

EV Rebates: Demographic Update, Program Design Features, and Paths Forward for Broadening Participation

ZEV Alliance Webinar: Expanding Access Listening Series

Webinar: 15 August 2019

Slides: 2 October 2019 version (replaces previous versions)

Brett Williams, PhD – Principal Advisor, EV Programs

with thanks to Jennifer Boughton, Michelle Jones, Ryan Bodanyi, and others at CSE



Center for
Sustainable
Energy™

State EV Rebate Programs Administered by CSE

(as of Jan. 2019; Oregon pending)



Fuel-Cell EVs



\$5,000

\$1,500

\$5,000

e-miles

≥ 120 \$2,000

All-Battery EVs



\$2,500

\$1,500

e-miles

≥ 200 \$2,000

≥ 120 \$1,500

< 120 \$500

≥ 40 \$1,700

Plug-in Hybrid EVs



\$2,500 (i3 REx)

\$1,500

BEVx only: \$1,500

≥ 45 \$1,000

< 45 \$500

≥ 20 \$1,100

< 20 \$500

Zero-Emission Motorcycles



\$900

\$450

- ≥ 20 e-miles only
- Income cap
- Increased rebates for lower-income households

- Base MSRP ≤ \$50k
- No fleet rebates

Program ended 9/30/19

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

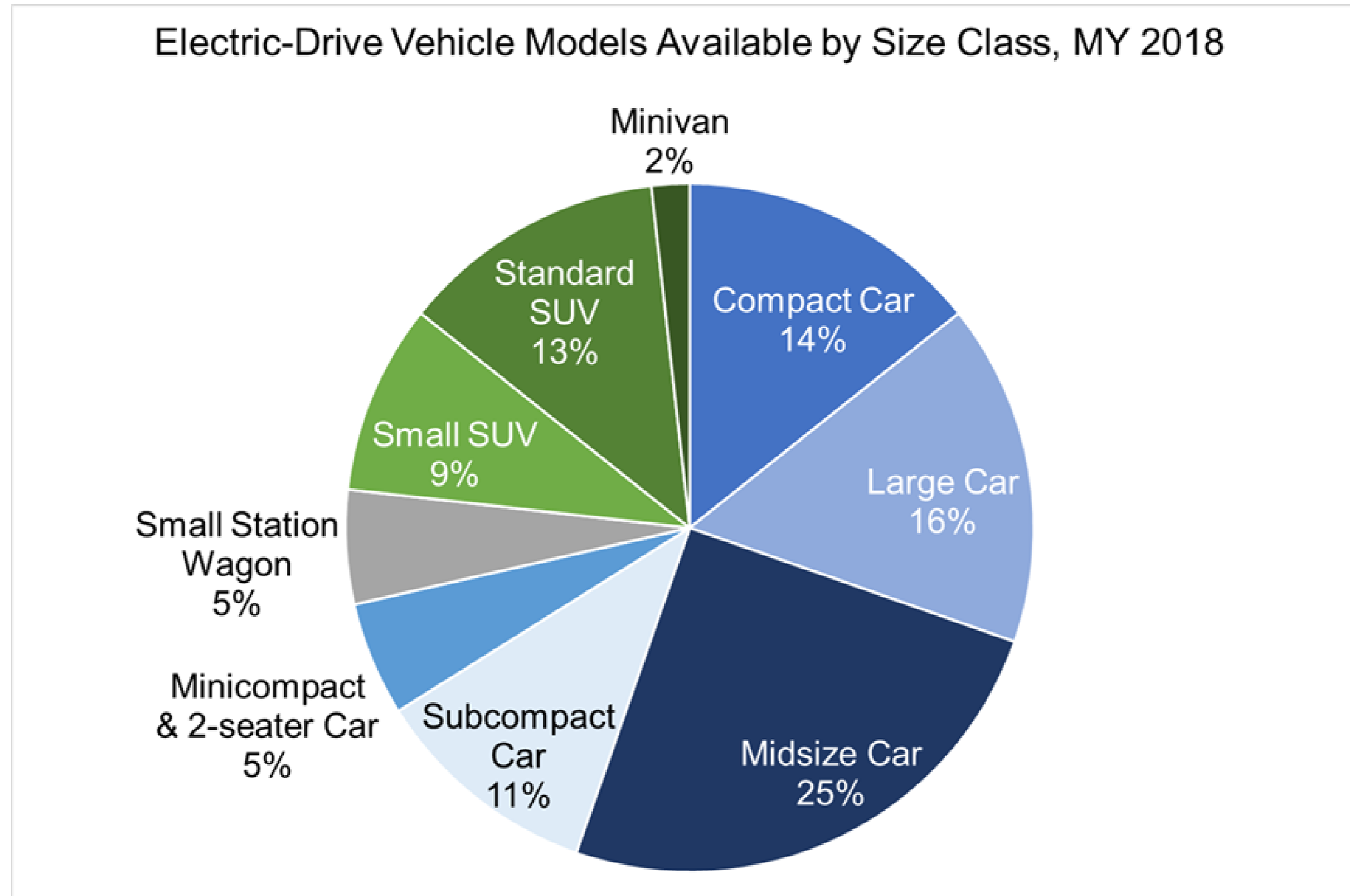
- Base MSRP > \$60k = \$500 max.;
- Point-of-sale



Where Are We?

Market Status, Equity Metrics, and Consumer Demographics in Context

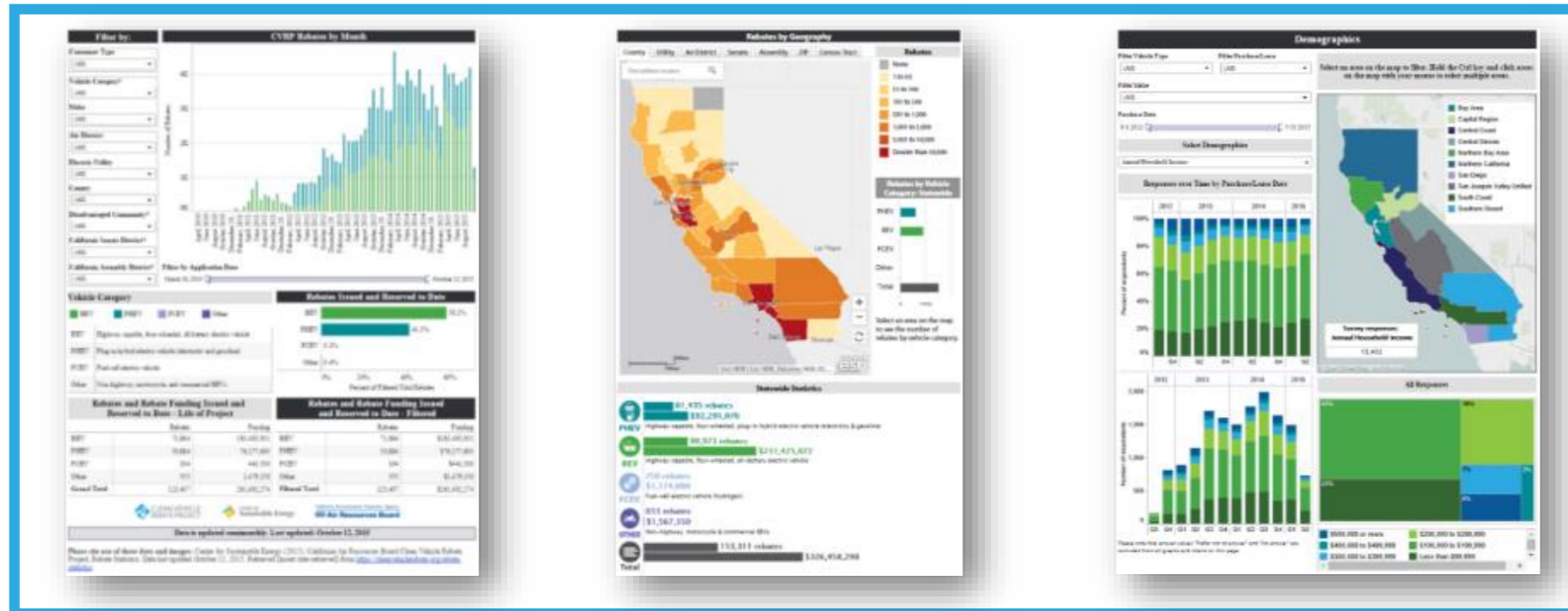
Market Choice Is Increasing



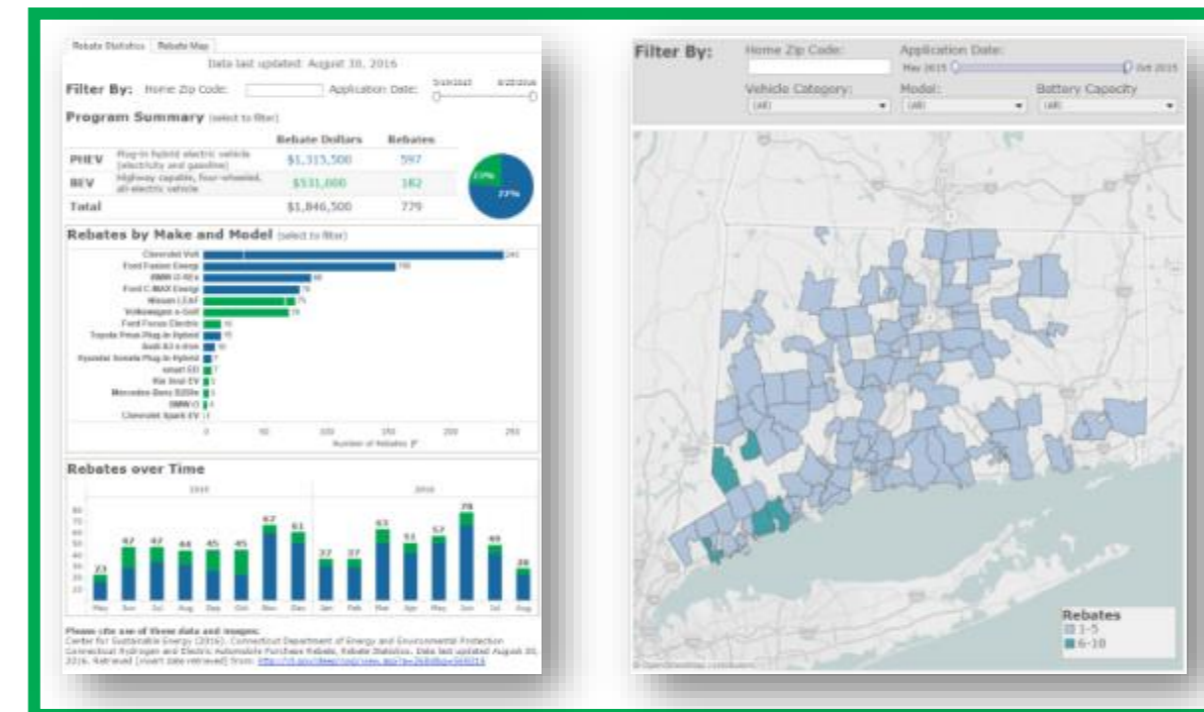
Source: Oak Ridge National Laboratory, [Transportation Energy Data Book: Edition 37](#), ORNL/TM-2018/987, January 2019. Original source: [FuelEconomy.Gov website](#).

Where are EV rebates going?

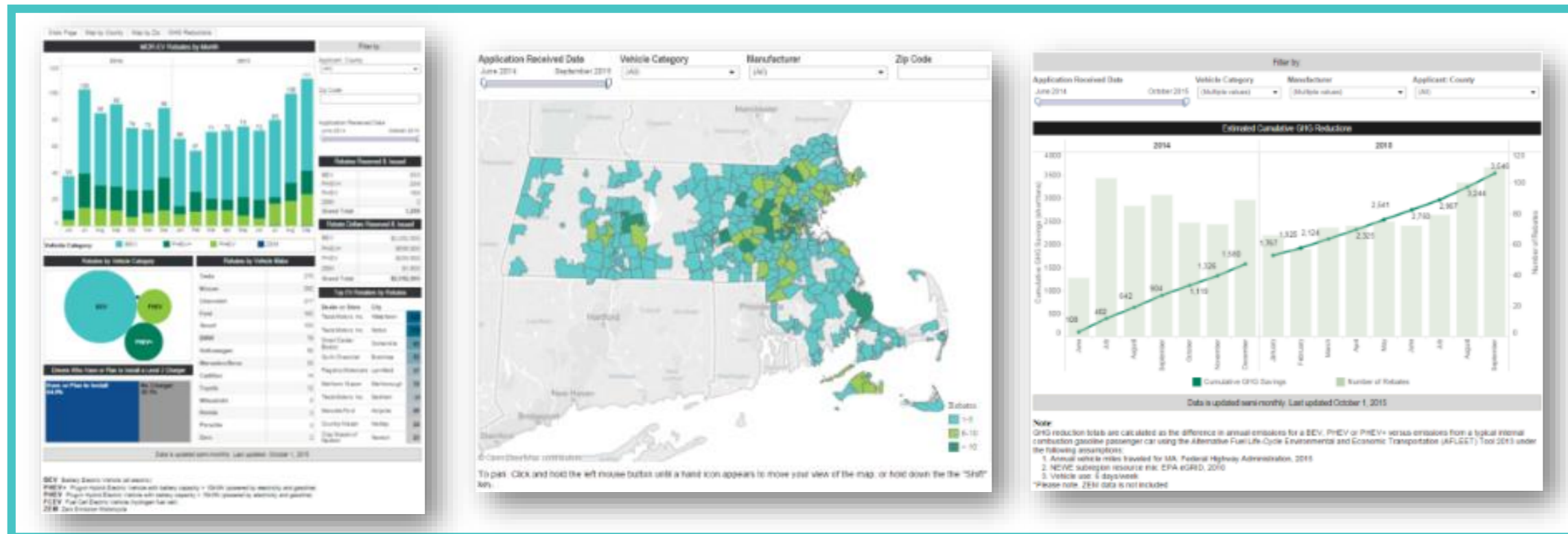
Public dashboards and data facilitate informed action



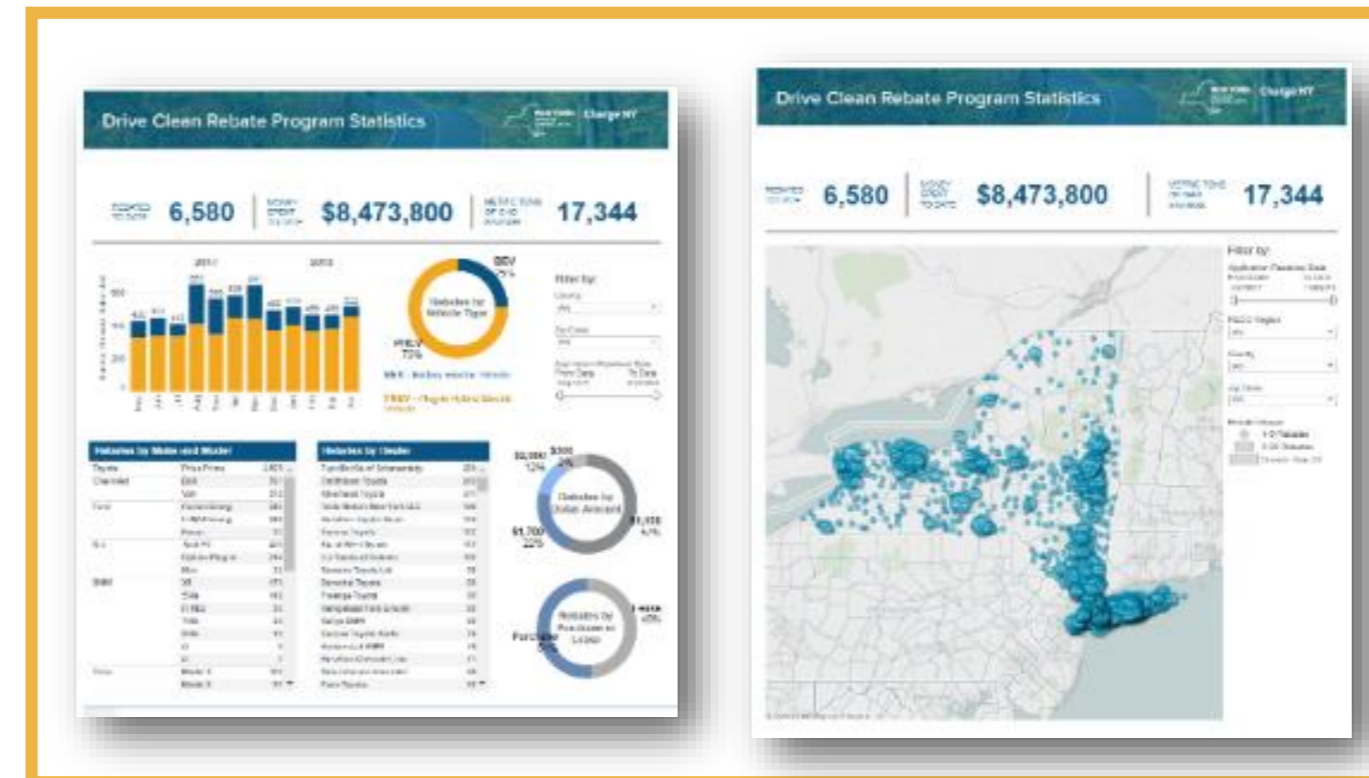
cleanvehiclerebate.org



ct.gov/deep



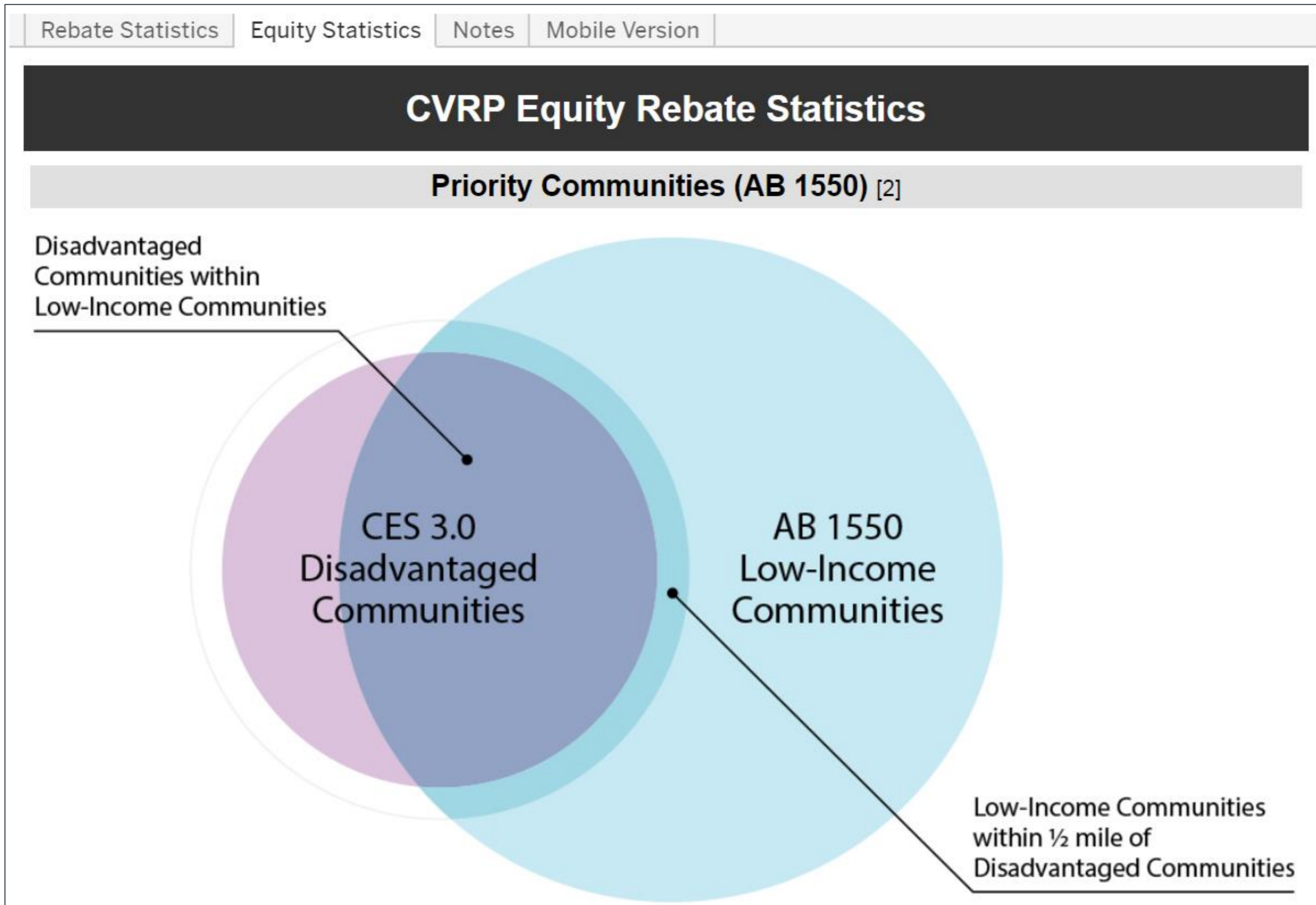
mor-ev.org



nyscrda.ny.gov

- > 320,000 EVs and consumers have received > \$720 M in rebates
- > 70,000 survey responses being analyzed so far, statistically represent > 300,000 consumers
- Reports, presentations, and analysis growing

Equity Statistics Dashboard (partial)



Rebates by Equity Group [2]

Timeframe: [1]

	Rebates	Funding	Percent of Funding
All Equity Groups	39,974	\$109,247,061	31.1%
Disadvantaged Communities	12,892	\$31,932,308	9.1%
Low-Income Communities	29,323	\$71,780,702	20.4%
<i>Disadvantaged Communities within Low-Income Communities</i>	<i>9,147</i>	<i>\$22,950,167</i>	<i>6.5%</i>
<i>Low-Income Communities within 1/2 mile of a Disadvantaged Community [2]</i>	<i>5,827</i>	<i>\$14,374,368</i>	<i>4.1%</i>
Increased Rebates for Low-/Moderate-Income Consumers [1]	11,405	\$46,553,152	13.3%

Geography

Rebate Type

Equity Statistics Dashboard

Rebate Statistics | **Equity Statistics** | Notes | Mobile Version

CVRP Equity Rebate Statistics

Priority Communities (AB 1550) [2]

Disadvantaged Communities within Low-Income Communities

Low-Income Communities within 1/2 mile of Disadvantaged Communities

Rebates by Equity Group [2]

Timeframe: [1] Current Income Criteria (11/1/2016 - Present)

	Rebates	Funding	Percent of Funding
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Rebate Type

Increased Rebates for Low-/Moderate-Income Consumers [1]	11,405	\$46,553,152	13.3%
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Filter by:

Consumer Type: (All)

Rebate Type [1]: Low-/Moderate-Income Inc...

Equity Communities [2]: (All)

County: (All)

Electric Utility: (All)

Air District: (All)

CA Senate District [3]: (All)

CA Assembly District [3]: (All)

Vehicle Category [4]: (All)

Make: (All)

Funding Source [5]: (All)

Grant Number [6]: (All)

Rebates by Month (Filtered)

Filter by Application Date: [7] March 18, 2010 - March 31, 2019

Rebates Issued or Approved to Date [1] (Filtered)

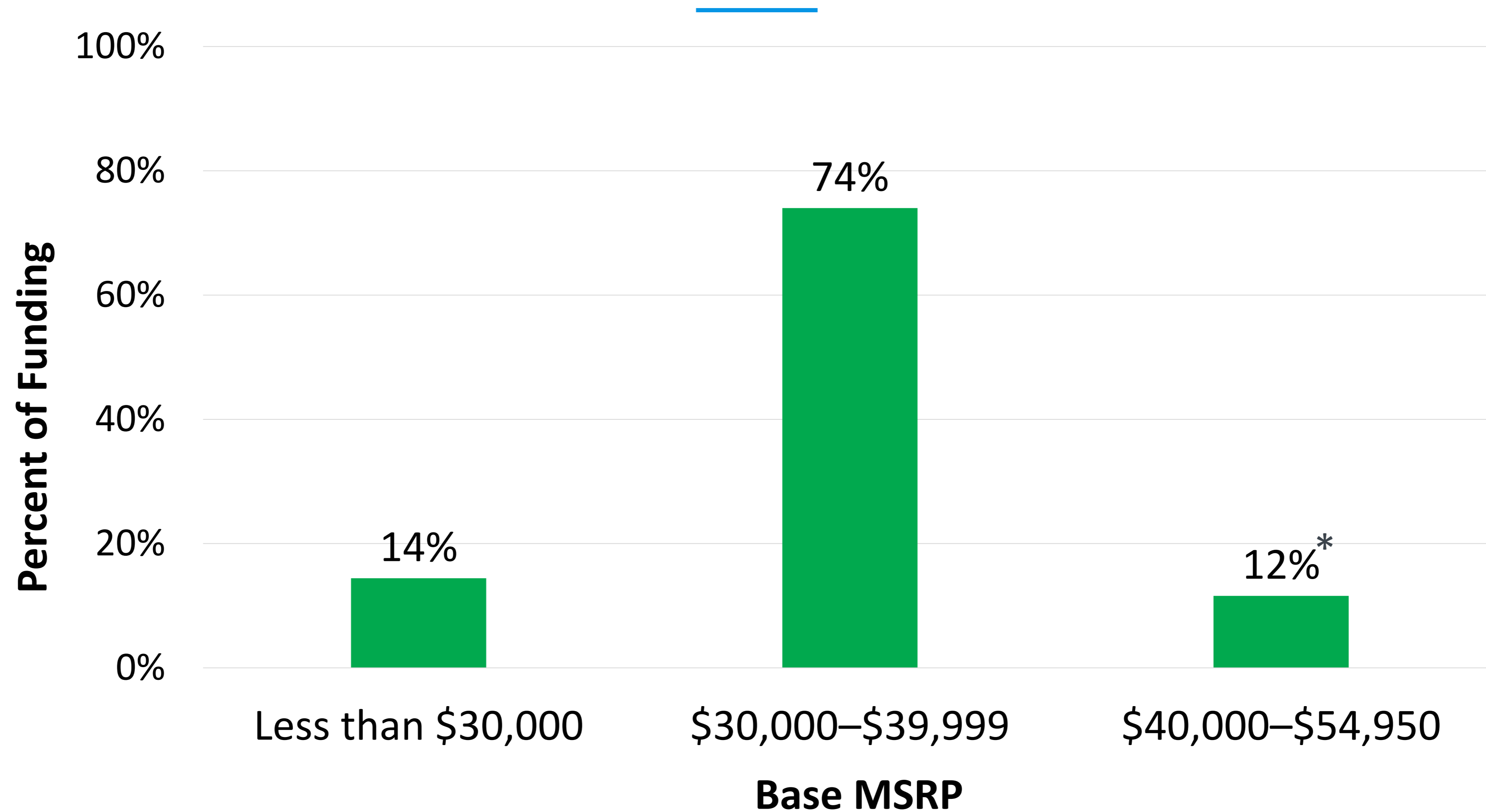
PHEV	45.3%
BEV	52.3%
FCEV	2.4%

Logos: CALIFORNIA AIR RESOURCES BOARD, CALIFORNIA GOVERNMENT, City and County Offices in Charge, Center for Sustainable Energy

Data is updated monthly. Last updated: June 26, 2019





[1-7] Please select the **Notes** tab of this dashboard for additional details and links to related information.

Moderately Priced Vehicles Received Most Funding thru April 2018 (pre-“Model 3 effect”)



*\$44,000 MSRP used for all rebated Model 3 vehicles
N=2,709 Total CHEAPR rebates through April 2018; Includes fleet rebates





Consumer Survey Data *(Shows Rebates to Individuals Only)*

	 CALIFORNIA CLEAN VEHICLE REBATE PROJECT™	 MOR-EV Massachusetts Offers Rebates for Electric Vehicles	 CHEAPR Connecticut Hydrogen and Electric Automobile Purchase Rebate	 NEW YORK STATE	Total
Vehicle Purchase/ Lease Dates	Dec. 2010 – Dec. 2018	June 2014 – Oct. 2018	May 2015 – Sept. 2018	March 2017 – July 2018	Dec. 2010 – Dec. 2018
Survey Responses (total n)*	62,092	4,555	1,565	1,808	70,020
Program Population (N)	278,538	10,920	3,510	8,651	301,619





* Weighted to represent the program population along the dimensions of vehicle category, vehicle model, buy vs. lease, and county (using raking method)

EV Rebate Designs (as of Sept. 2018), Reflective of most of the data gathered



	CALIFORNIA CLEAN VEHICLE REBATE PROJECT™	MOR-EV Massachusetts Offers Rebates for Electric Vehicles	CHEAPR Connecticut Hydrogen and Electric Automobile Purchase Rebate	NEW YORK STATE
Fuel-Cell EVs 	\$5,000	\$2,500	\$5,000	<u>e-miles</u> ≥ 120 \$2,000 ≥ 40 \$1,700 ≥ 20 \$1,100 < 20 \$500
All-Battery EVs 	\$2,500	\$2,500	<u>e-miles</u> ≥ 175 \$3,000 ≥ 100 \$2,000 < 100 \$500	
Plug-in Hybrid EVs 	\$2,500 (i3 REx) \$1,500	≥10 kWh \$2,500 <10 kWh \$1,500	≥ 40 \$2,000 < 40 \$500	
Zero-Emission Motorcycles 	\$900	\$750		
	<ul style="list-style-type: none"> e-miles ≥ 20 only Consumer income cap increased rebates for lower-income households 	<ul style="list-style-type: none"> Base MSRP ≥ \$60k = \$1,000 max. no fleet rebates 	<ul style="list-style-type: none"> Base MSRP ≤ \$60k only dealer assignment \$150 dealer incentive (\$300 previous) 	<ul style="list-style-type: none"> Base MSRP > \$60k = \$500 max. point-of-sale via dealer

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Vehicle Purchase/ Lease Dates	<u>Nov. 2016*</u> – Dec. 2018	June 2014 – Oct. 2018	May 2015 – Sept. 2018	March 2017 – July 2018	June 2014 – Dec. 2018
Survey Responses (total n)**	23,478	4,555	1,565	1,808	31,406
Program Population (N)	135,897	10,920	3,510	8,651	158,978

* After the most recent change in the program's income criteria, to reflect the "current program era"

** Weighted to represent the program population along the dimensions of vehicle category, vehicle model, buy vs. lease, and county (using raking method)

Setting an Appropriate Baseline: Car Buyers Are Different Than the Population

	U.S. Population (Census 2018)	U.S. New-Vehicle Buyers, MYs '16-'17 (2017 NHTS)
Selected solely White/Caucasian	61%	74% ↑
≥ 50 Years Old	34%	51% ↑
≥ Bachelor's Degree*	31%*	56%* ↑
Own Residence	64%	75% ↑
≥ \$150k HH Income	12%	23% ↑
Selected Male	49%	51%





- New-car buyers are different on almost every dimension. They appear to be more frequently:
 - White
 - Older
 - Degree holders
 - Residence owners
 - Higher income
- Some differences explained by driving age
- Others may be due to *social inequities*

"Prefer not to answer," "I don't know," and similar responses are excluded throughout.

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 & NHTS data characterize *individual* educational attainment (Census for ≥ 25 year-olds).

Rebated EV Consumer Characteristics

	U.S. Population (Census 2018)	U.S. New-Vehicle Buyers, MYs '16-'17 (2017 NHTS)	 CALIFORNIA CLEAN VEHICLE REBATE PROJECT™ Nov. 2016 – Dec. 2018 weighted n = 23,478	 MOR-EV Massachusetts Offers Rebates for Electric Vehicles Jun. 2014 – Oct. 2018 weighted n = 4,555	 CHEAPR Connecticut Hydrogen and Electric Automobile Purchase Rebate May 2015 – Sep. 2018 weighted n = 1,565	 NEW YORK STATE Mar. 2017 – Jul. 2018 weighted n = 1,808
Selected solely White/Caucasian	61%	74%	54%	85%	87%	86%
≥ 50 Years Old	34%	51%	52%	58%	54%	59%
≥ Bachelor's Degree*	31%*	56%*	83%	90%	83%	76%
Own Residence	64%	75%	82%	92%	89%	90%
≥ \$150k HH Income	12%	23%	42%	58%	43%	39%
Selected Male	49%	51%	73%**	78%	74%	70%





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** 100% includes non-binary options.

Differing approaches, similar metrics...

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What are we doing?

Incentive-design features

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(as of Jan. 2019; Oregon pending)



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Program ended 9/30/19

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

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CVRP	Eligibility		Rebate Amount			
	Filing Status	Gross Annual Income	FCEV	BEV	PHEV	ZEM
Income Cap	Individual	> \$150,000	\$5,000 (unless received an HOV sticker)	Not Eligible		
	Head of Household	> \$204,000				
	Joint	> \$300,000				
Standard Rebate	Individual	300% FPL to \$150,000	\$5,000	\$2,500	\$1,500	\$900
	Head of Household	300% FPL to \$204,000				
	Joint	300% FPL to \$300,000				
Increased Rebate for Low-Income Applicants*	Household Income ≤ 300 percent of the federal poverty level (FPL)		\$7,000	\$4,500	\$3,500	

Income-Based Eligibility: Implementation Considerations

- Dealer reluctance, fears about liability
- Outreach complexity, consumer confusion
- Application complexity, affects all applicants
- Intrusiveness, tax forms
- Wait times, even for priority applicants
- Investment in processing systems, labor
- Fraud
- Loopholes
- Precludes a point-of-sale rebate, which would benefit those that need the rebate most

Point-of sale rebates with MSRP caps *may* better support equity goals...
Supplemented with *Increased Rebates* based upon income or other criteria

Differing approaches, similar metrics

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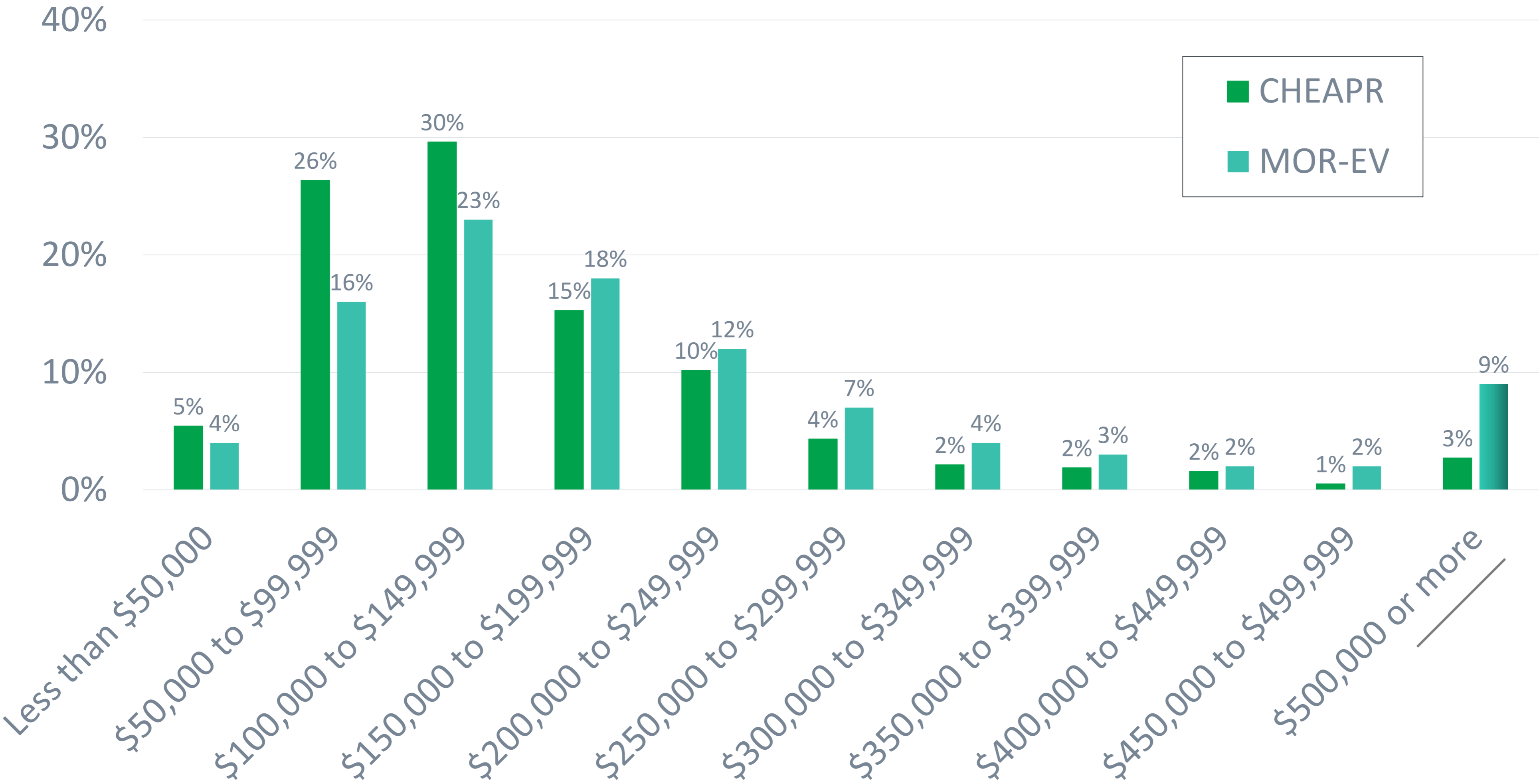
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CHEAPR and MOR-EV Respondents by Household Income

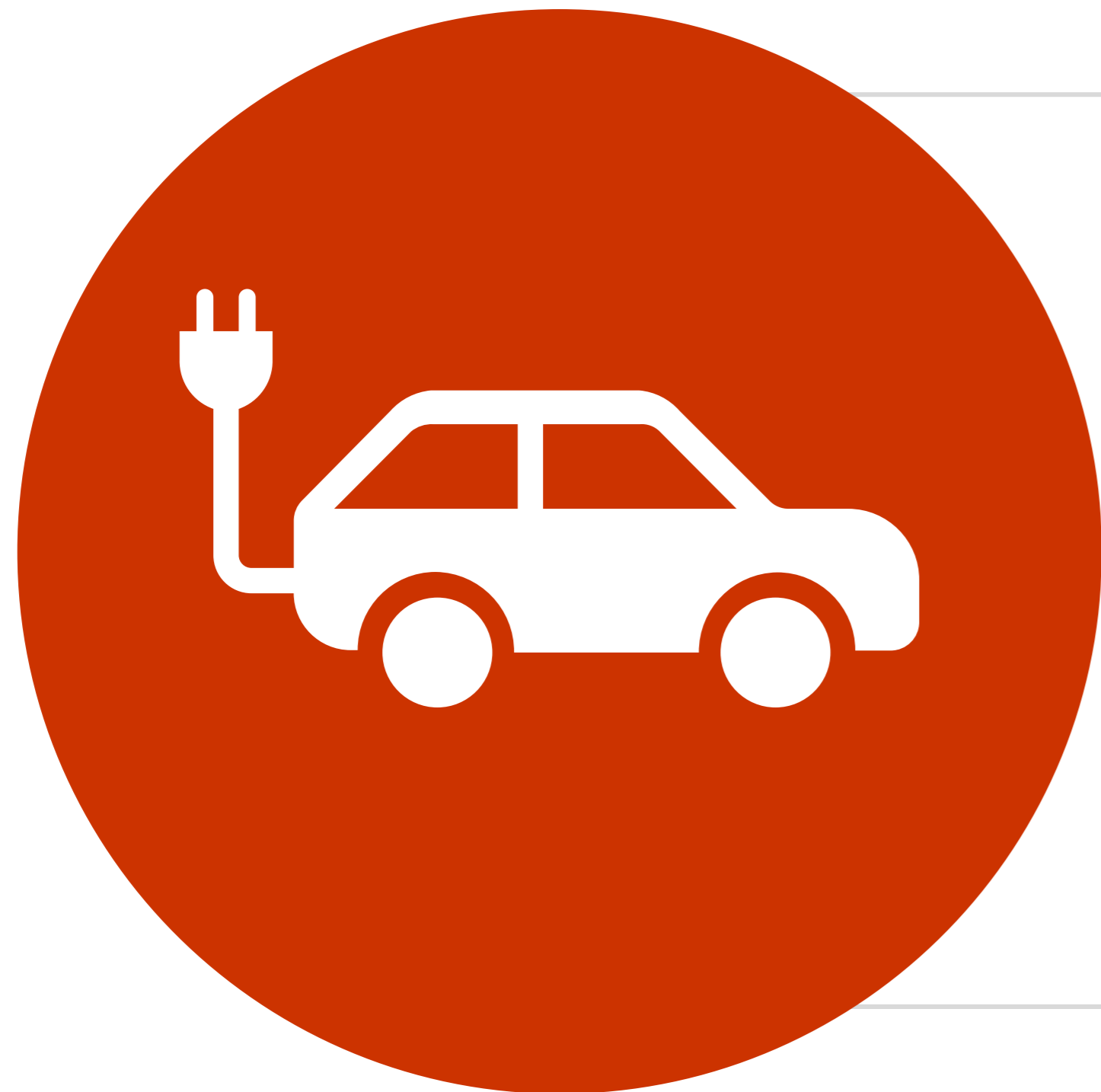




What is the path forward?

Strategies for Program Design and Outreach

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

Paths Forward: CA

	Low-Hanging Fruit <i>Nov. 2016 – Dec. 2018</i> weighted n = 23,478 	Rebate Essentials 	Converts 	CA New-Vehicle Buyers, MYs '16-'17 (2017 NHTS)	Priority Populations 
Selected solely White/Caucasian	54% ↑	↑	↑	51%	CalEnviroScreen Disadvantaged Communities, AB 1550 Priority Populations
≥ 50 Years Old	52% ↑	↓	↓↓	46%	
≥ Bachelor's Degree*	83% ↑↑	↑↑	↑	58%*	
≥ \$150k HH Income	42% ↑↑	↑		32%	
Selected Male	73%** ↑↑	↑↑	↑	50%	

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** 100% includes non-binary options.

Strategic Segments: 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

Strategic Segments: Prioritization

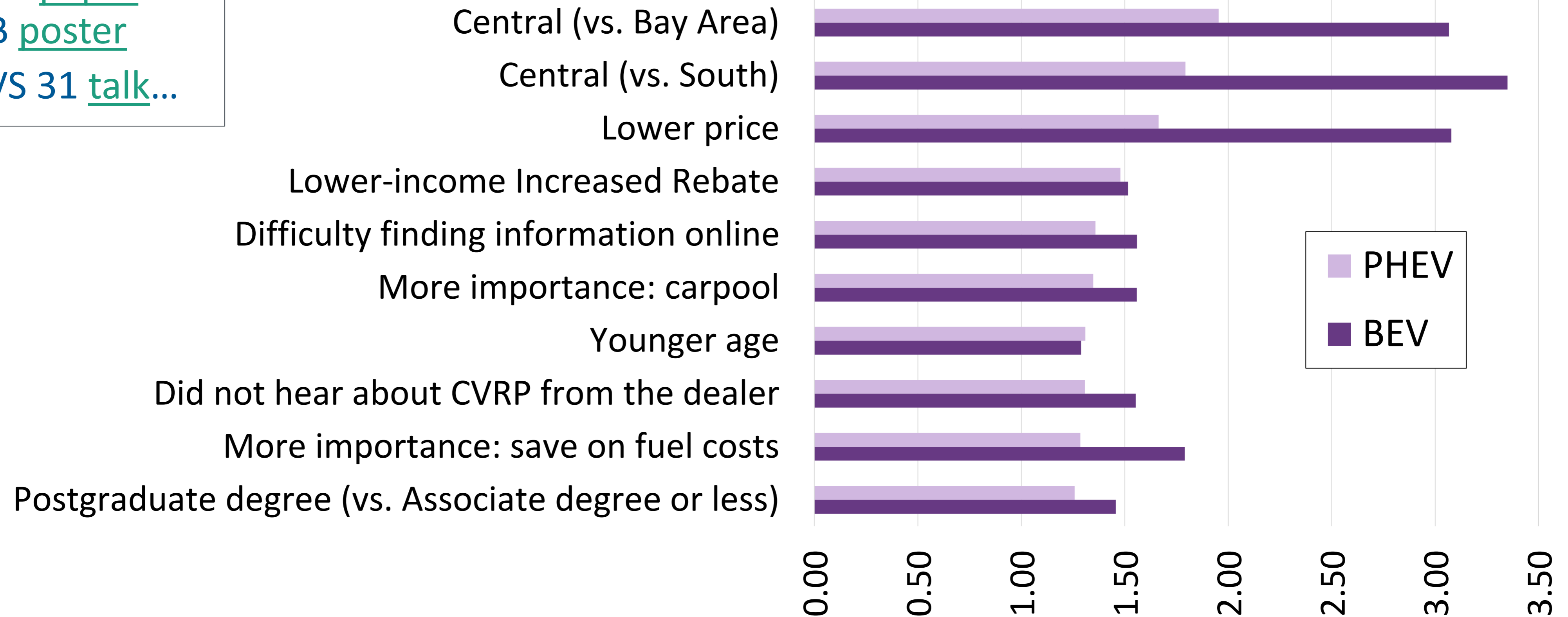
Comparison to Other Plug-in EV Adopters: Rebate Essential Explanatory Factors*



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 of data characterizing CA rebate recipients who bought/leased EVs Nov. 2016 thru May 2017

A close-up photograph of a hand plugging a charging cable into the port of an electric vehicle. The scene is set outdoors during the day, with a bright sun in the upper right corner creating a lens flare effect. The background is slightly blurred, showing a parking area with other vehicles and buildings.

Additional Design Considerations

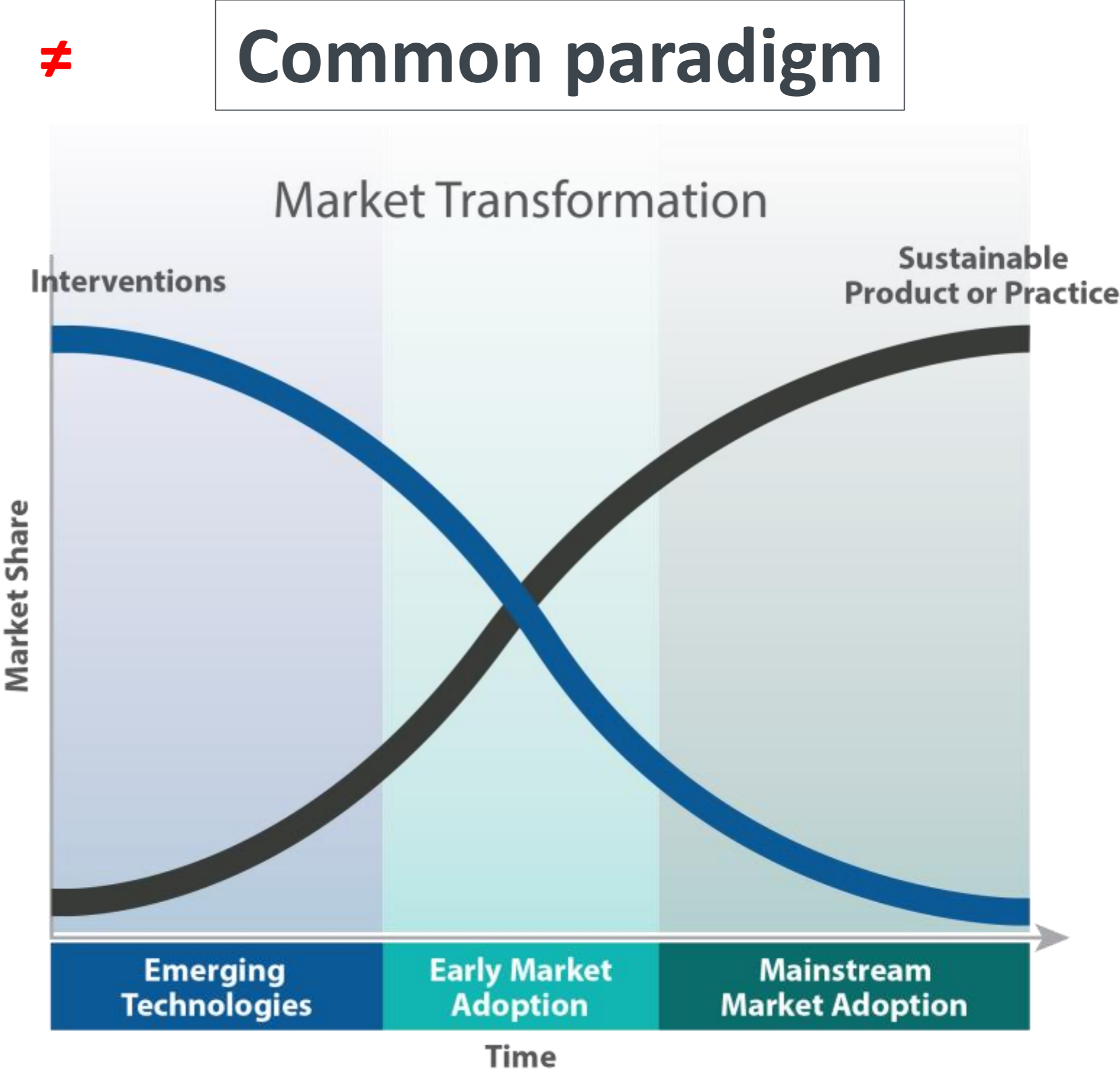
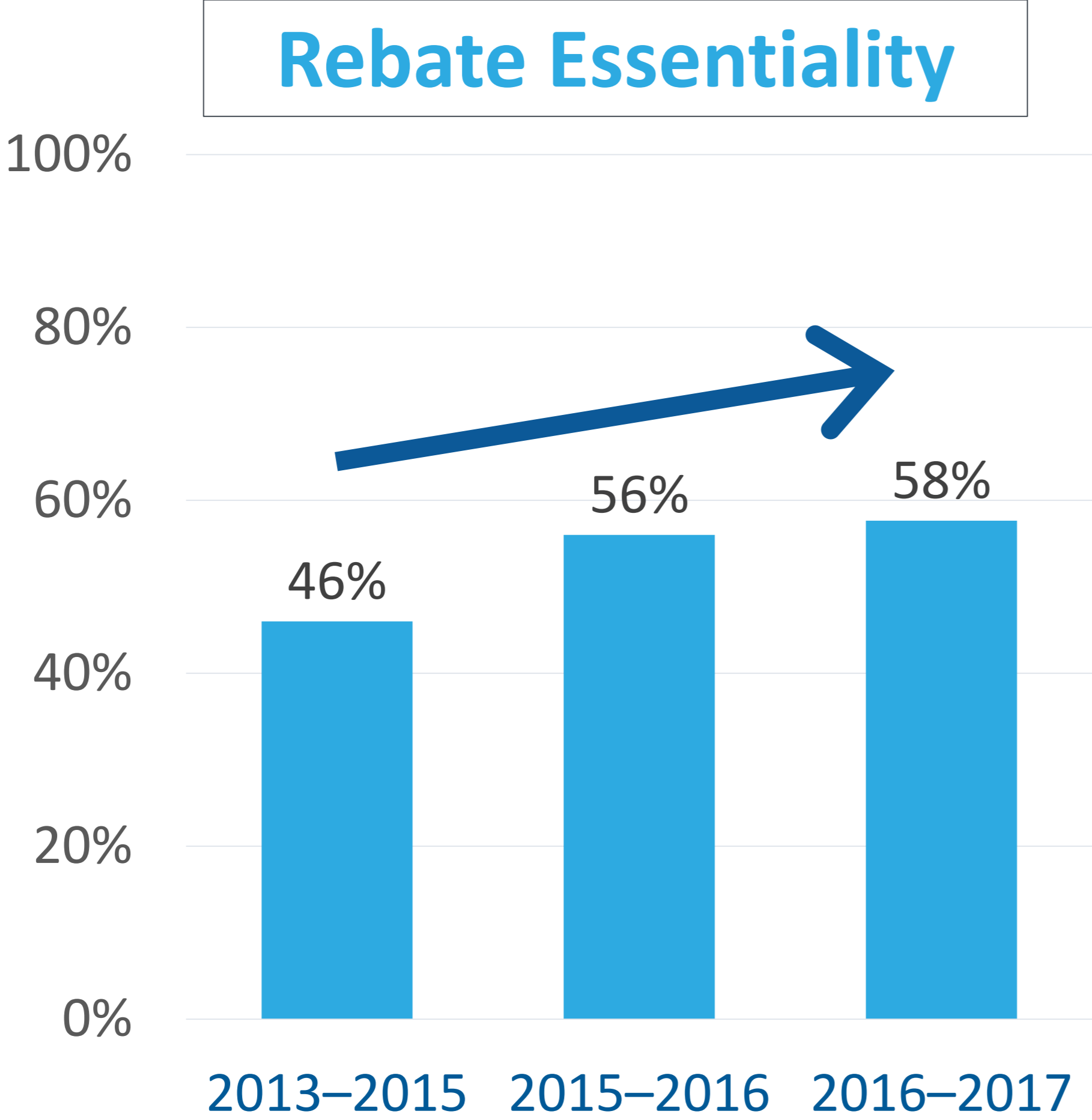
Rebate Effectiveness, Income and MSRP caps

Program-Change Scenarios: Individual Measures



#	Scenario	Savings, % of Middle	First-cycle cost	% of first-cycle vehicles lost	Cost-effectiveness: \$ saved per vehicle lost
1	Middle (baseline)	0%	\$505 M	-	-
2	Limit one per person	-2%	\$494 M	1%	\$3,820
3	Limit 3 months between purchase and application	-3%	\$488 M	1%	\$3,961
4	<\$60k MSRP	-3%	\$487 M	1%	\$4,232
5	<\$50k MSRP	-4%	\$486 M	1%	\$4,021
6	>30-mi EPA all-electric range (AER)	-4%	\$484 M	2%	\$3,092
7	>40-mi AER	-4%	\$482 M	2%	\$3,040
8	<\$40k MSRP	-5%	\$481 M	2%	\$3,953
9	>50-mi AER	-5%	\$479 M	2%	\$2,947
10	Income cap—single filers: ≤\$150k, other filers: ≤\$250k	-5%	\$479 M	2%	\$3,832
11	>30-mi AER for PHEV/BEVx, >100-mi for others	-7%	\$467 M	3%	\$3,477
12	>50-mi AER for PHEV/BEVx, >100-mi for others	-8%	\$463 M	3%	\$3,326
13	>100-mi AER	-11%	\$447 M	4%	\$3,269
14	Standard rebates lowered \$500	-12%	\$444 M	NA	NA
15	Income cap—single filers: ≤\$150k, other filers: ≤\$204k	-12%	\$445 M	4%	\$3,737
16	Income cap—all filers: ≤\$150k	-22%	\$392 M	8%	\$3,718

Rebate Essentiality is *Increasing* Over Time, Contradicting a Common Paradigm About Phasing Out Incentives



CVRP Consumer Survey. 2013–2015 edition: weighted, n=19,208
 2015–2016 edition: weighted, n=11,457
 2016–2017 edition: weighted, n=9,261

Select Findings: Program Impacts


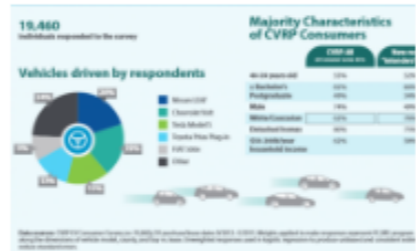




- Some consumer differences, particularly gender, remain
 - Trending in the right direction
 - Segmentation can support market-acceleration, equity, cost-effectiveness, or mainstreaming goals
- ~ 4/5^{ths} of rebated EVs replace older, more polluting vehicles
- Rebate influence on purchase/lease:
 - moderately to extremely important to 9/10^{ths}
 - essential to > 1/2
- Avoiding > 30 tons of GHG emissions per vehicle over ~12-year vehicle life
- Indicators of impact are increasing over time
- Programs with MSRP caps and cash on the hood may support equity as well as, or better than, programs with income caps. *Supplement* with Increased Rebates based on income.
- Dealer sales incentives motivate EV salespeople, particularly those with prior EV ownership experience

A close-up photograph of a person's hand plugging a charging cable into the charging port of a white electric car. The scene is set outdoors at sunset, with warm, golden light and lens flare effects. In the background, a public charging station with orange cables is visible, along with a blurred city street and buildings.

Additional Resources

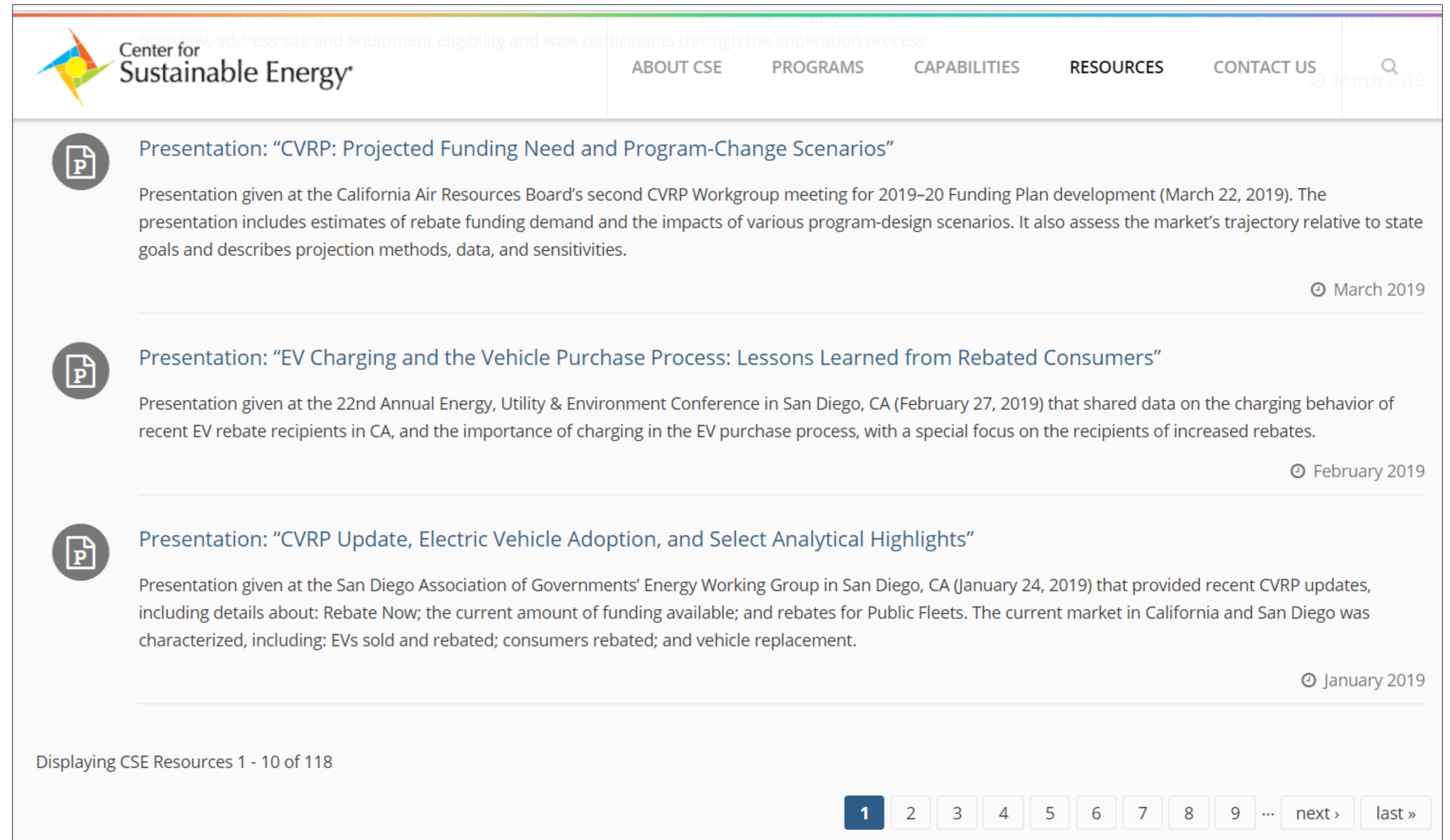
Evaluation: CVRP Analysis

Program reports, fact sheets, infographics & presentations

	Summary Documentation of the Electric Vehicle Consumer Survey, 2013-2015 Edition June 15, 2017
	Infographic: Characterizing California Electric Vehicle Consumer Segments - TRB Poster January 16, 2017
	Infographic: Plug-in Electric Vehicle Owners in California's Disadvantaged Communities January 11, 2017
	CVRP Final Report 2014-2015 November 21, 2016
	Characterizing Plug-In Hybrid Electric Vehicle Consumers Most Influenced by CVRP November 15, 2016
	Presentation: "Electric Vehicle Rebates in Disadvantaged Communities: Evaluating Progress with Appropriate Comparisons" October 26, 2016

CSE Clean Transportation Resources

Reports, analysis,
infographics,
presentations, ...



The screenshot shows the Center for Sustainable Energy website. The header includes the logo and navigation links: ABOUT CSE, PROGRAMS, CAPABILITIES, RESOURCES, CONTACT US, and a search icon. The main content area lists three presentations, each with a document icon, a title, a description, and a date.

Center for Sustainable Energy

ABOUT CSE PROGRAMS CAPABILITIES RESOURCES CONTACT US

Presentation: "CVRP: Projected Funding Need and Program-Change Scenarios"
Presentation given at the California Air Resources Board's second CVRP Workgroup meeting for 2019-20 Funding Plan development (March 22, 2019). The presentation includes estimates of rebate funding demand and the impacts of various program-design scenarios. It also assesses the market's trajectory relative to state goals and describes projection methods, data, and sensitivities.
March 2019

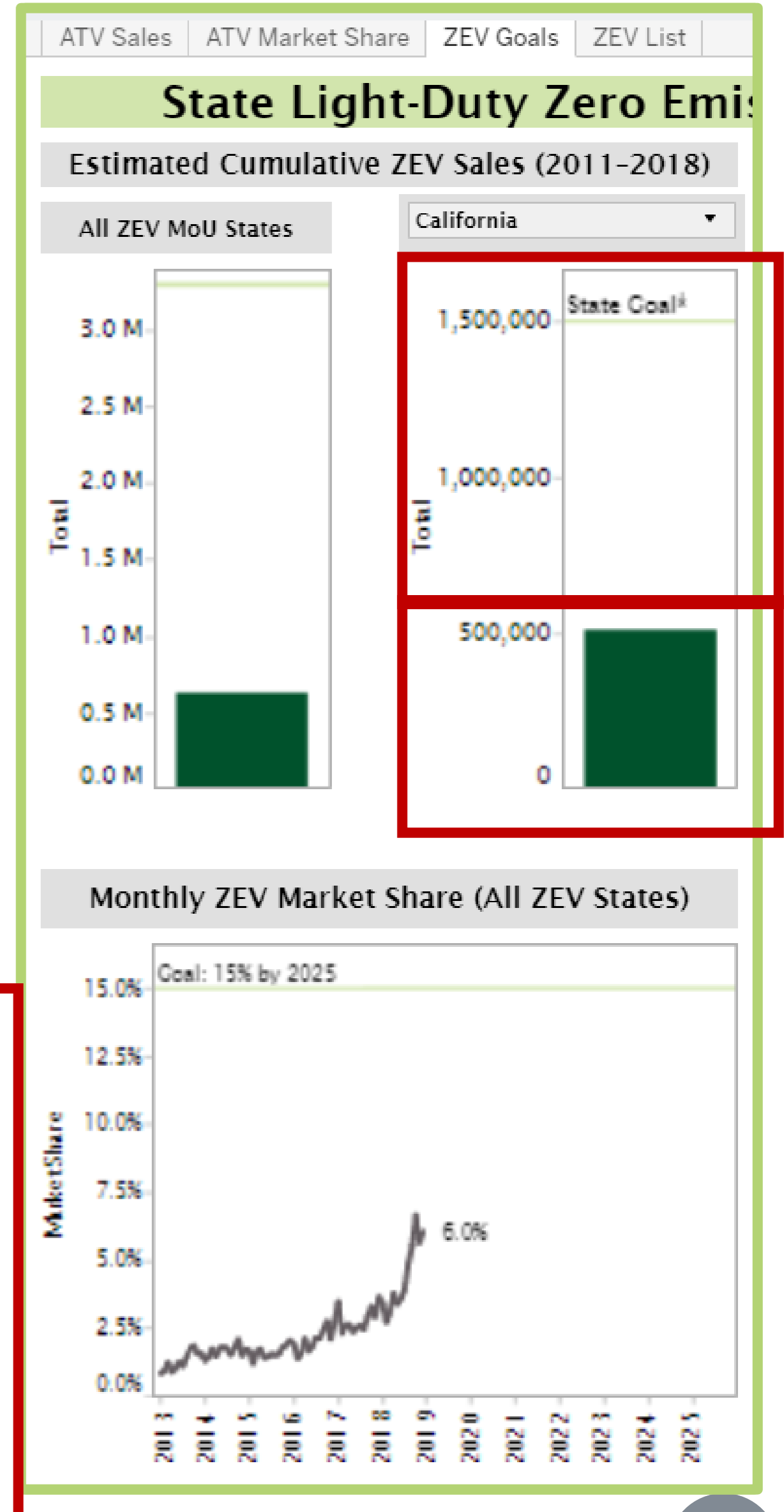
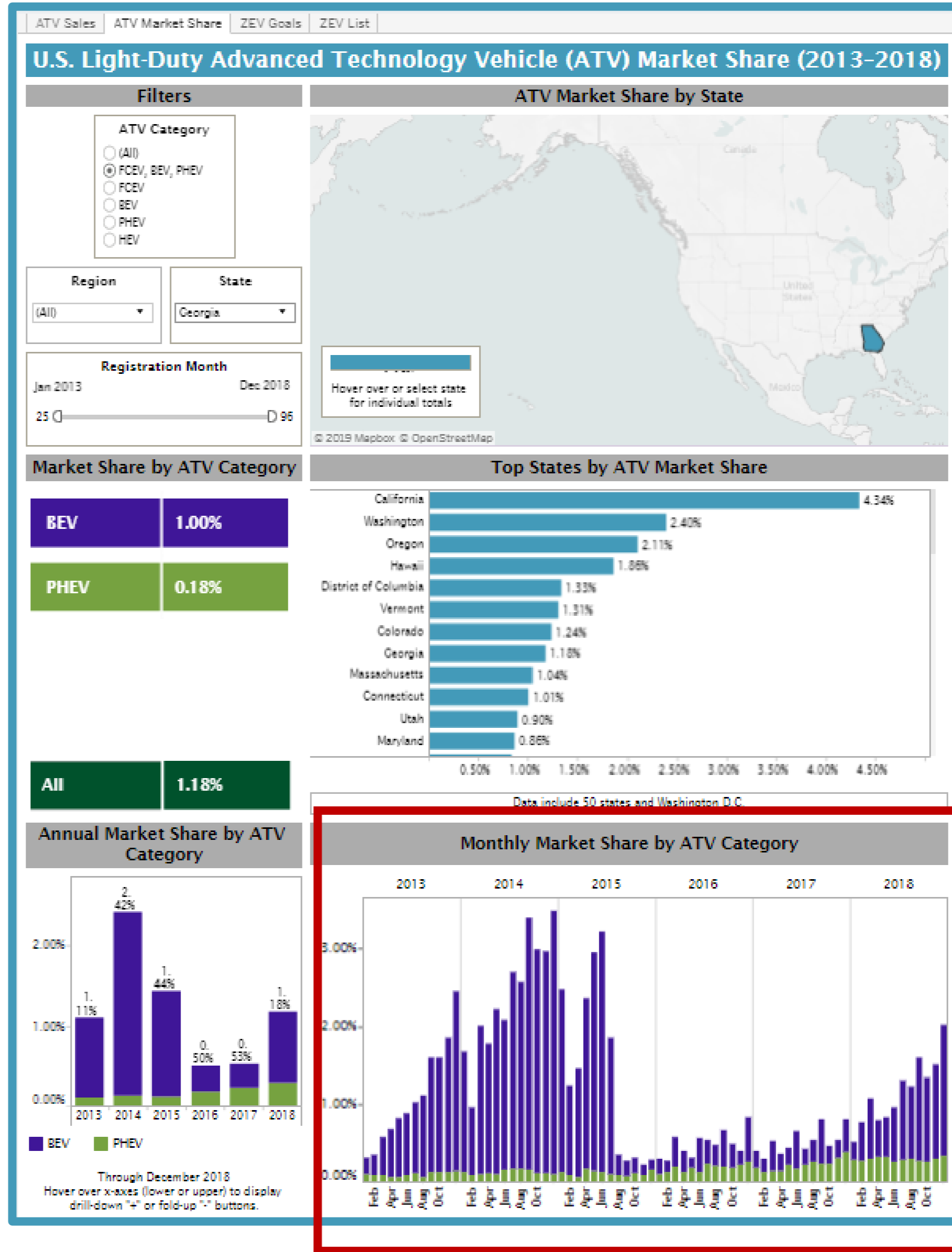
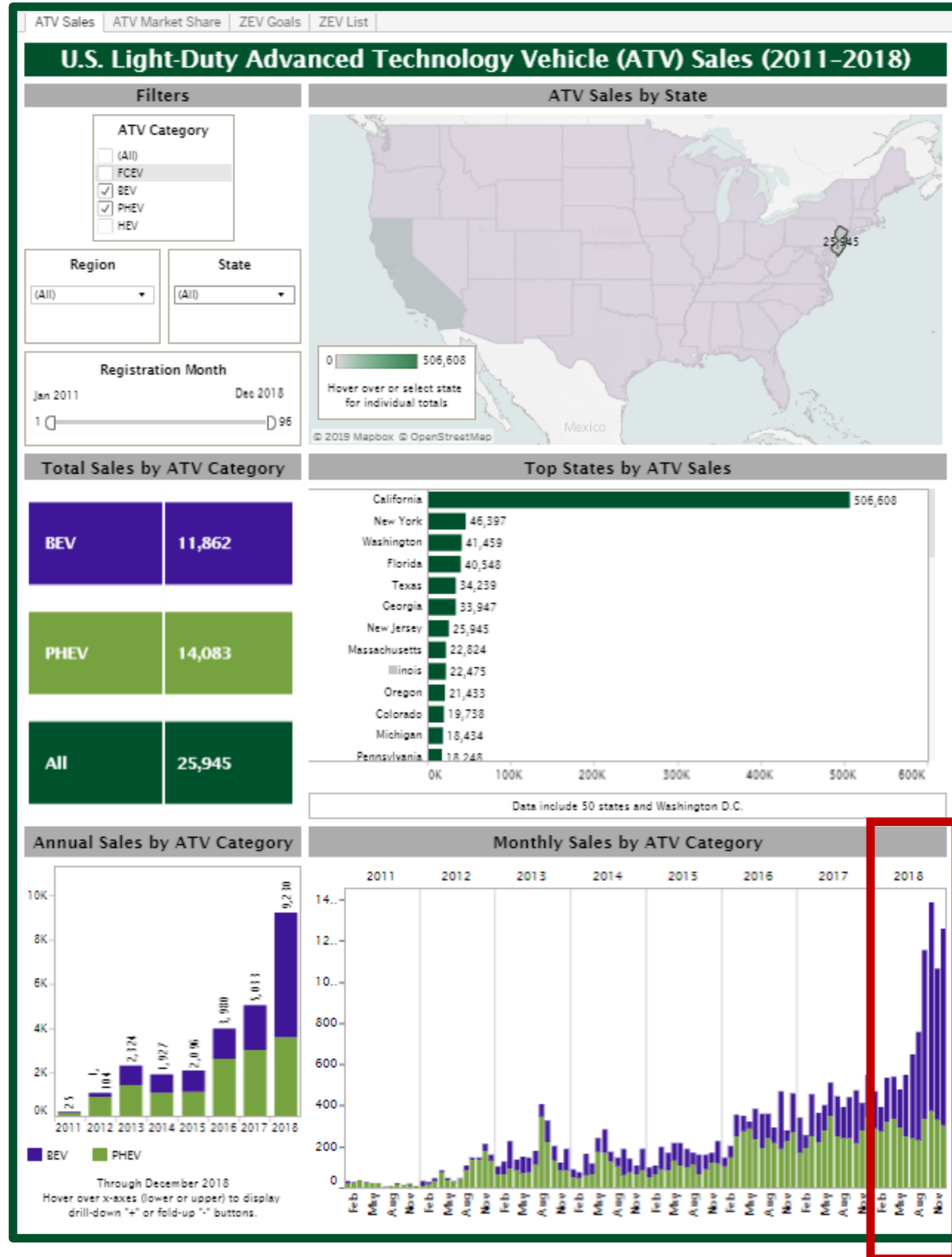
Presentation: "EV Charging and the Vehicle Purchase Process: Lessons Learned from Rebated Consumers"
Presentation given at the 22nd Annual Energy, Utility & Environment Conference in San Diego, CA (February 27, 2019) that shared data on the charging behavior of recent EV rebate recipients in CA, and the importance of charging in the EV purchase process, with a special focus on the recipients of increased rebates.
February 2019

Presentation: "CVRP Update, Electric Vehicle Adoption, and Select Analytical Highlights"
Presentation given at the San Diego Association of Governments' Energy Working Group in San Diego, CA (January 24, 2019) that provided recent CVRP updates, including details about: Rebate Now; the current amount of funding available; and rebates for Public Fleets. The current market in California and San Diego was characterized, including: EVs sold and rebated; consumers rebated; and vehicle replacement.
January 2019

Displaying CSE Resources 1 - 10 of 118

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50-State EV Sales, Market Share, and Goals Dashboard for AA



Linked at zevfacts.com

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

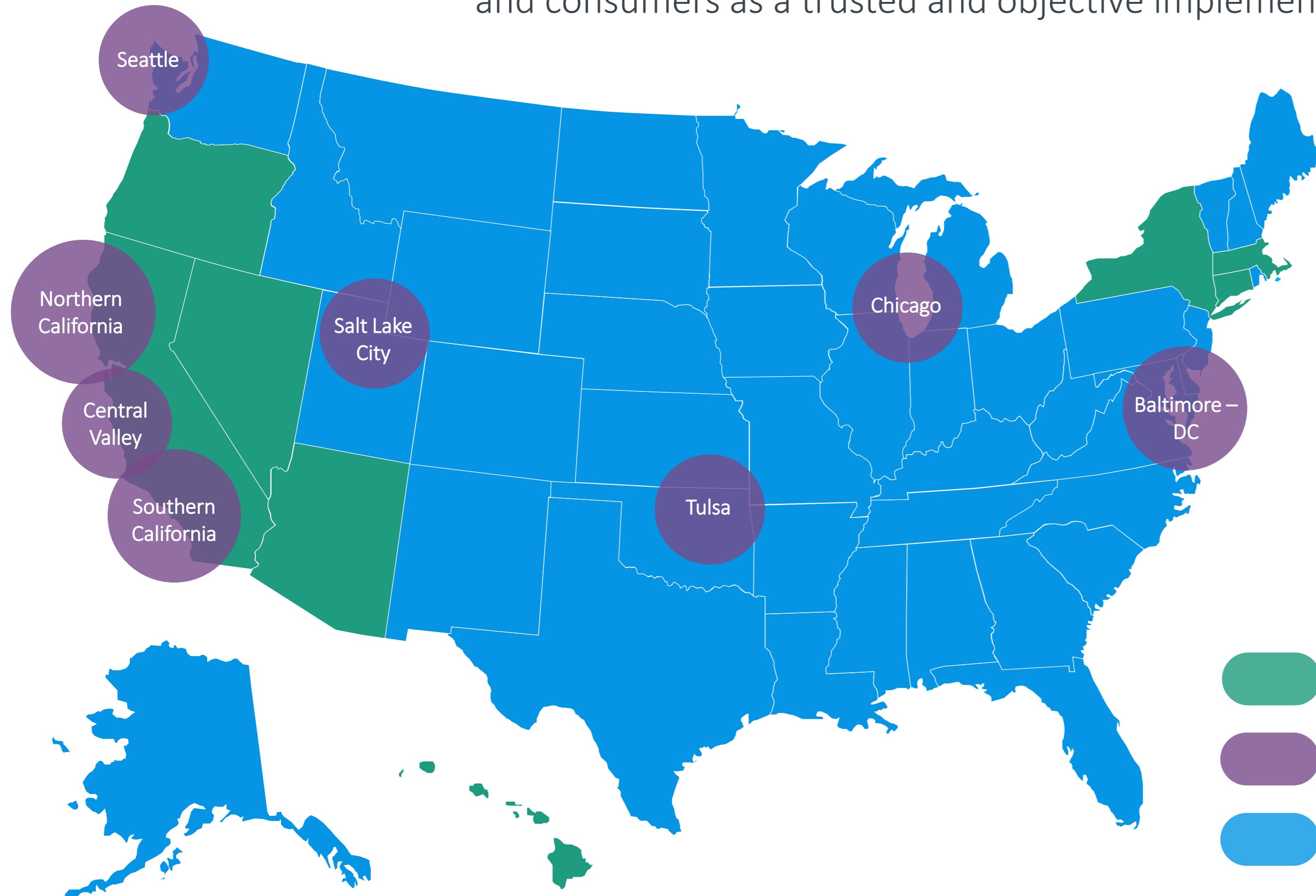
CSE: A Nonprofit With Billion-Dollar Program Management Experience

- **Five Statewide Electric Vehicle Rebate Programs**
 - > \$720 million
 - > 320,000 rebated vehicles
 - > 300,000 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



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

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