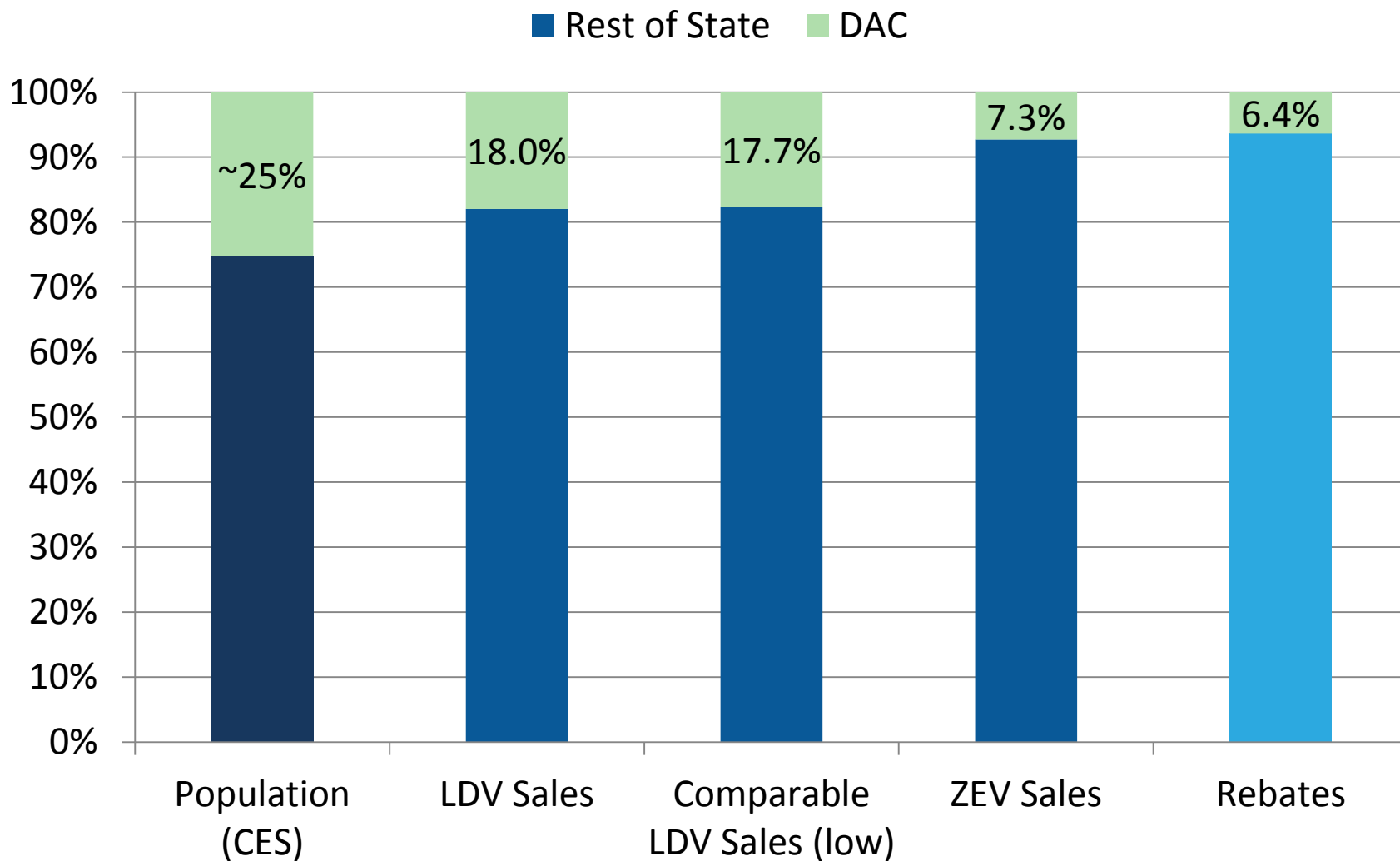


PEV Rebate Dollars to Disadvantaged Communities

(Life of Program thru 2015)

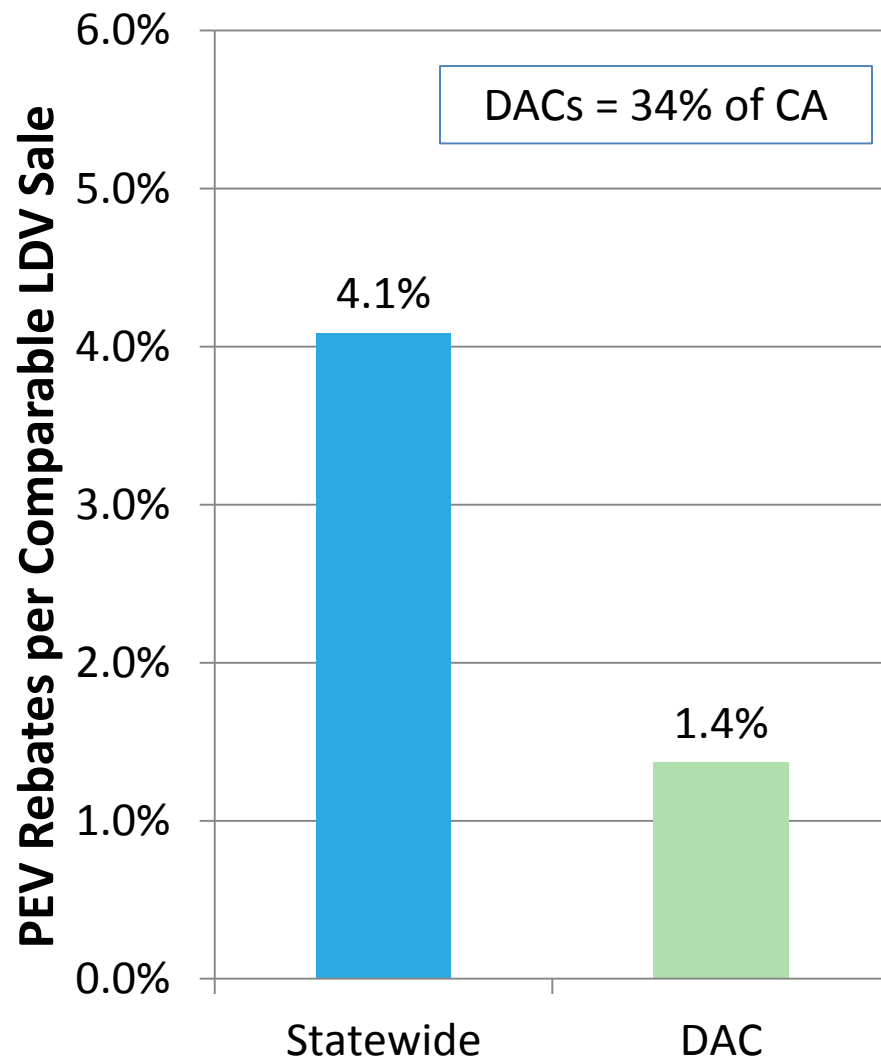
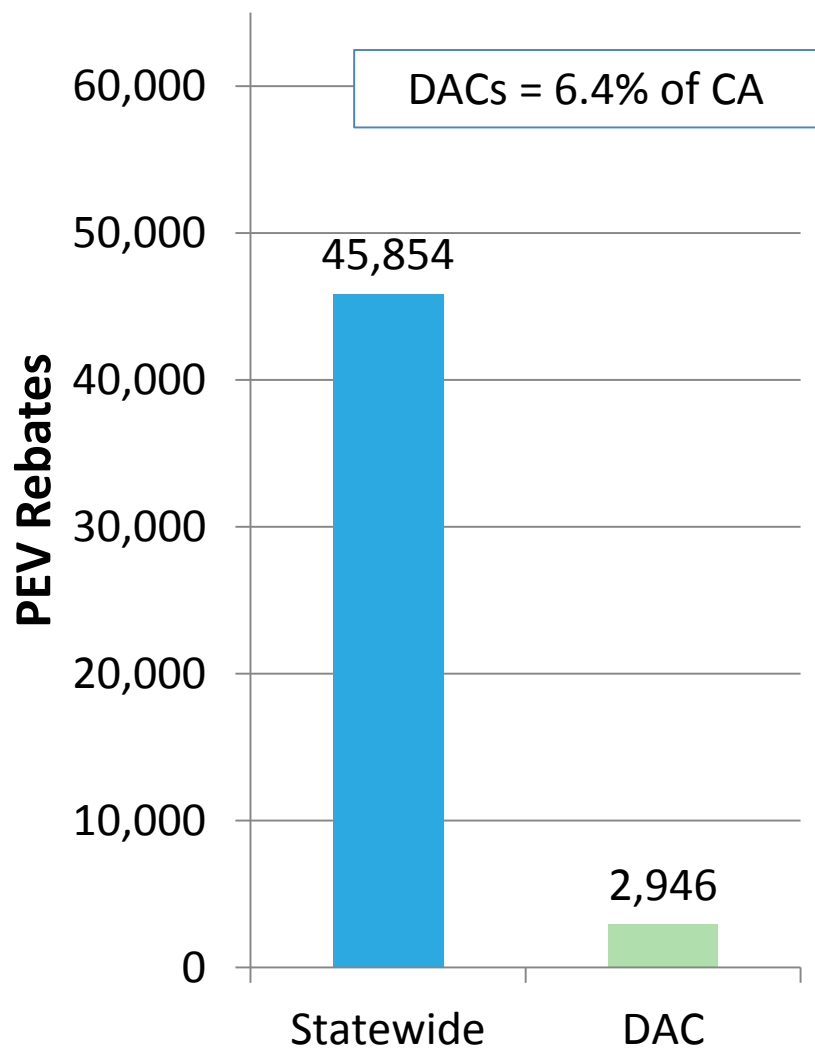


DACs as a Percentage of Entire State (2015)



Rebates as a % of Comparable New Car Sales

(2015 calendar year)



Legislation: New CVRP Eligibility Requirements

	Took effect March 2016	To take effect November 2016
Consumer Income Cap*:		
Single filers	\$250,000	\$150,000
Head-of-household filers	\$340,000	\$204,000
Joint filers	\$500,000	\$300,000
Vehicle Requirement:		
Electric range		Must be \geq 20 e-mi
Increased Rebate for Low-to-Moderate Income Households**:		
	\$1,500	\$2,000

*Income cap is deferred for consumers of fuel-cell electric vehicles

** Defined as \leq 300% of the Federal Poverty Level

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






On November 1, 2016:

- The increased rebate amount will become \$2,000
- Prioritization of rebate payments to low income consumers

Persons in household	Max Income*
1	\$35,640
2	\$48,060
3	\$60,480
4	\$72,900
5	\$85,320
6	\$97,740
7	\$110,190
8	\$122,670

* 300% of the Federal Poverty Level

Statewide Monetary Incentives (as of 1 Nov.)

		CVRP	CVRP-LMI (≤300% FPL)
	Hydrogen Fuel-Cell Electric Vehicles	\$5,000	\$7,000
	Battery Electric Vehicles (& i3 REx)	\$2,500	\$4,500
	Plug-in Hybrid Electric Vehicles	\$1,500	\$3,500
	Neighborhood Electric Vehicles	\$900	\$900
	Zero-Emission Motorcycles	\$900	\$900

Summary

- 5.9% of rebate funds have gone to DACs, but context is important:
 - Some “small markets” (e.g., Fresno) show similar EV market shares as L.A.
 - DACs are 1/4th of the population, but only ~1/6th of new-car market and ~1/14th of the ZEV market
 - Similarly, CVRP demographics differ less from new-car buyers than the population
- When normalized for comparable new-car sales, the rebate share in DACs is ~34% that of the state overall, not 6%
- Expectations should be further calibrated in light of underlying “structural” differences that make EV adoption more challenging in DACs
 - E.g., lower income, greater portion of MUDs and lower access to workplace charging
 - Underlying proclivity for PHEVs is counter to incentive structure favoring BEVs
- The stated importance of the rebate is growing and is higher in DACs
- Measures to increase the proportion of low-to-moderate income program participants are underway, but add program complexity
- Expectations should be modest about how these LMI measures will affect DAC indicators, due to modest levels of LMI participants to date in DACs

Weighted EV Consumer Survey: Overall and DACs

(CVRP vehicles acquired Sep 2012 thru May 2015)

Overall:

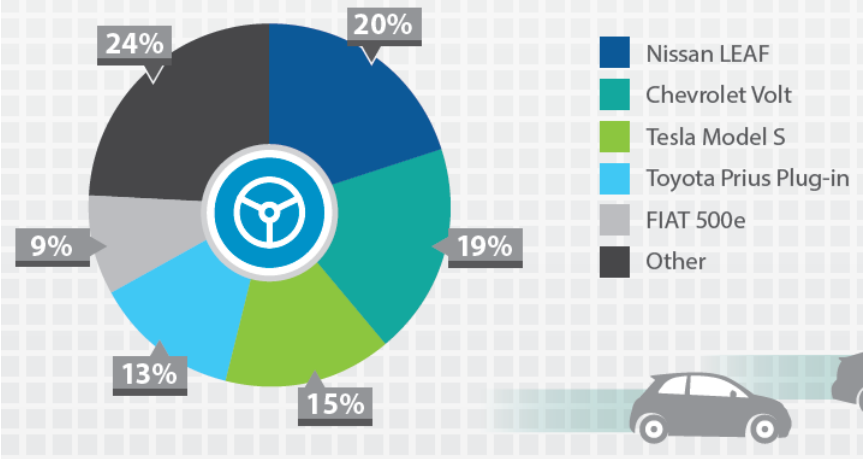
Survey population
91,085
 plug-in electric vehicles (PEVs) were adopted by individuals and rebated from September 1, 2012 to June 17, 2015*

39,325
 Plug-in hybrid electric vehicles (PHEVs)

51,760
 Battery electric vehicles (BEVs)

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

Vehicles driven by respondents



DACs:

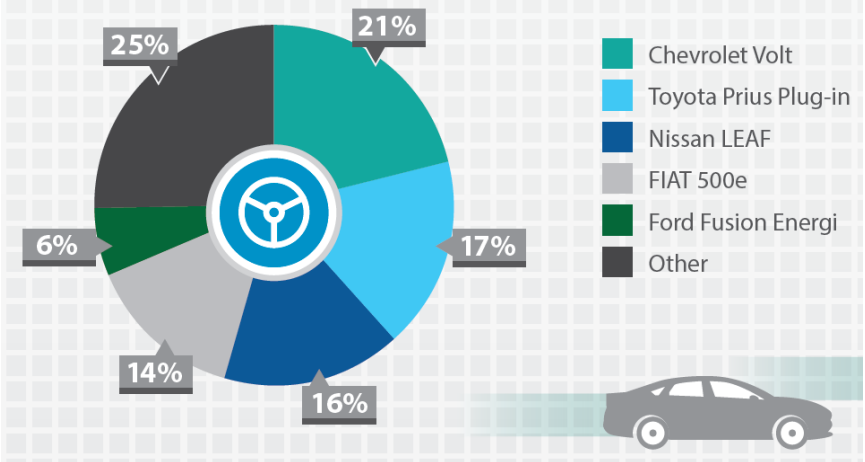
Survey population
5,320
 plug-in electric vehicles (PEVs) were adopted by individuals in DACs and rebated from September 1, 2012 to June 17, 2015†

2,608
 Plug-in hybrid electric vehicles (PHEVs)

2,712
 Battery electric vehicles (BEVs)

Survey sample
1,120
 individuals responded to the survey†

Vehicles driven by respondents

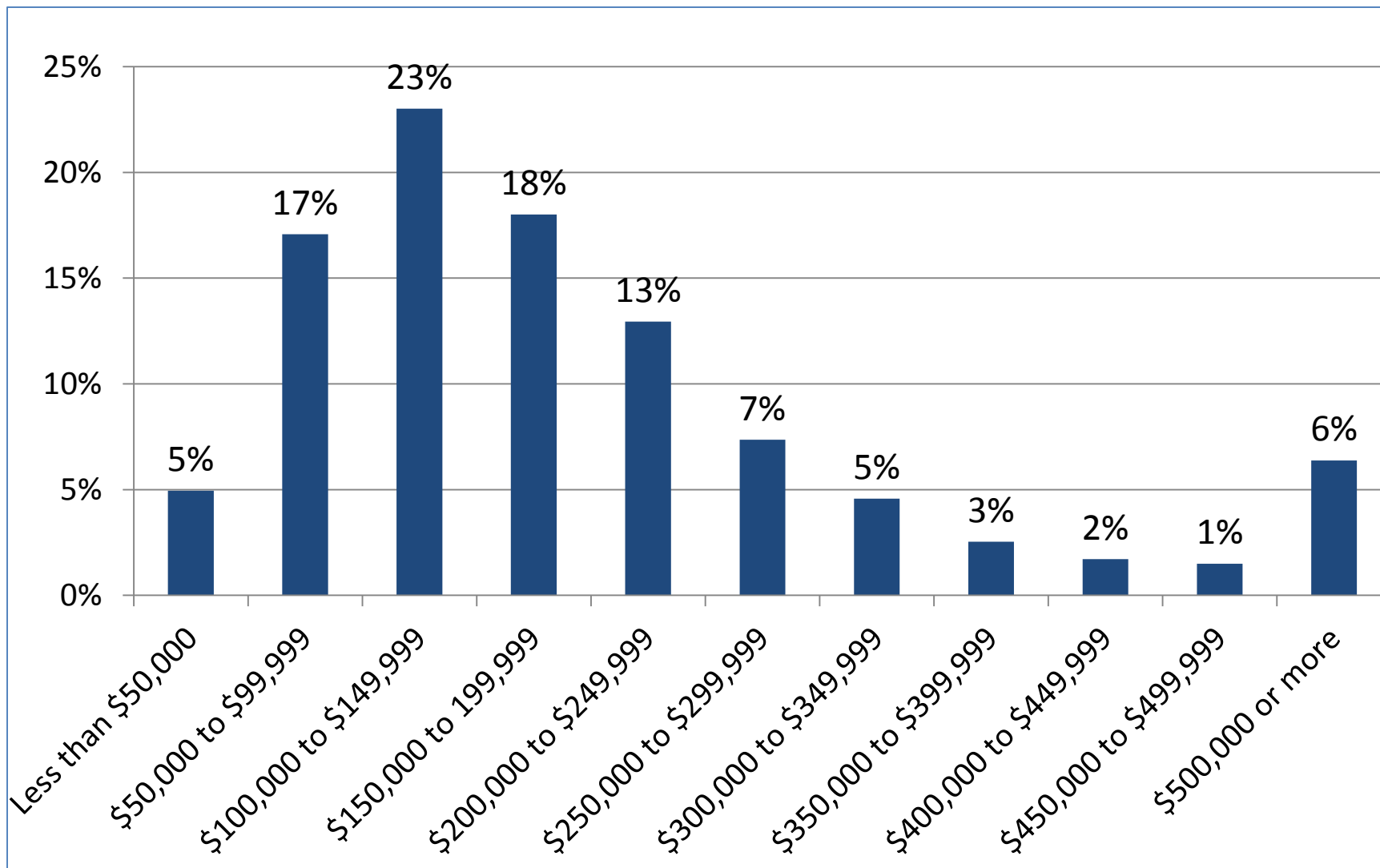


A photograph of two men in business attire standing next to a white car with a red interior. The man on the left is wearing a black suit and a red tie, and the man on the right is wearing a light blue shirt. They are both looking towards the car. The car's door is open, and the interior is visible, showing red leather seats and a black dashboard. The background is a bright, modern setting, possibly a car dealership.

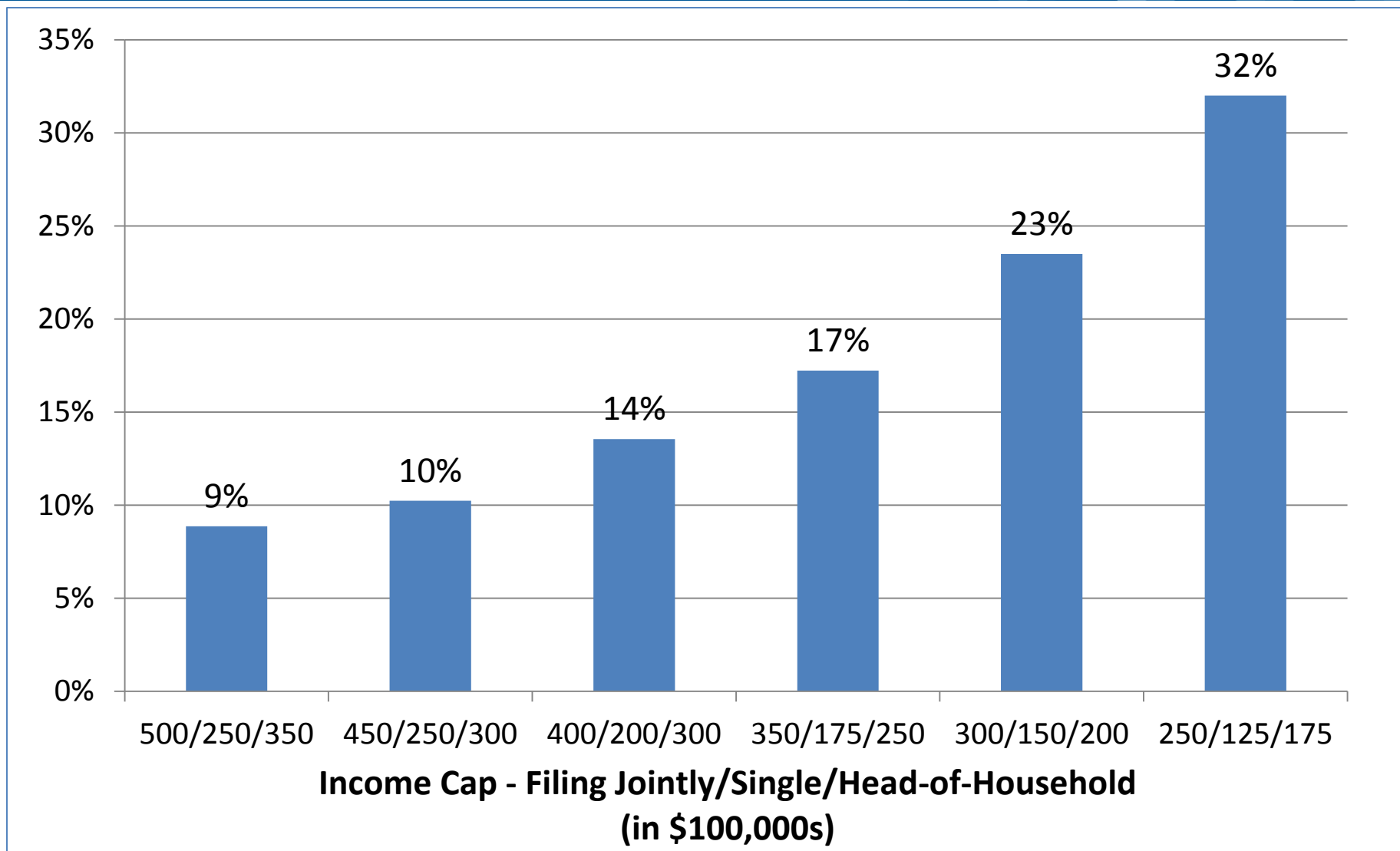
What is the impact of an income cap?

August 2016 estimates from CVRP

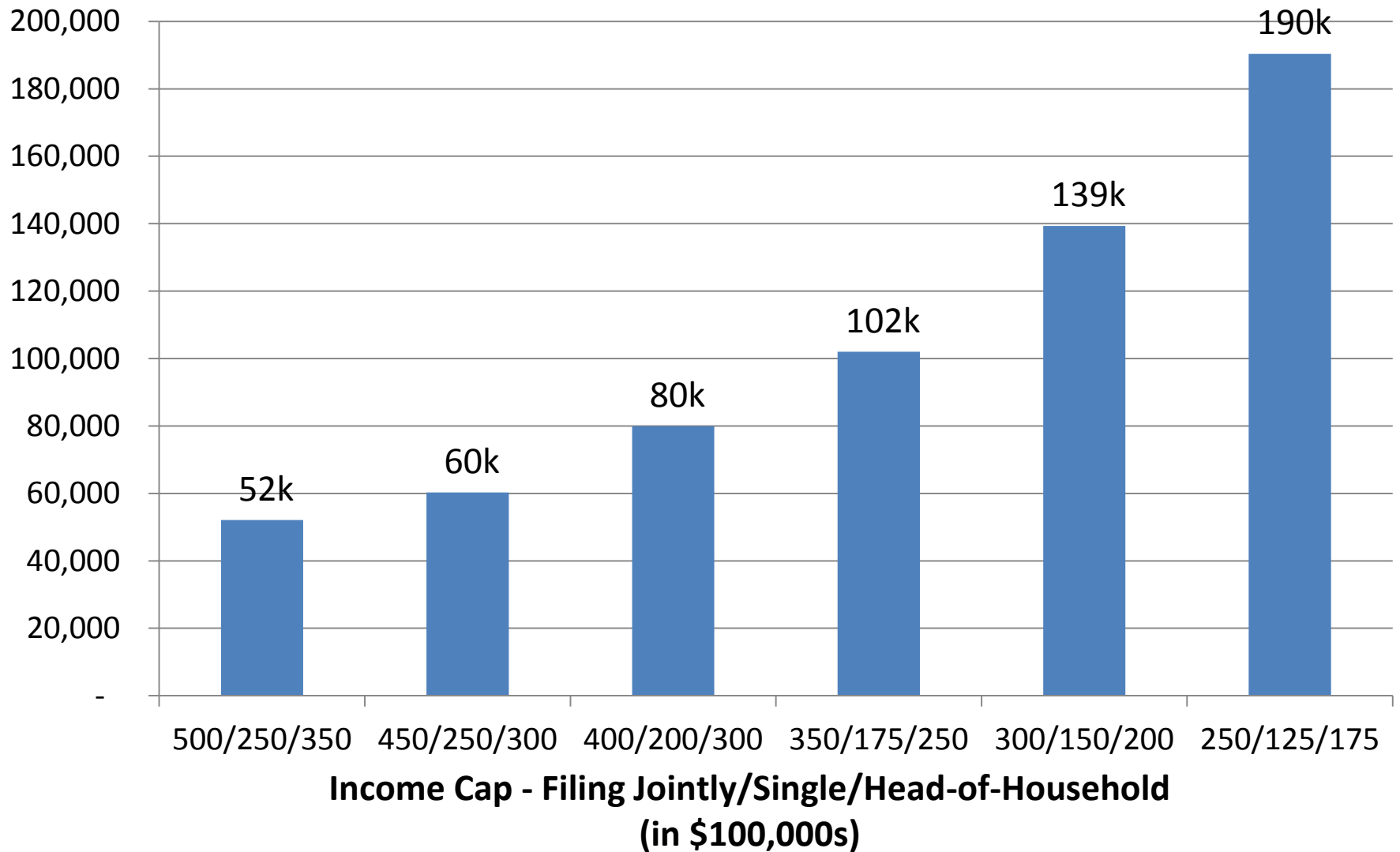
Distribution of CVRP Respondents by Household Income



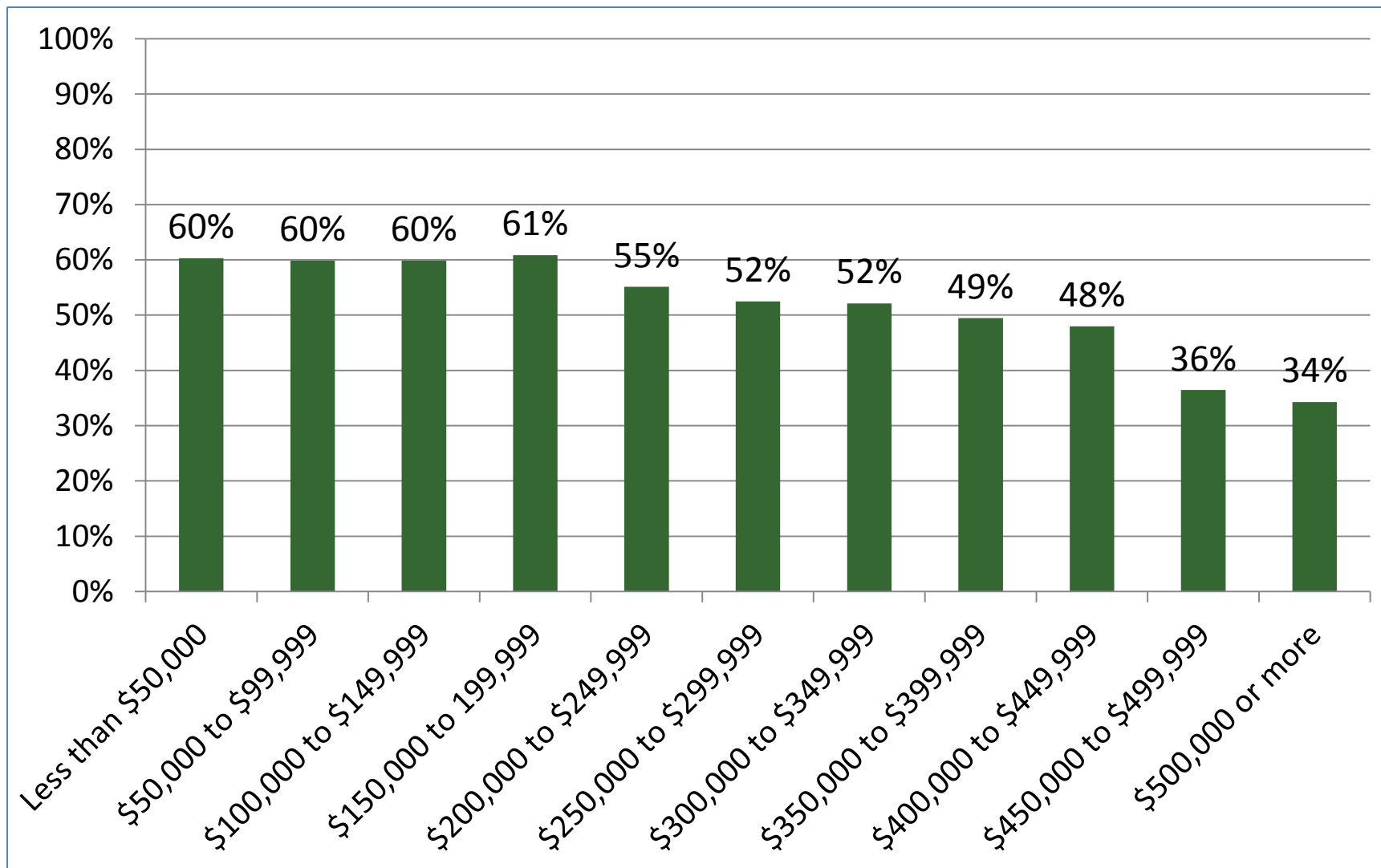
Percent of CVRP Program Excluded by Different Caps



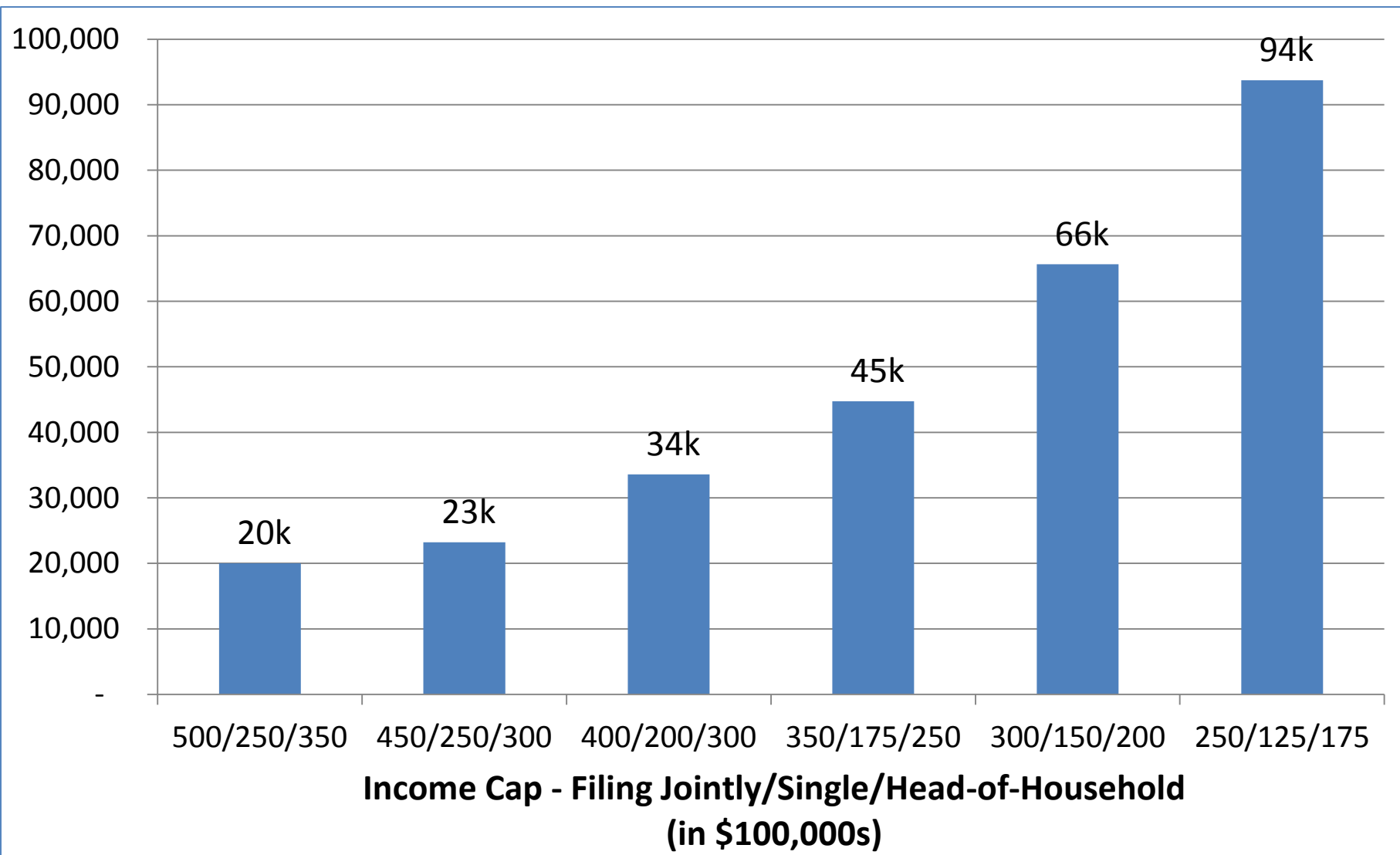
Estimated Vehicles Excluded from the CVRP thru 2022



Rebate Essential by Income



Estimated Vehicles Lost from ZEV Market thru 2022



Major takeaways

- Lowering the cap is likely to have a non-linear impact
 - As the cap moves to and below \$400k/\$200k/\$300k the losses “accelerate”
 - Halving the cap (from \$500k/\$250k/\$350k to \$250/\$125/\$175) causes 5-fold losses
 - This might make meeting SB 1275’s goal of 1M ZEVs by 2023 “more difficult” by roughly 10%



Online Resources

Participant Evaluation Examples

- **Target Consumer Segments: Converts, Rebate Essentials** ([BECC pres 2016](#) and [TRR 2017 journal article](#))
 - Progress in **Disadvantaged Communities** ([AEA pres 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 ([CVRP DAC infographic, 2017](#))
 - 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 ([AEA pres 2016](#))

Outline: CVRP data and analysis

Available on the Clean Vehicle Rebate Project (CVRP) website (cleanvehiclerebate.org):

- [Rebate statistics dashboard](#)
- [Rebate map](#)
- [Consumer survey dashboard](#)
- [Program reports and analysis](#)

Additional information available on the Center for Sustainable Energy (CSE) website (energycenter.org):

- [Presentations](#)

Thank You for Your Attention

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

*We work nationally in the clean energy industry and
are always open to collaboration.*