

# CVRP: Data and Analysis Update

Public Workshop: Update to the 3-Year Plan for LDV Investments  
(4 Dec. 2018, El Monte CA)

Brett Williams, PhD – Senior Principal Advisor, EV Programs, CSE

With thanks to:

- Nick Pallonetti, Ryan Bodanyi, John Anderson and others at CSE



# Outline

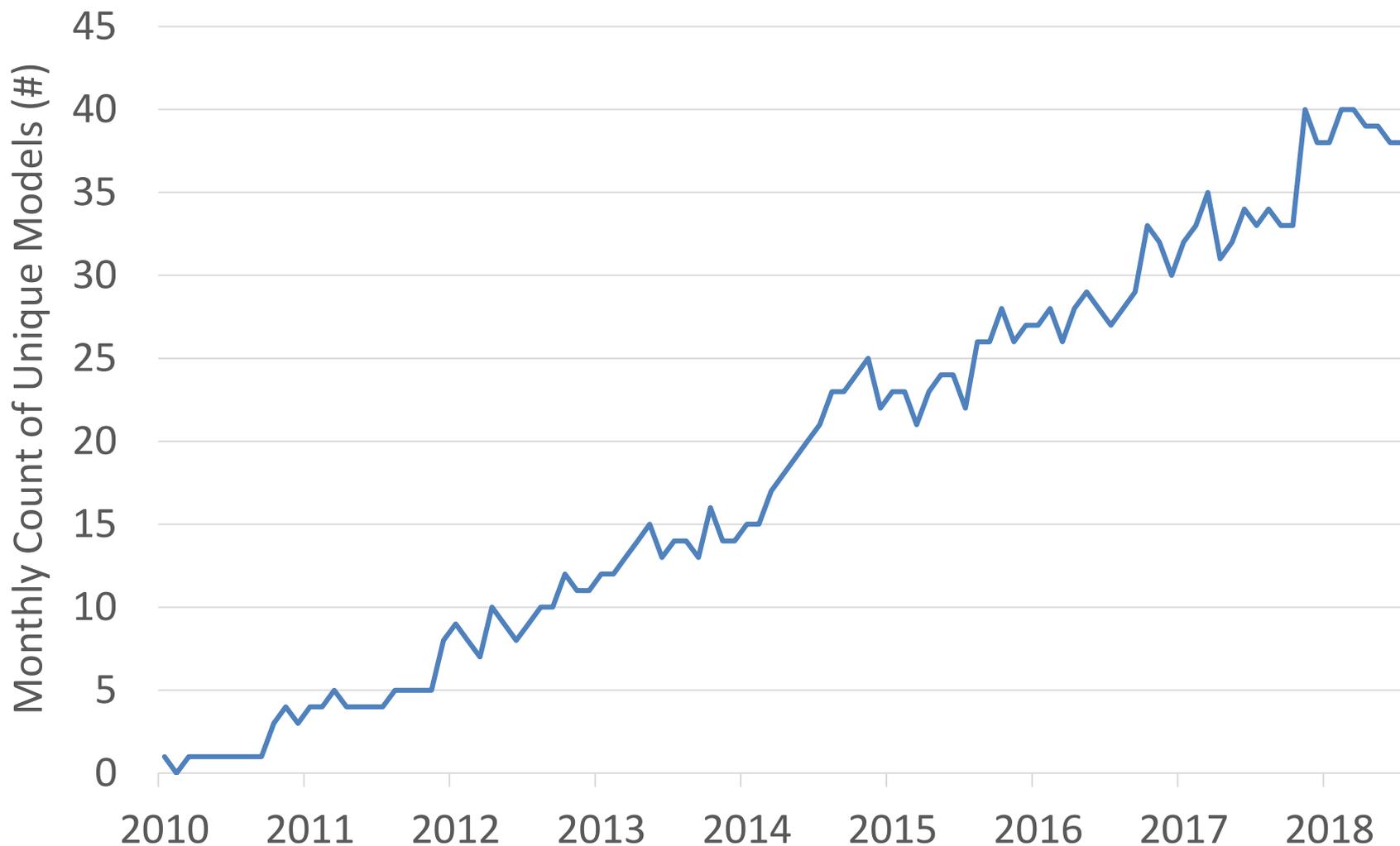
- Market Update
  - Models,
  - Market Share
  - Sales Price: EVs\* and Non-EVs
- CVRP Update
  - Outputs: Vehicles & Consumers Rebated
  - Outcomes: Behaviors Influenced
  - Impacts: Emission & Market
- Additional Considerations
  - Rebate Effectiveness
  - Select “Before”/“After” Indicators

A close-up photograph of a person's hand plugging a charging cable into the port of an electric vehicle. The scene is set during 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 bicycle rack and other vehicles.

# Market Update

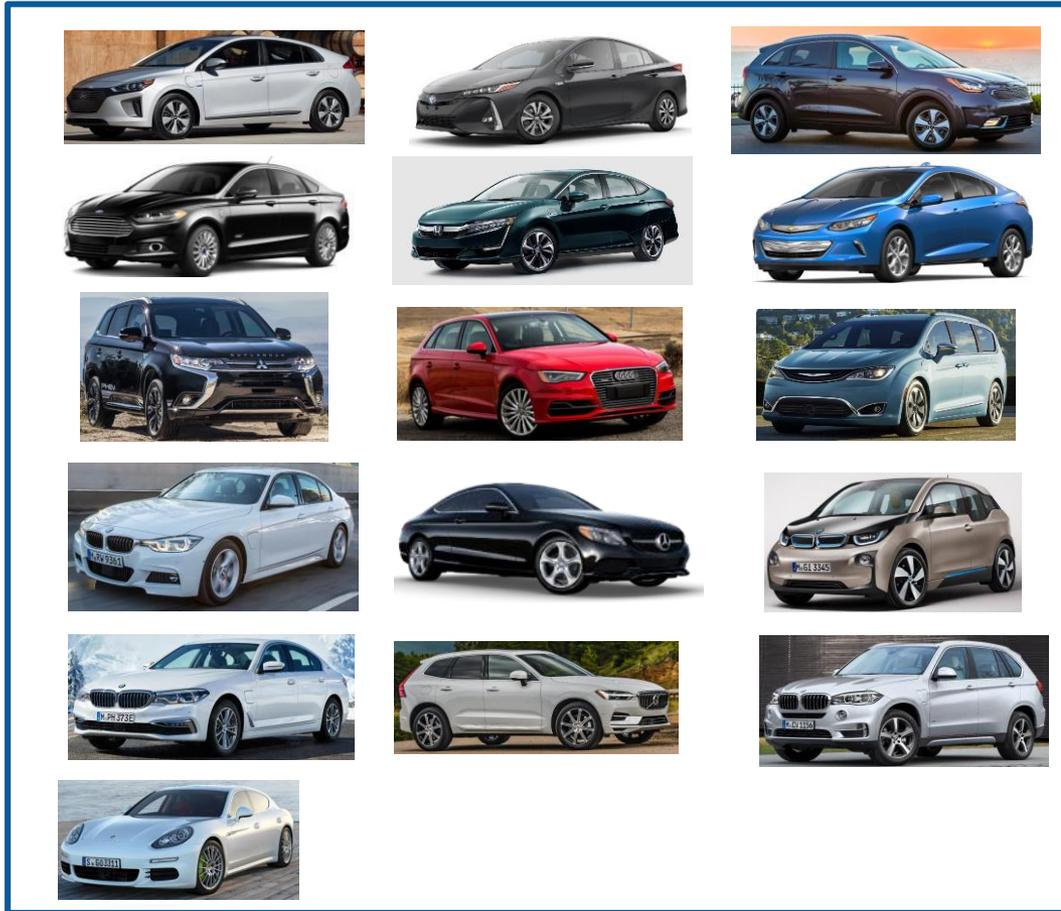
Models, Market Share, & Sales Price: EVs and non-EVs

# Unique Light-Duty Electric Vehicle Models Registered



# Electric Vehicle Choices: Major 2018 Models

## Plug-in hybrid EVs



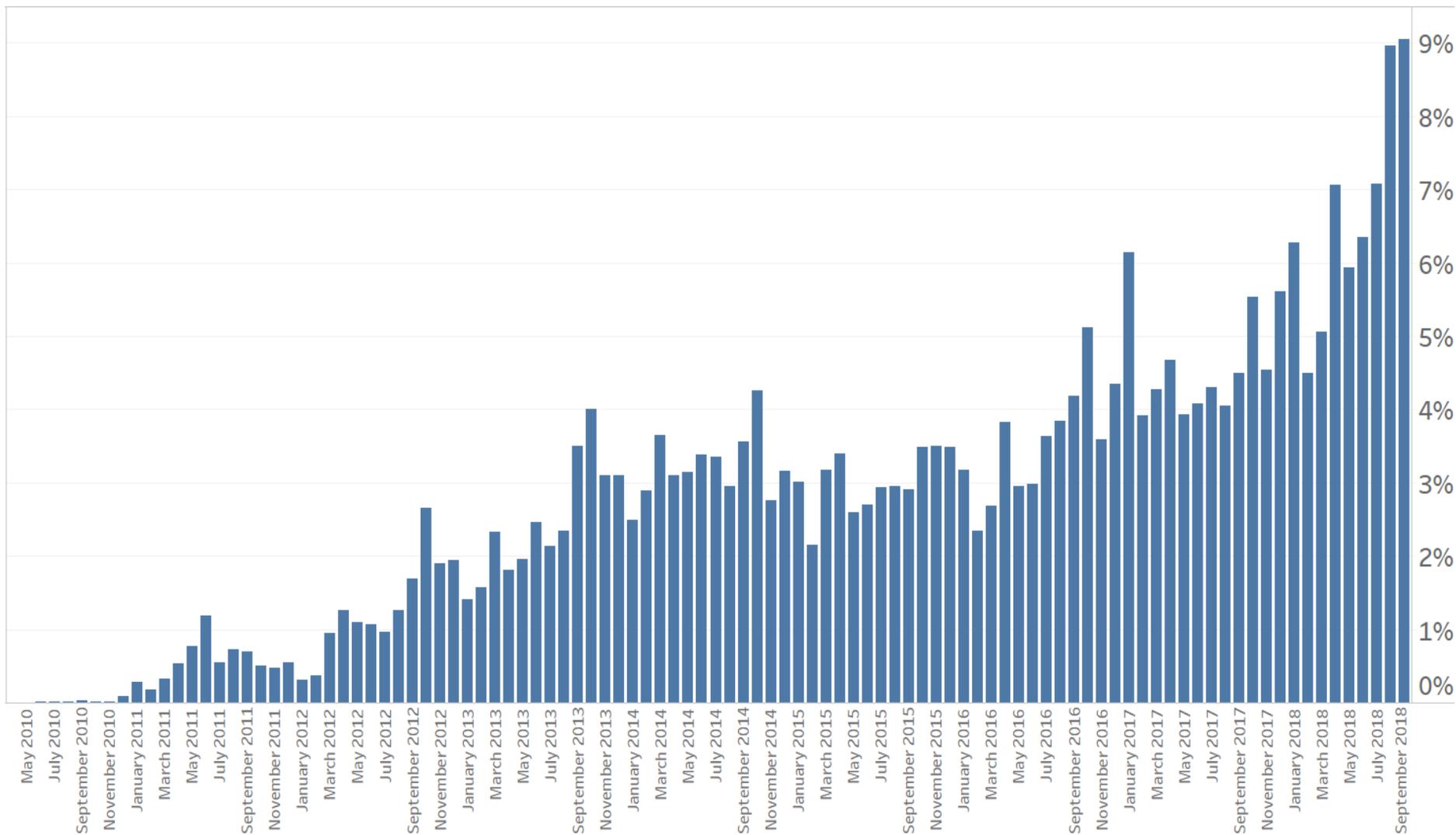
## All-battery EVs



## Fuel-cell EVs



# EV Share of CA New Light-Duty-Vehicle Registrations

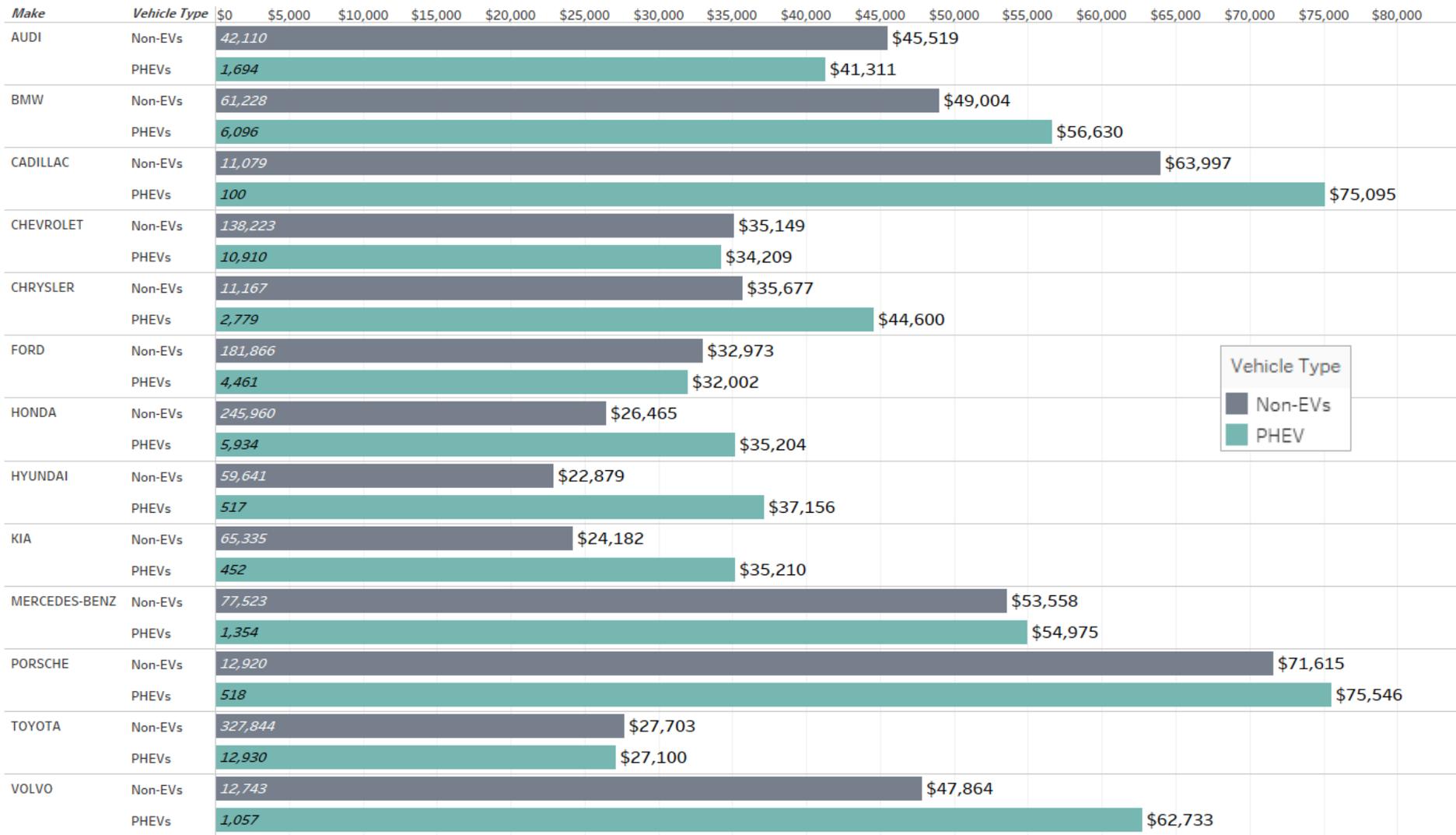


Note: LDV denominator includes light pickups and other categories with no EV offerings to date.  
 Includes content supplied by R.L. Polk & Co, © 2018

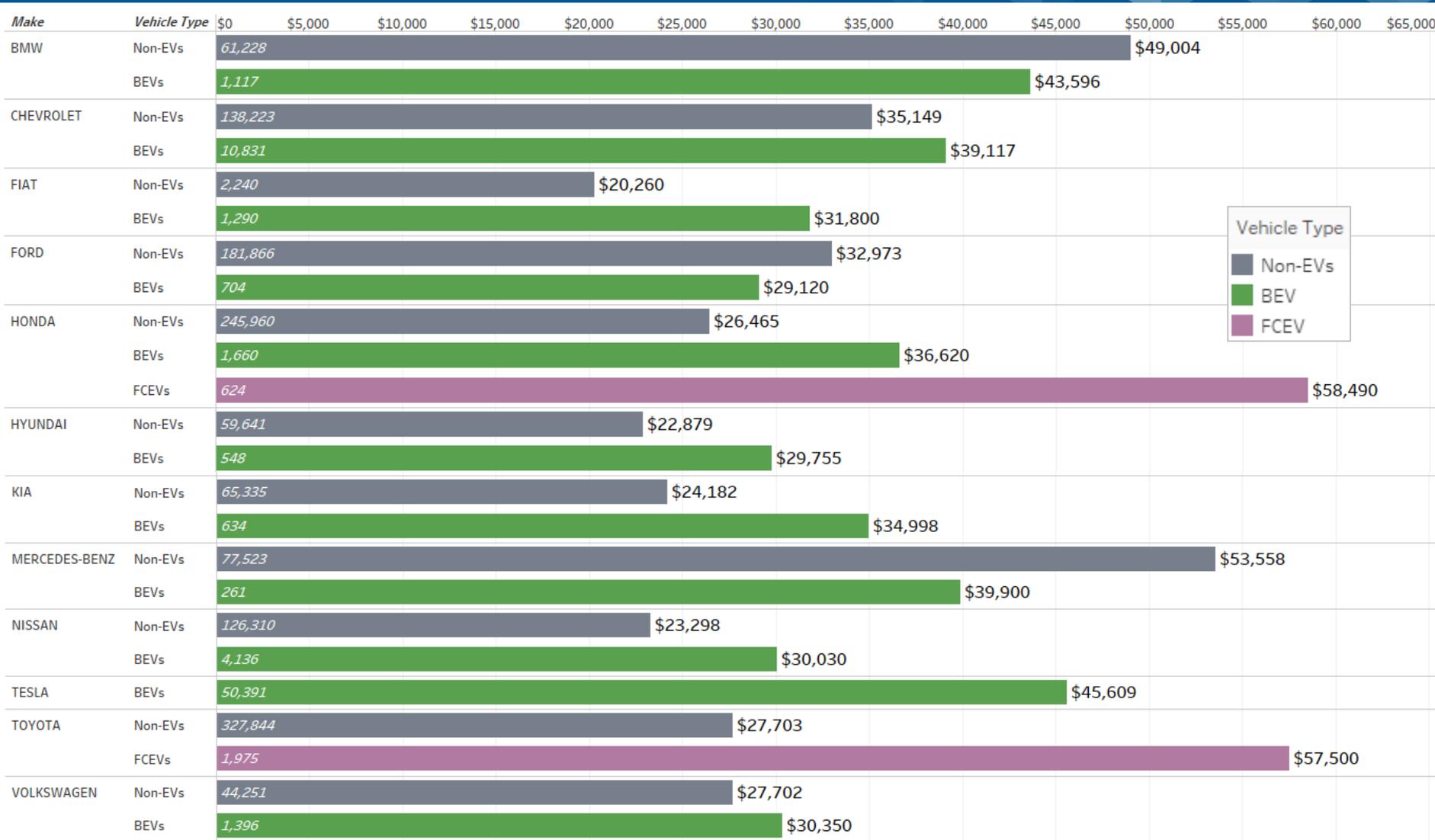
# Average Base MSRP and Number of Vehicles: PHEVs (Oct. 2017 – Sept. 2018)

Make	Vehicle Type	\$0	\$10,000	\$20,000	\$30,000	\$40,000	\$50,000	\$60,000	\$70,000	\$80,000	
TOYOTA	PHEVs	12,930				\$27,100					
FORD	PHEVs	4,461				\$32,002					
CHEVROLET	PHEVs	10,910				\$34,209					
HONDA	PHEVs	5,934				\$35,204					
KIA	PHEVs	452				\$35,210					
HYUNDAI	PHEVs	517				\$37,156					
AUDI	PHEVs	1,694				\$41,311					
CHRYSLER	PHEVs	2,779				\$44,600					
MERCEDES-BENZ	PHEVs	1,354				\$54,975					
BMW	PHEVs	6,096				\$56,630					
VOLVO	PHEVs	1,057				\$62,733					
CADILLAC	PHEVs	100				\$75,095					
PORSCHE	PHEVs	518				\$75,546					

# Average Base MSRP and Number of Vehicles: PHEVs (Oct. 2017 – Sept. 2018)



# Average Base MSRP and Number of Vehicles: BEVs & FCEVs (Oct. 2017 – Sept. 2018)



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

# **CVRP Update**

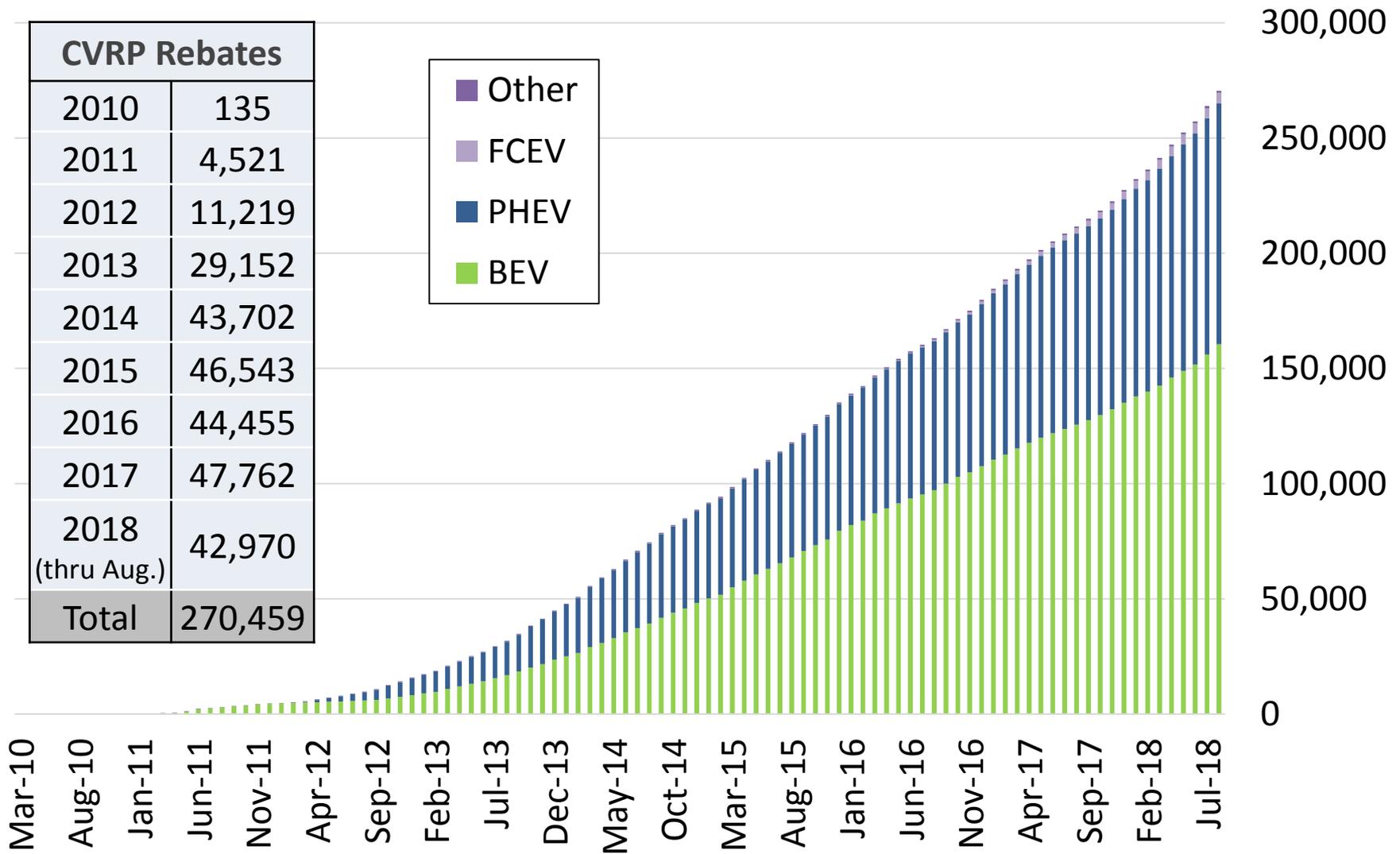
Outputs, Outcomes, and Impacts



# **CVRP Outputs**

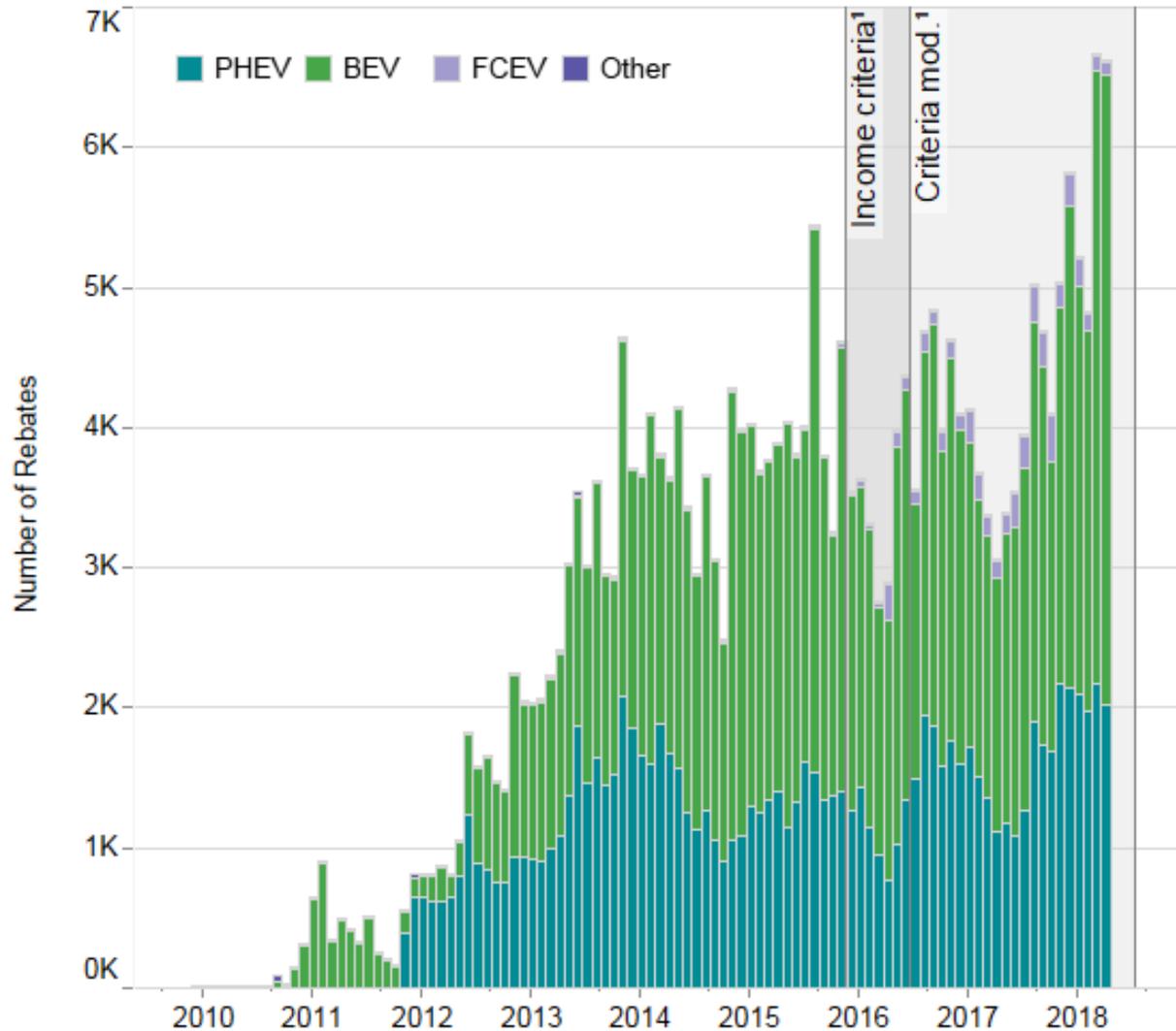
Vehicles Rebated

# Cumulative CVRP Rebates (through August 2018)

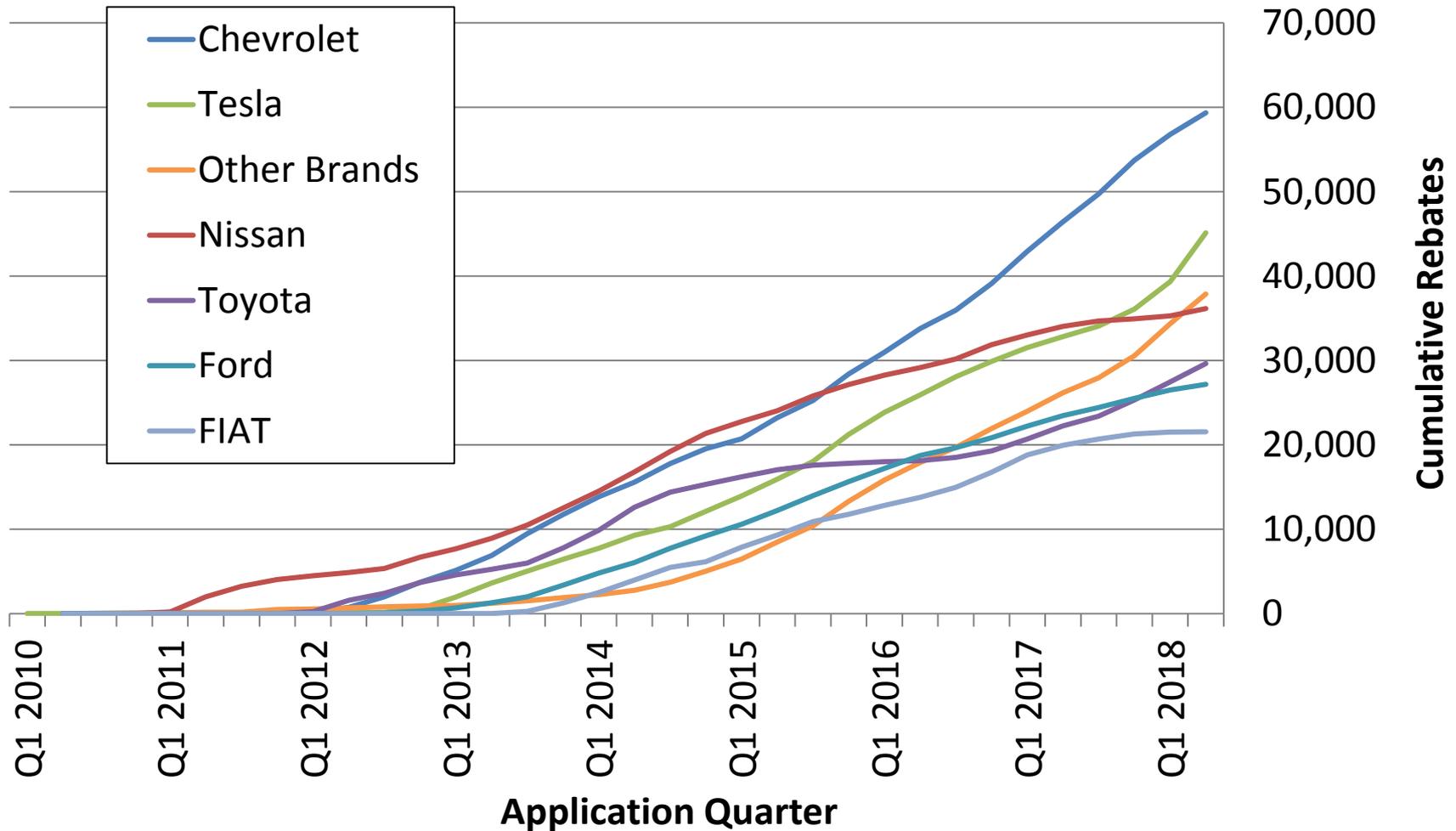


# CVRP Rebate Volumes Are Increasing

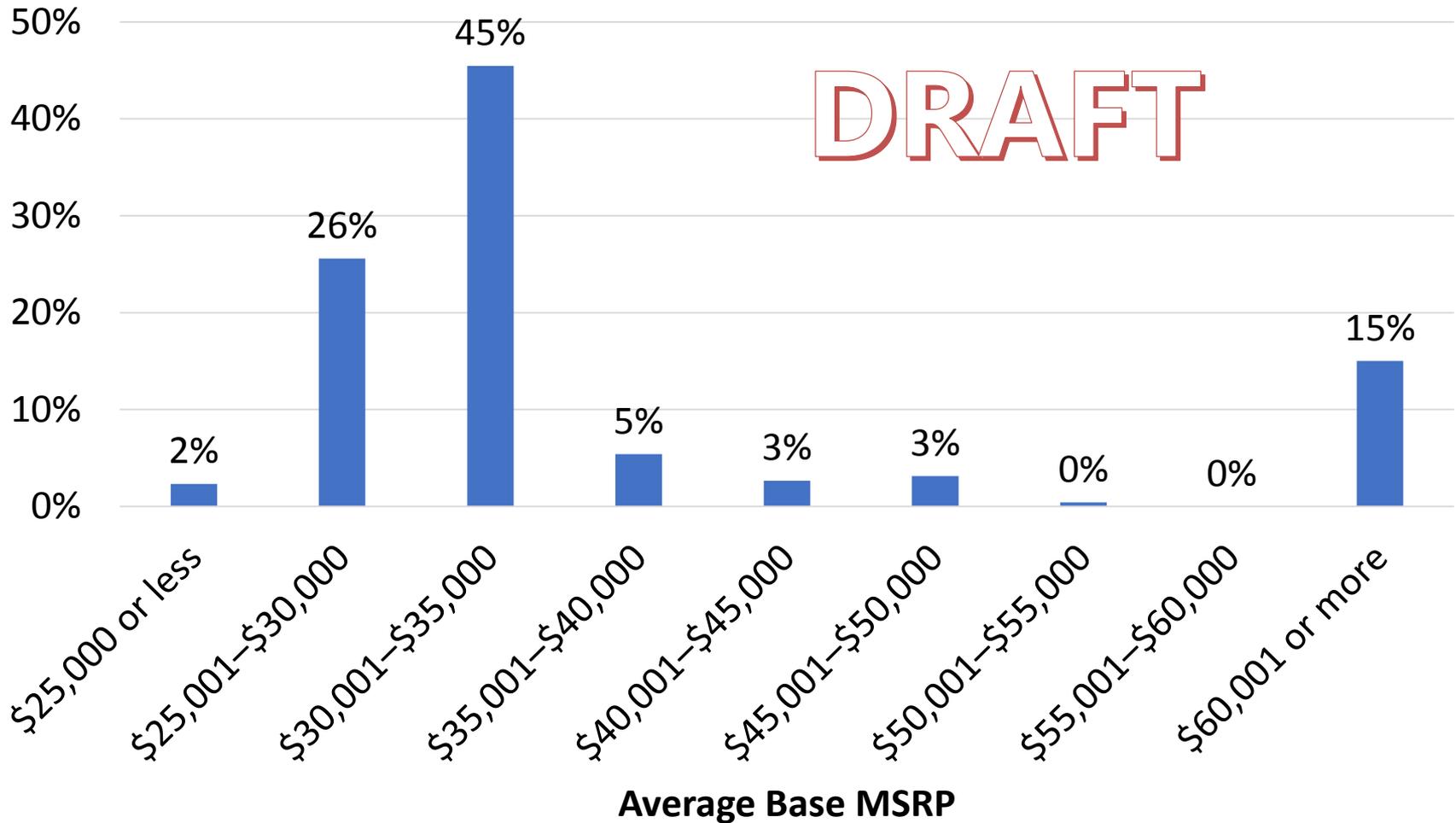
CVRP Rebates	
2010	135
2011	4,521
2012	11,219
2013	29,152
2014	43,702
2015	46,543
2016	44,455
2017	47,762
2018 (thru Aug.)	42,970
<b>Total</b>	<b>270,459</b>



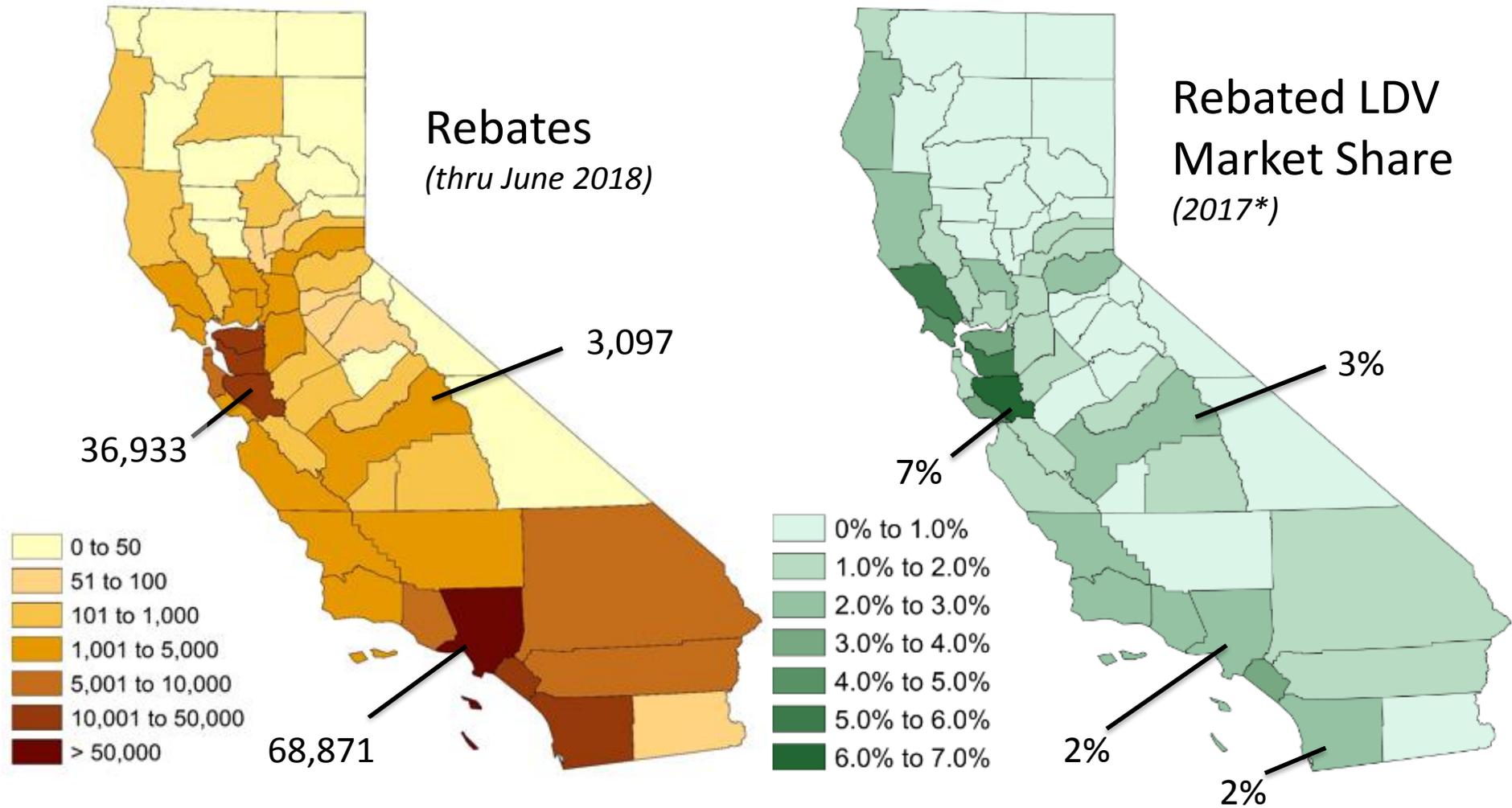
# Cumulative Rebates by Automaker (through June 2018)



# Moderately-Priced Vehicles Receive Most Rebates: Life of Program (Plug-in Vehicles through Aug. 2018)



# Rebates By County: Absolute and Share of Market



\* Applications received in 2017, which may not align as closely to LDV registration dates as application purchase dates  
Includes content supplied by R.L. Polk & Co, © 2018



# Outputs

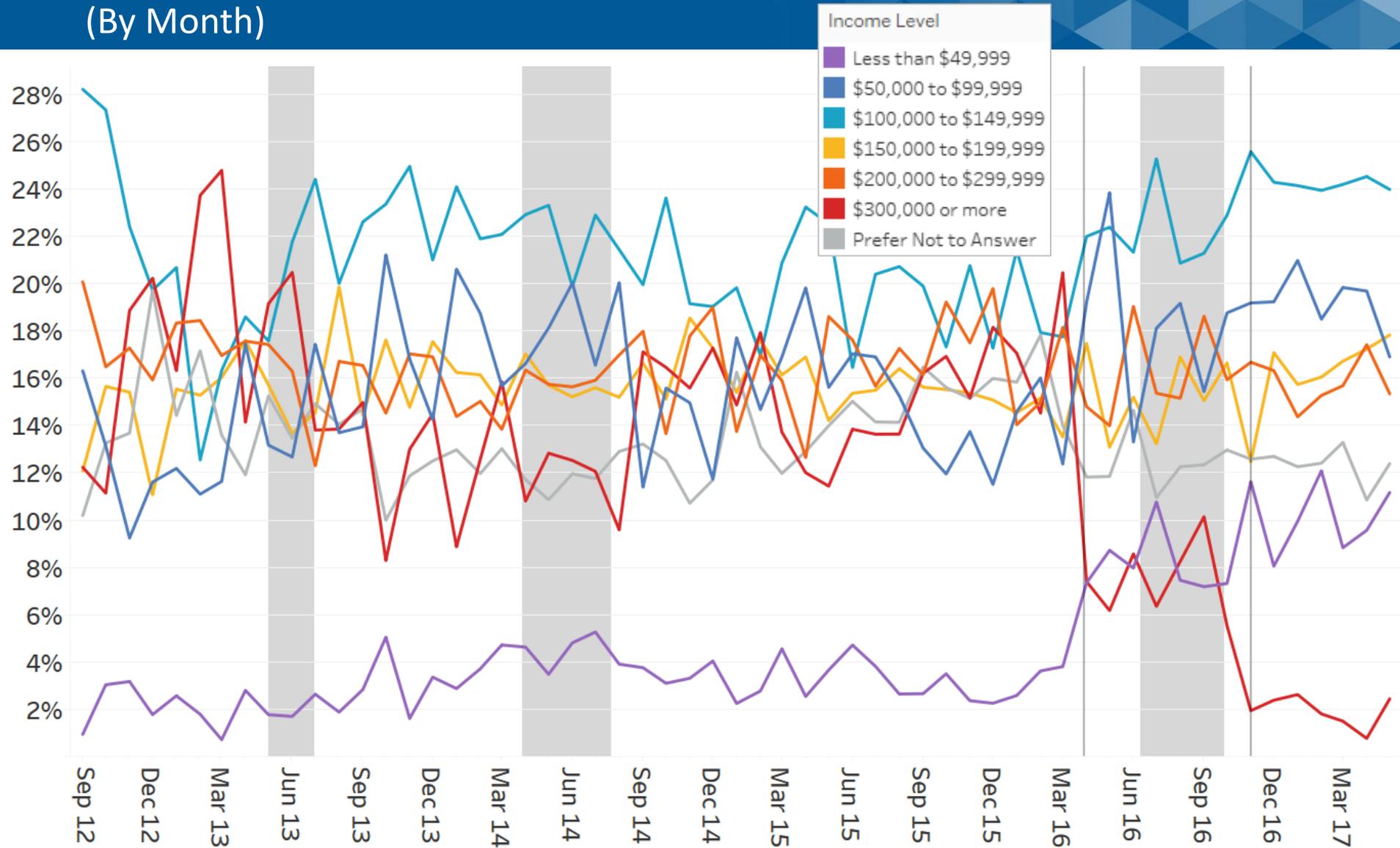
Consumers Rebated (incl. Equity Indicators)

# Majority Characteristics

	Vehicle purchase “intenders” (CHTS 2012)	CVRP Consumer Survey 2016–17 edition		
		All	PHEV	BEV
White/ Caucasian	76%	56%	58%	54%
Male	49%	72%	71%	73%
≥ Bachelor’s degree	66%	79%	76%	81%
Detached homes	75%	77%	75%	78%
40–59 years old	52%	50%	48%	51%
< \$150k HH Income	79%	80%	83%	77%

# CVRP Rebates By Household Income Over Time

(By Month)

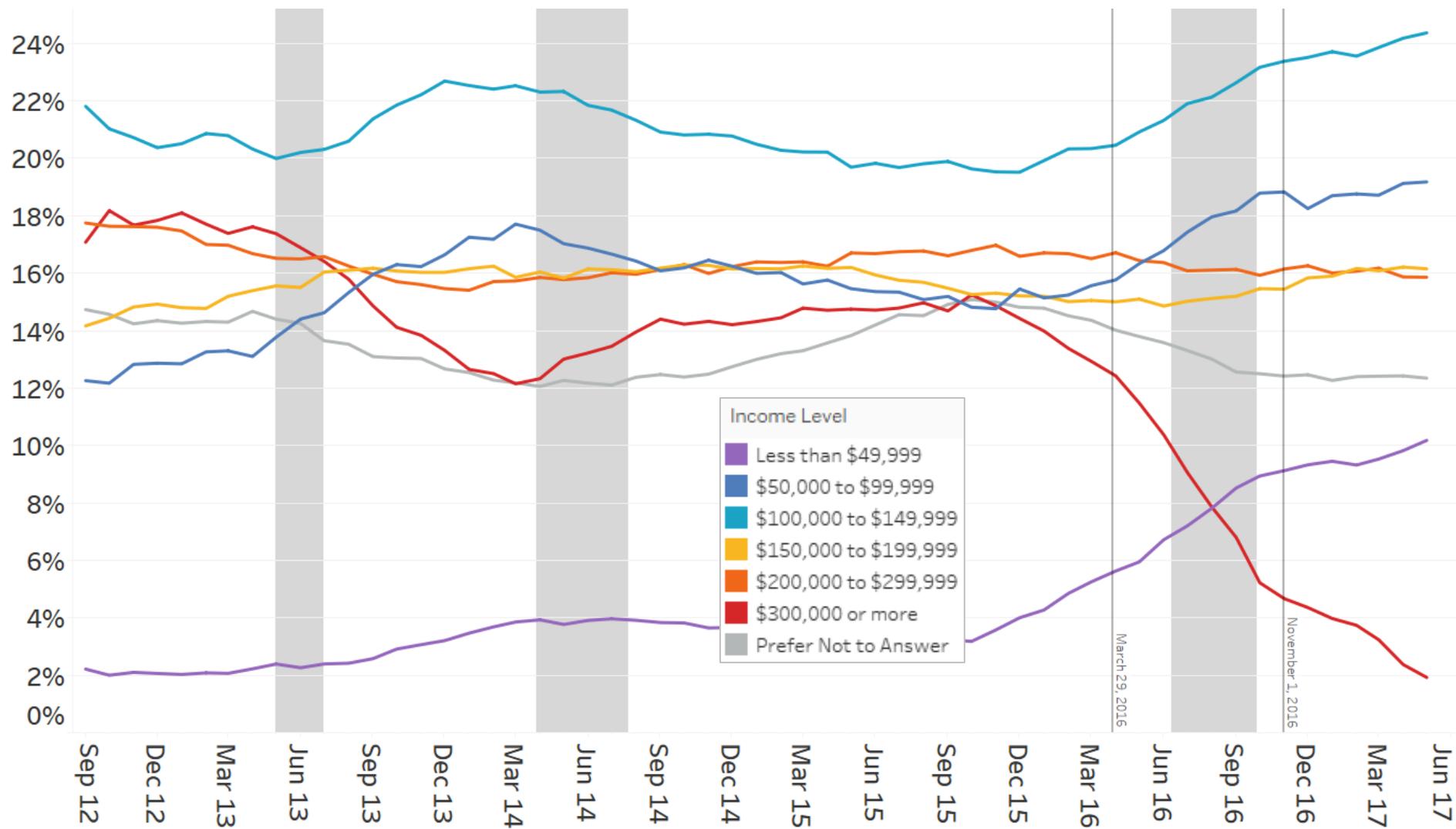


Shaded bands denote waitlist periods.

Source: CVRP Consumer Survey, Sept. 2012–May 2017

# CVRP Rebates By Household Income Over Time

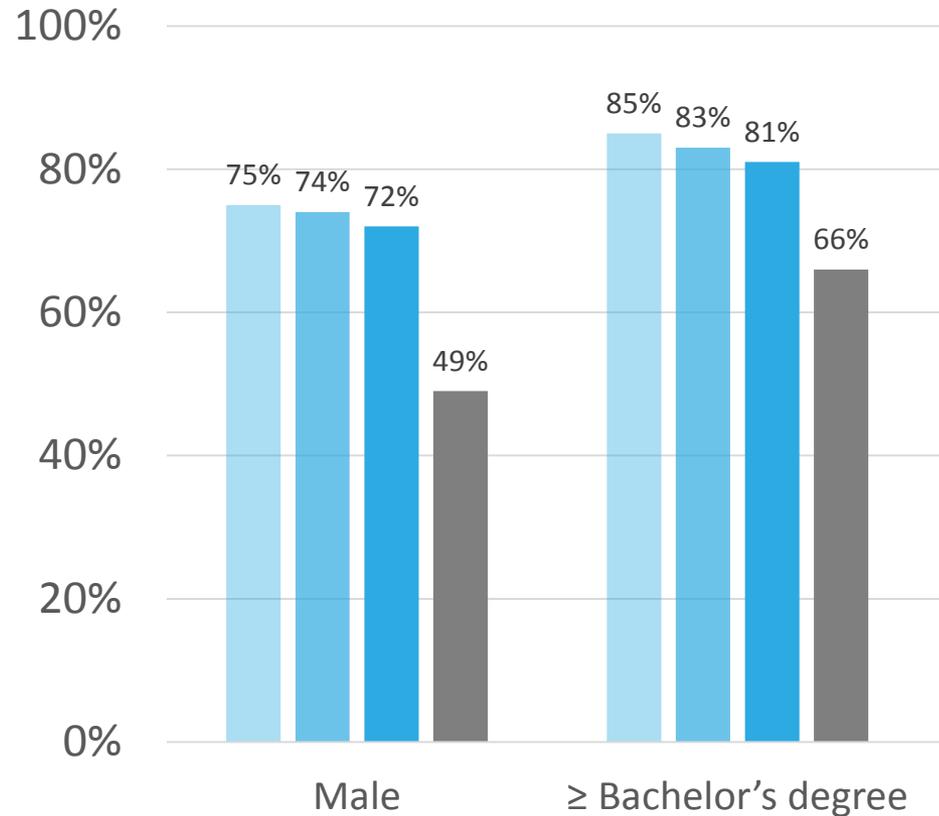
(Smoothed with 1-Year Running Average)



Shaded bands denote waitlist periods.

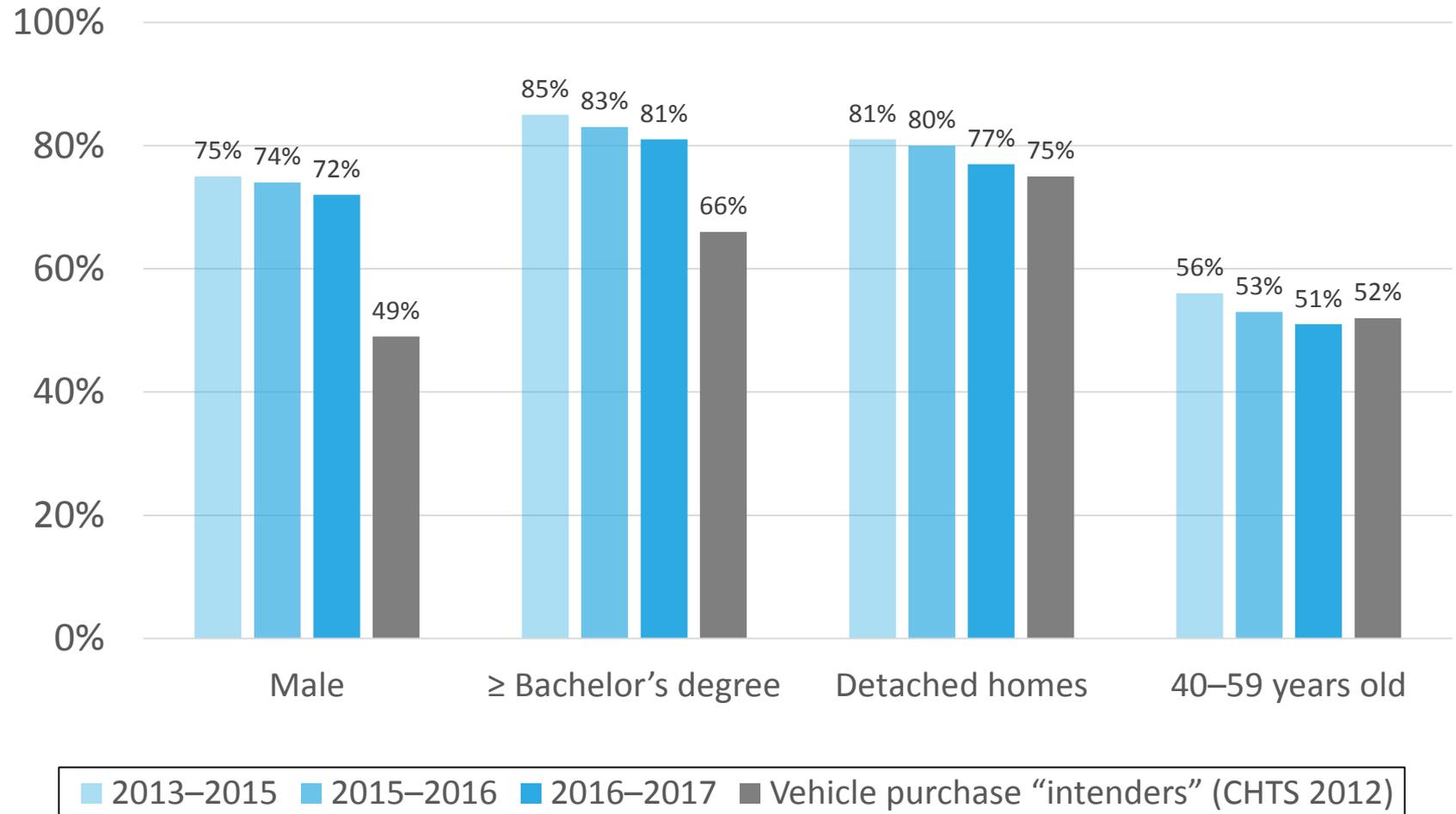
Source: CVRP Consumer Survey, Sept. 2012–May 2017

# Even Where Differences Remain, Rebate Recipients Look More And More Like Other Car Buyers



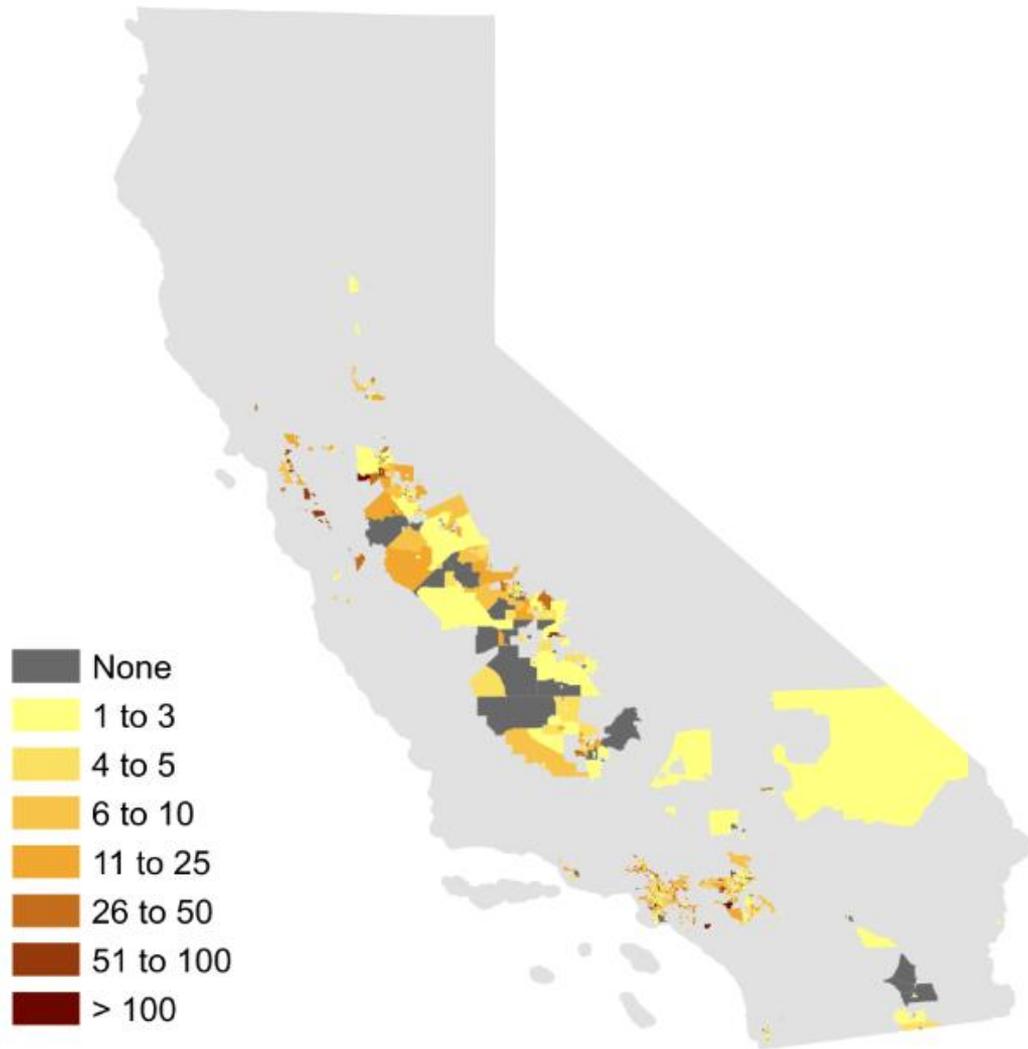
■ 2013-2015 ■ 2015-2016 ■ 2016-2017 ■ Vehicle purchase "intenders" (CHTS 2012)

# Even Where Differences Remain, Rebate Recipients Look More And More Like Other Car Buyers

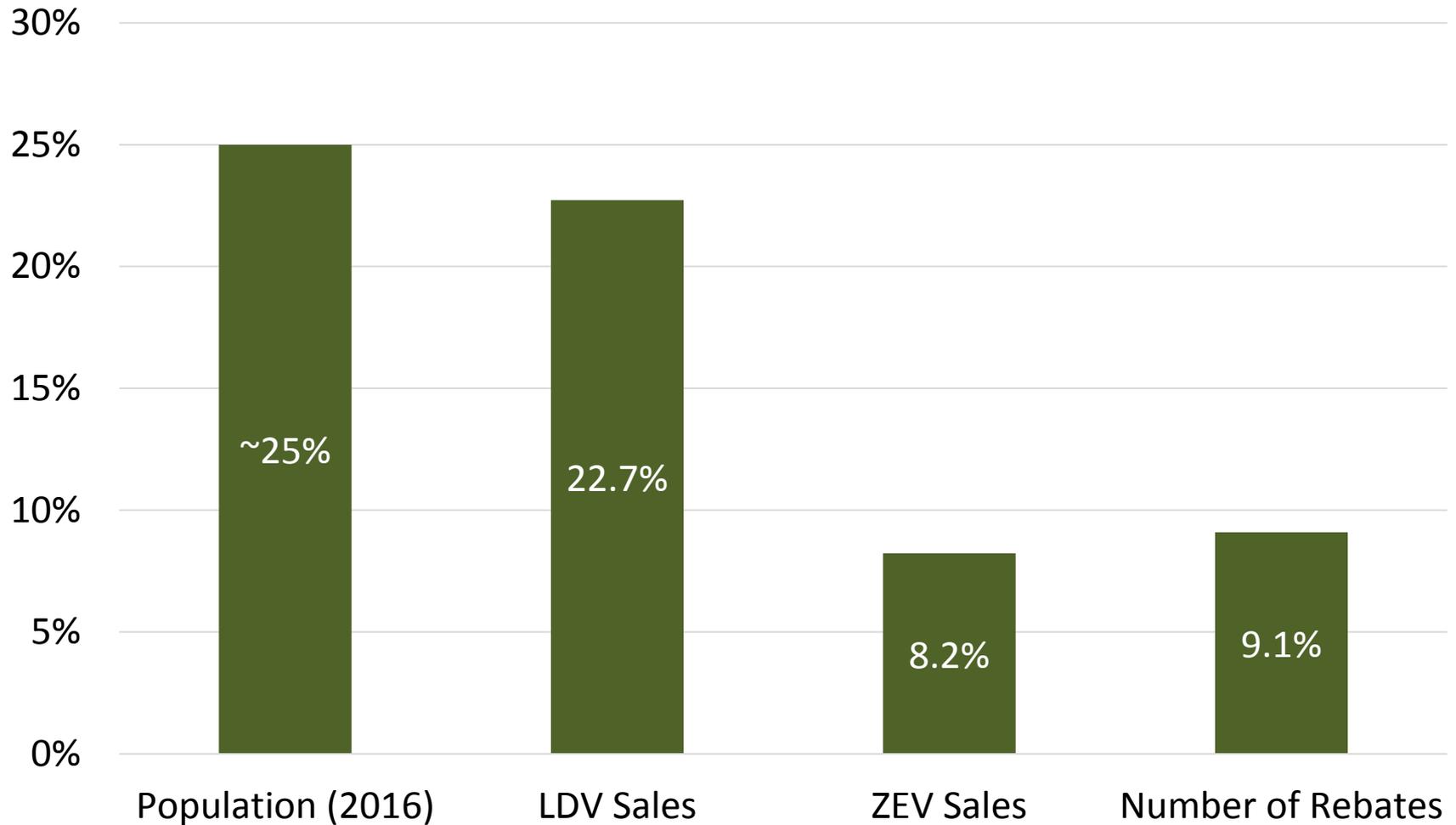


CVRP Consumer Survey, Sept. 2012–May 2017: 2013–15 edition, weighted,  $n = 19,460$ ;  
 2015–16 edition, weighted,  $n = 11,611$ ; 2016–17 edition, weighted,  $n = 9,367$   
 California Household Travel Survey, 2012: weighted,  $n = 42,431$

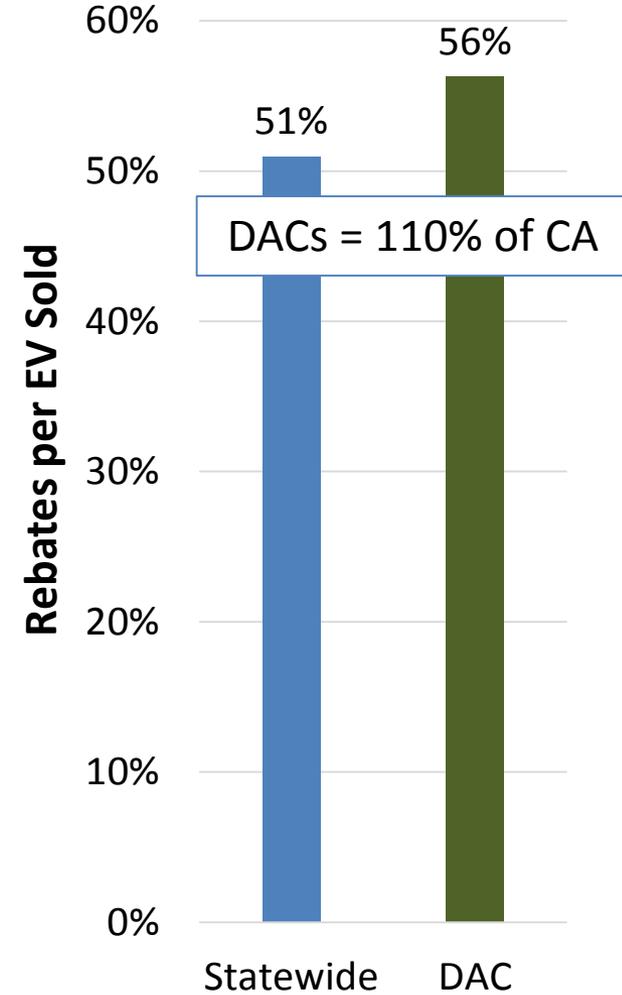
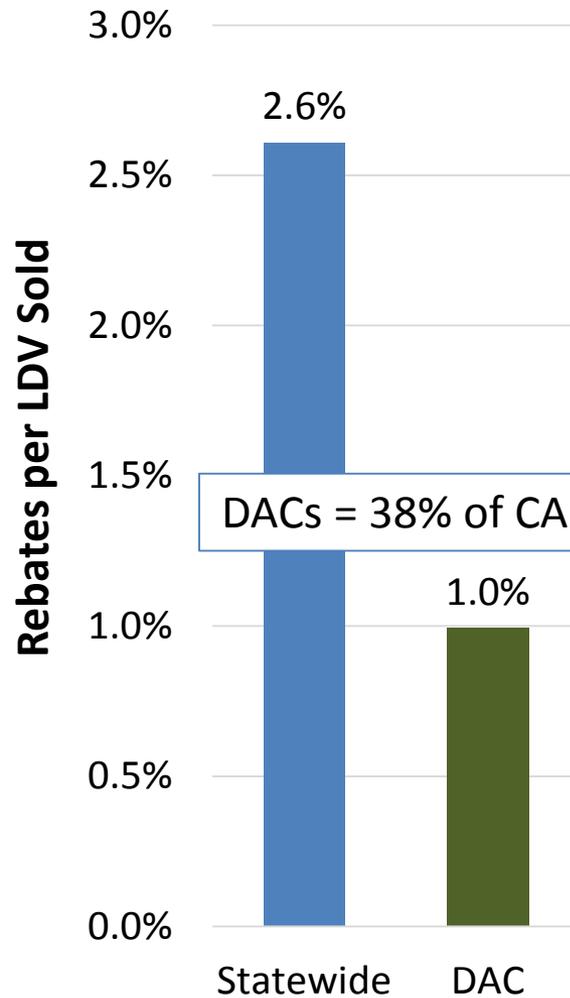
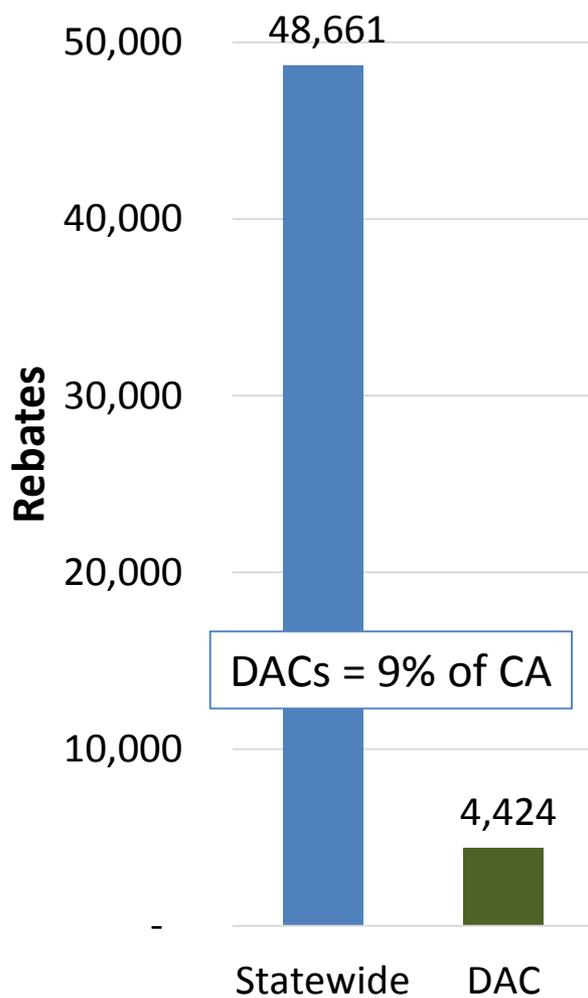
# Rebates in Disadvantaged Communities (DACs)



# Disadvantaged Communities (DACs) (2017)



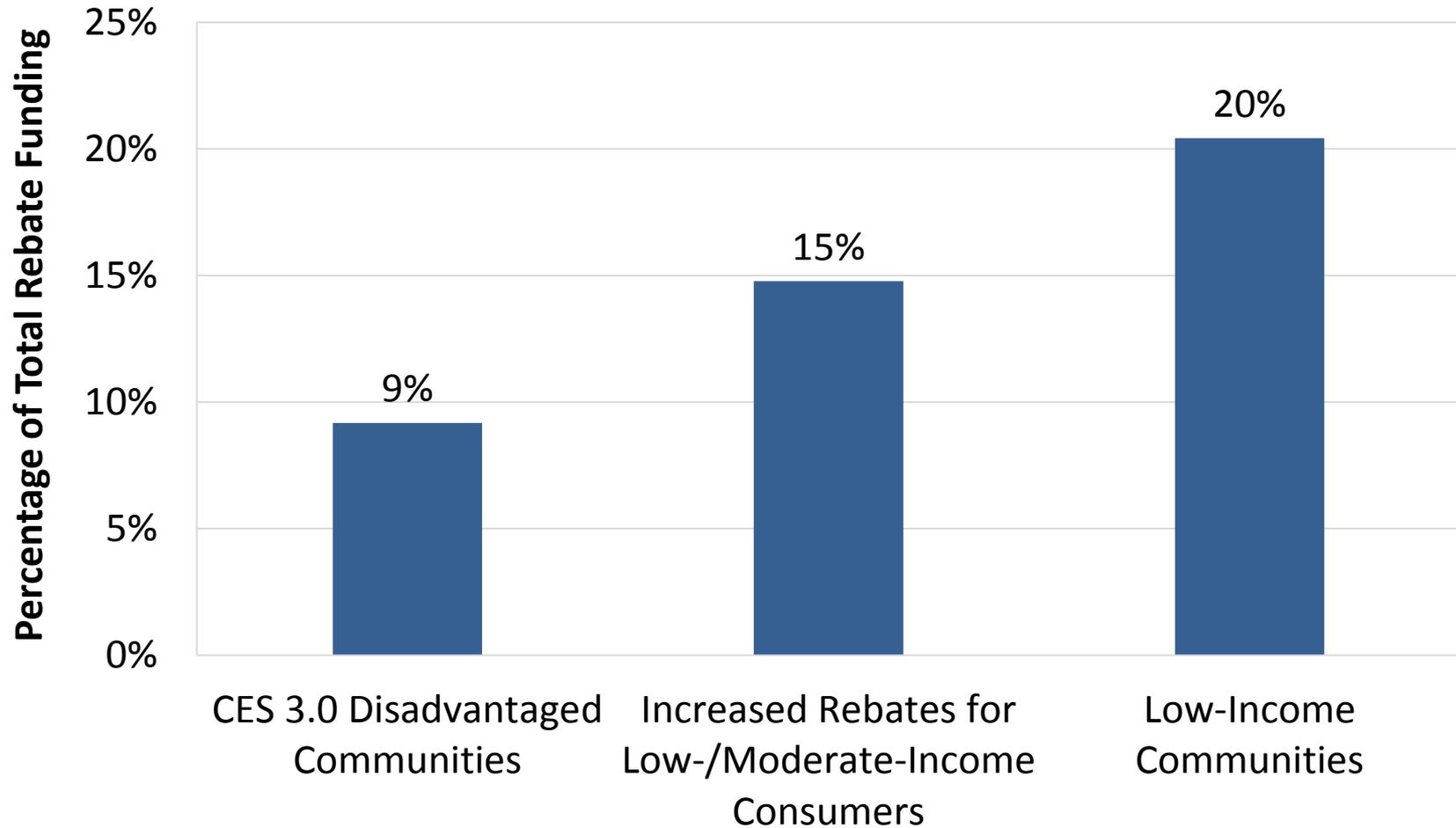
# Context Is Important: DAC vs. CA Rebates (2017)



*Includes vehicles purchased/registered in 2017 and content supplied by R.L. Polk & Co, © 2018.*

*Note: Some PHEV models could not be identified in the registration data, which may result in a minor overestimation of percent of market rebated.*

# Funding Proportion Going to Equity Groups: Current Program (Nov. 2016 thru June 2018)

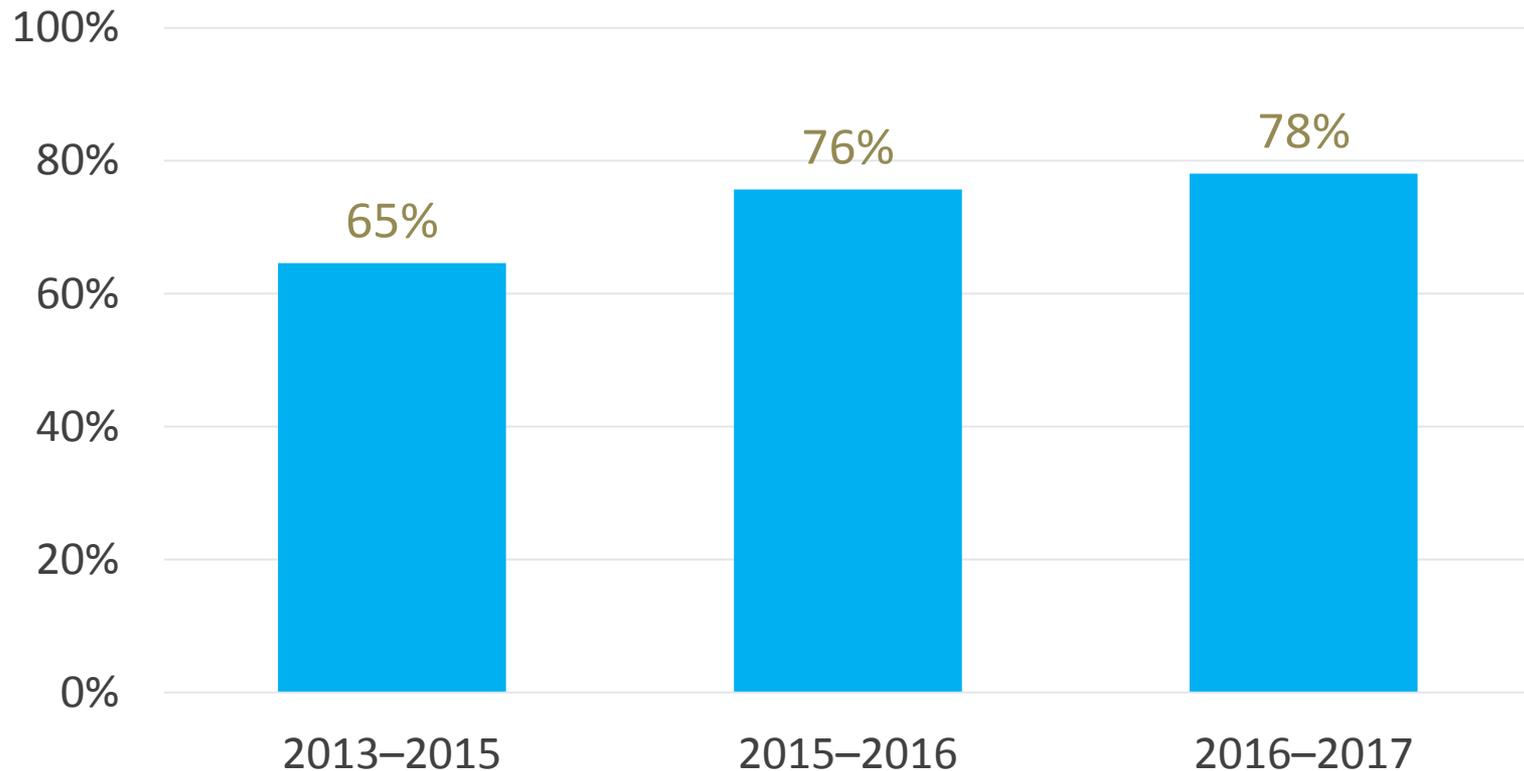




# Outcomes

Behaviors Influenced

## Replaced a vehicle with their rebated EV



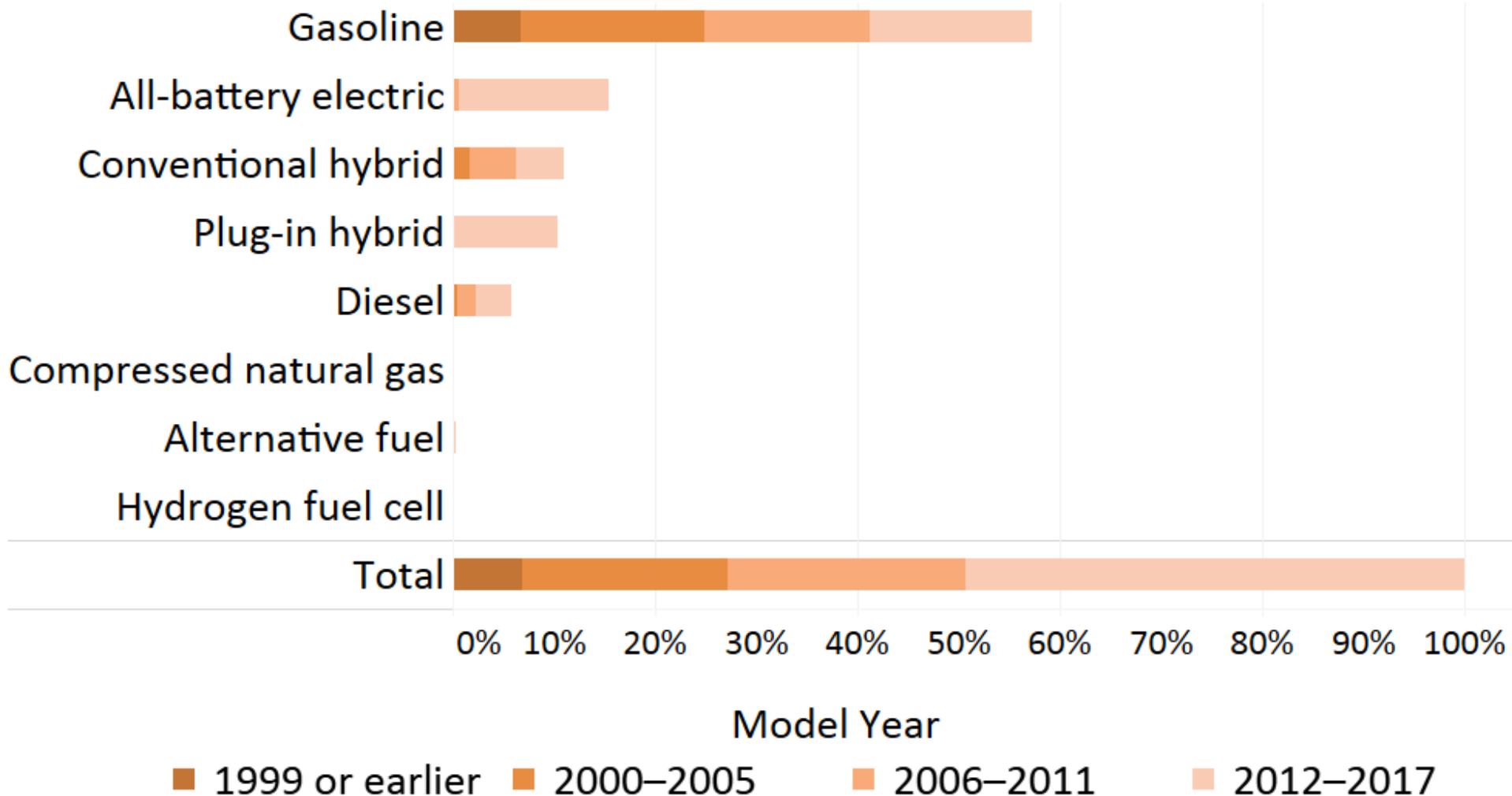


# Impacts

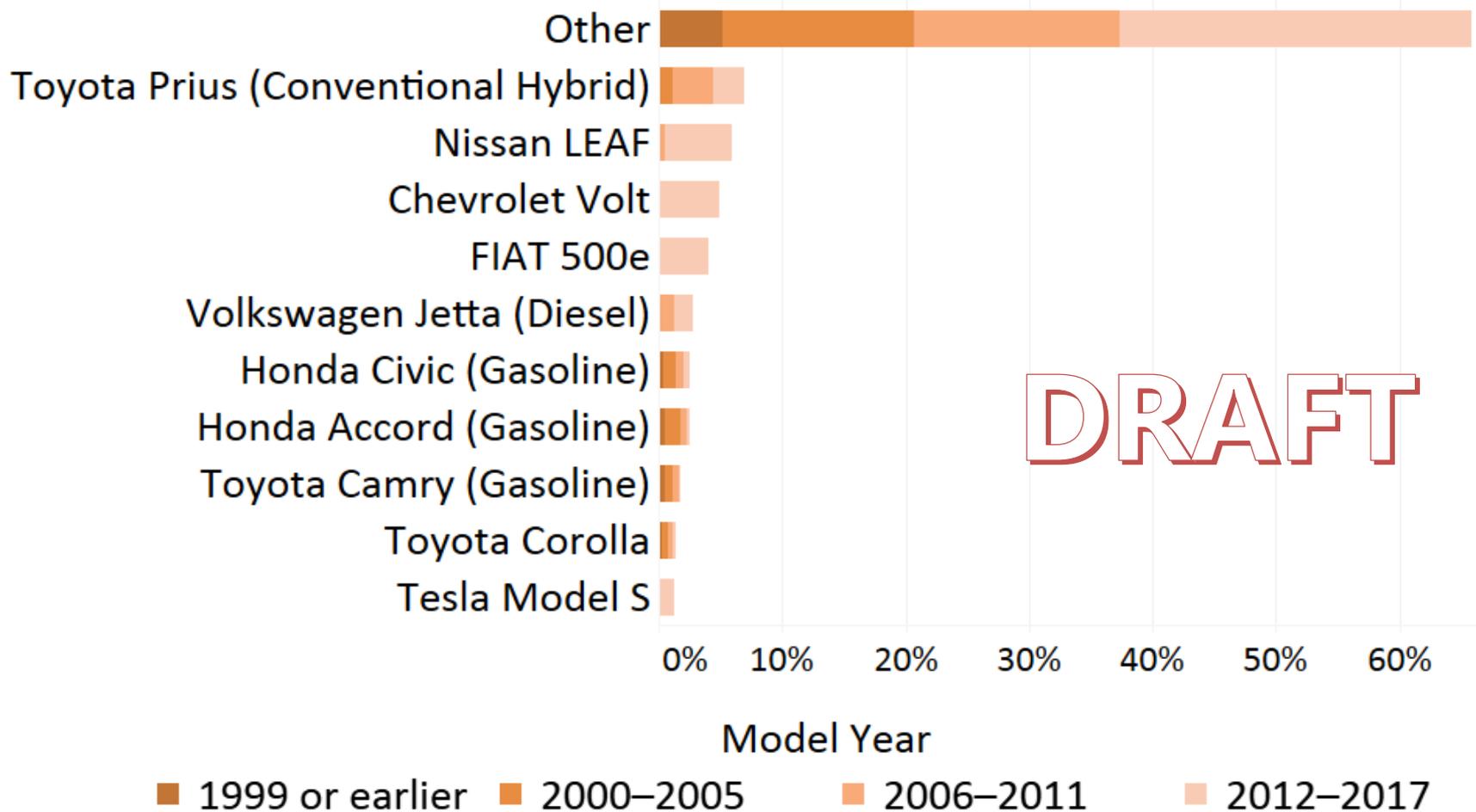
Emission



# What vehicles types have rebates helped replace?



# Replaced Vehicle Distribution



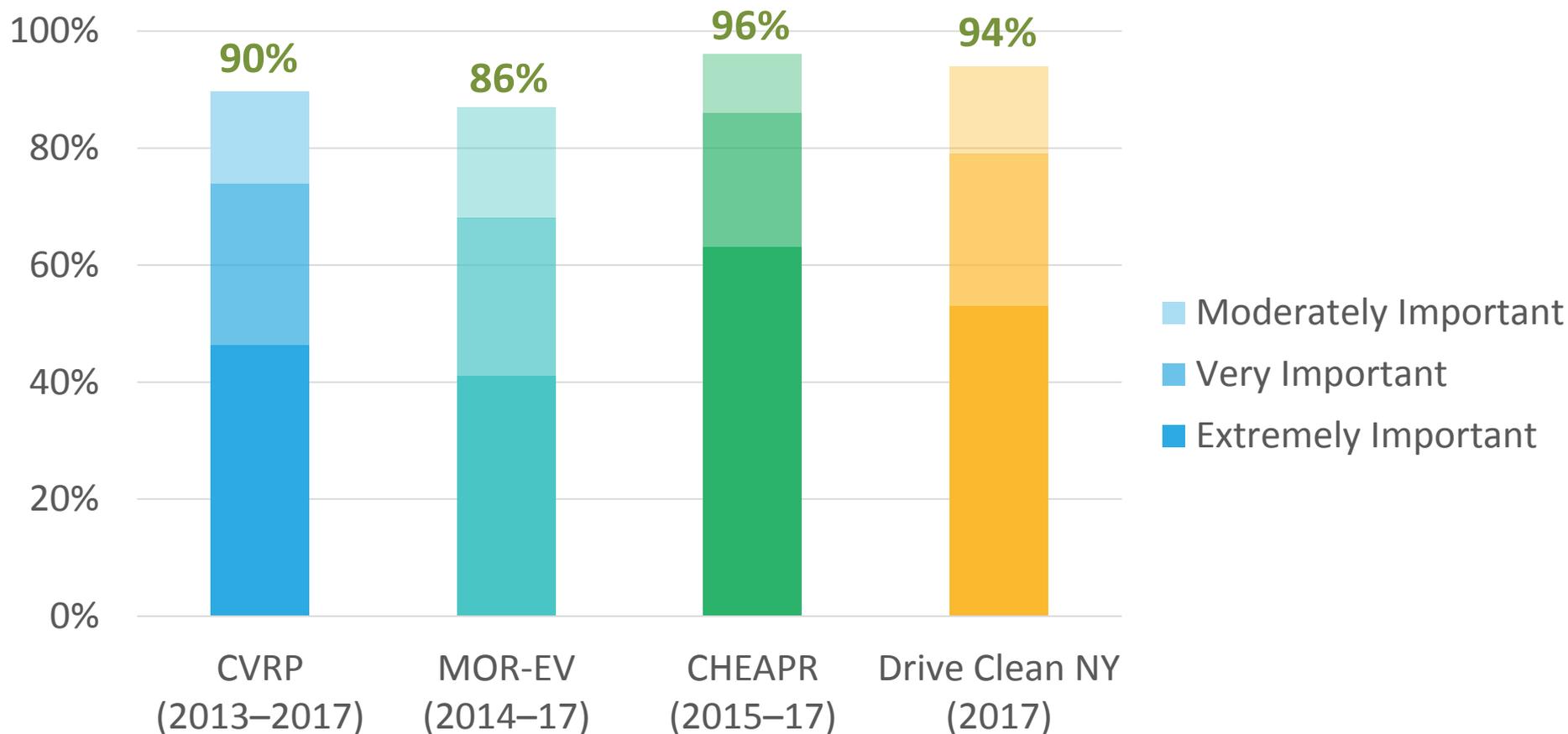


# Impacts

Market

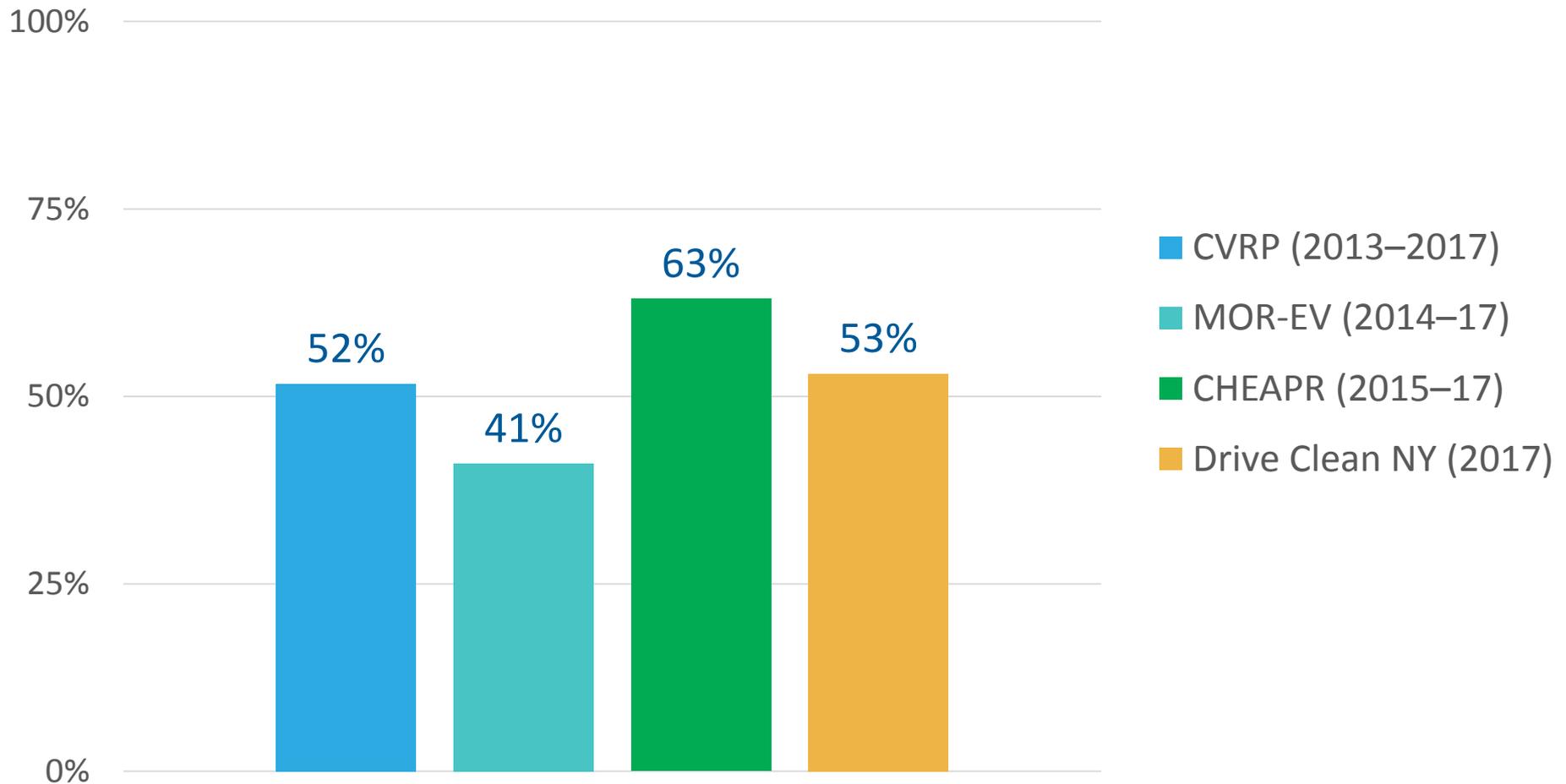
# Rebate Influence: Importance

How **important** was the state rebate in **making it possible** for you to acquire your clean vehicle?



# Rebate Influence: Essentiality

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



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 the sun low on the horizon, creating a warm, golden glow and lens flare effects. The background is slightly blurred, showing a city street with buildings and other vehicles.

# Additional Considerations

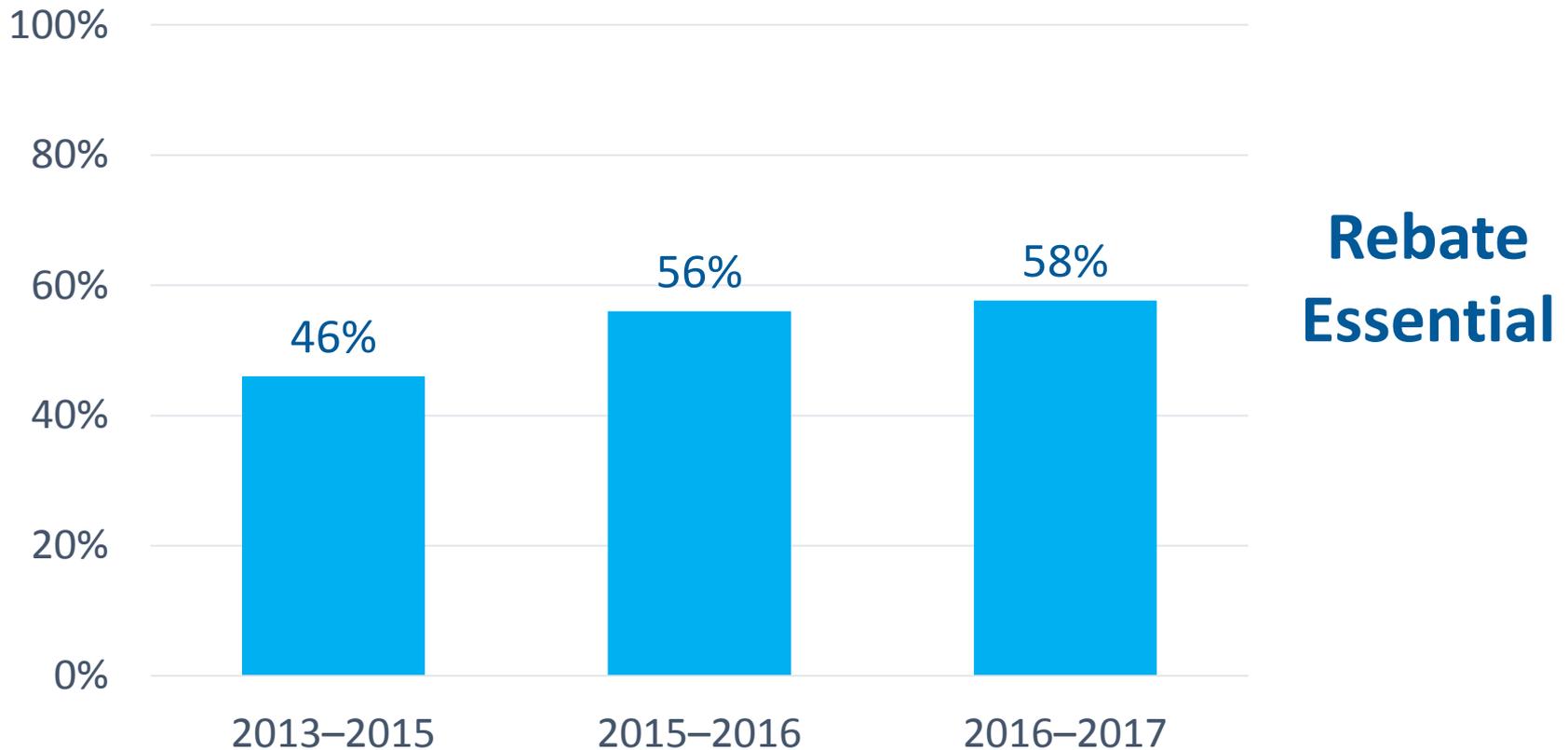
Rebate Effectiveness, “Before/After” Comparisons



# Rebate Effectiveness

# Rebate Essentiality is *Increasing* Over Time

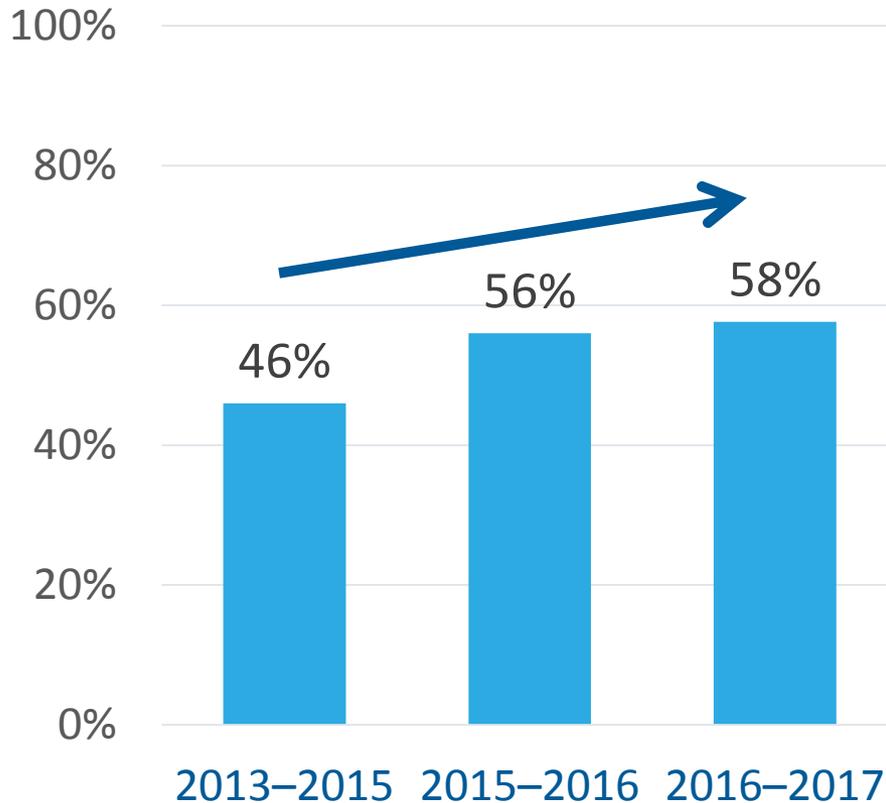
Would **not** have purchased/leased their EV **without** rebate



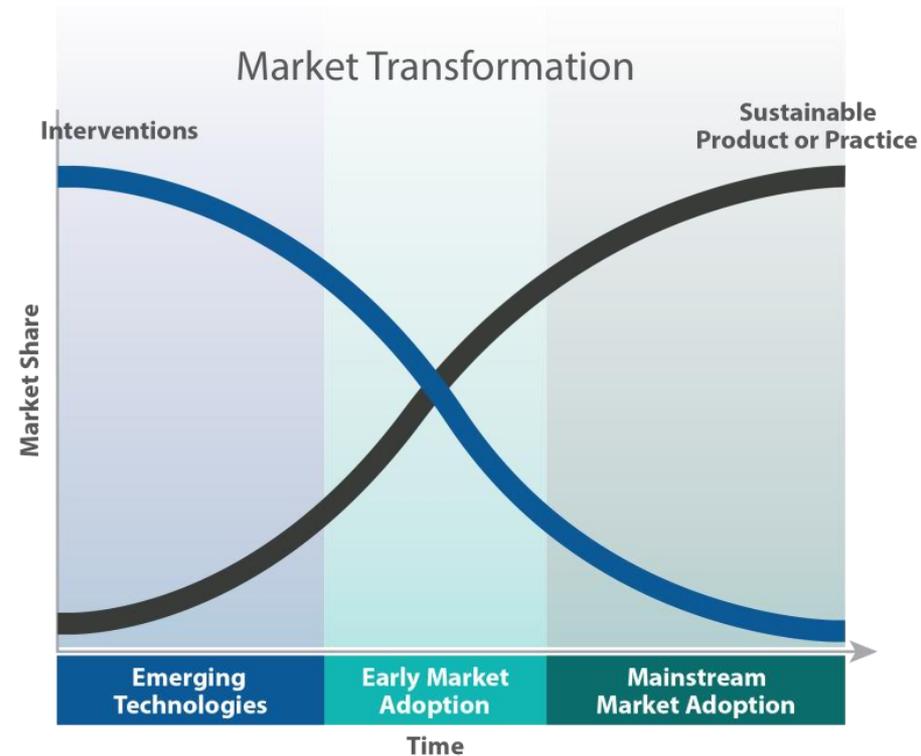
*CVRP Consumer Survey. 2013-2015 edition: weighted, n=19,208  
2015-2016 edition: weighted, n=11,457  
2016-2017 edition: weighted, n=9,261*

# Rebate Essentiality

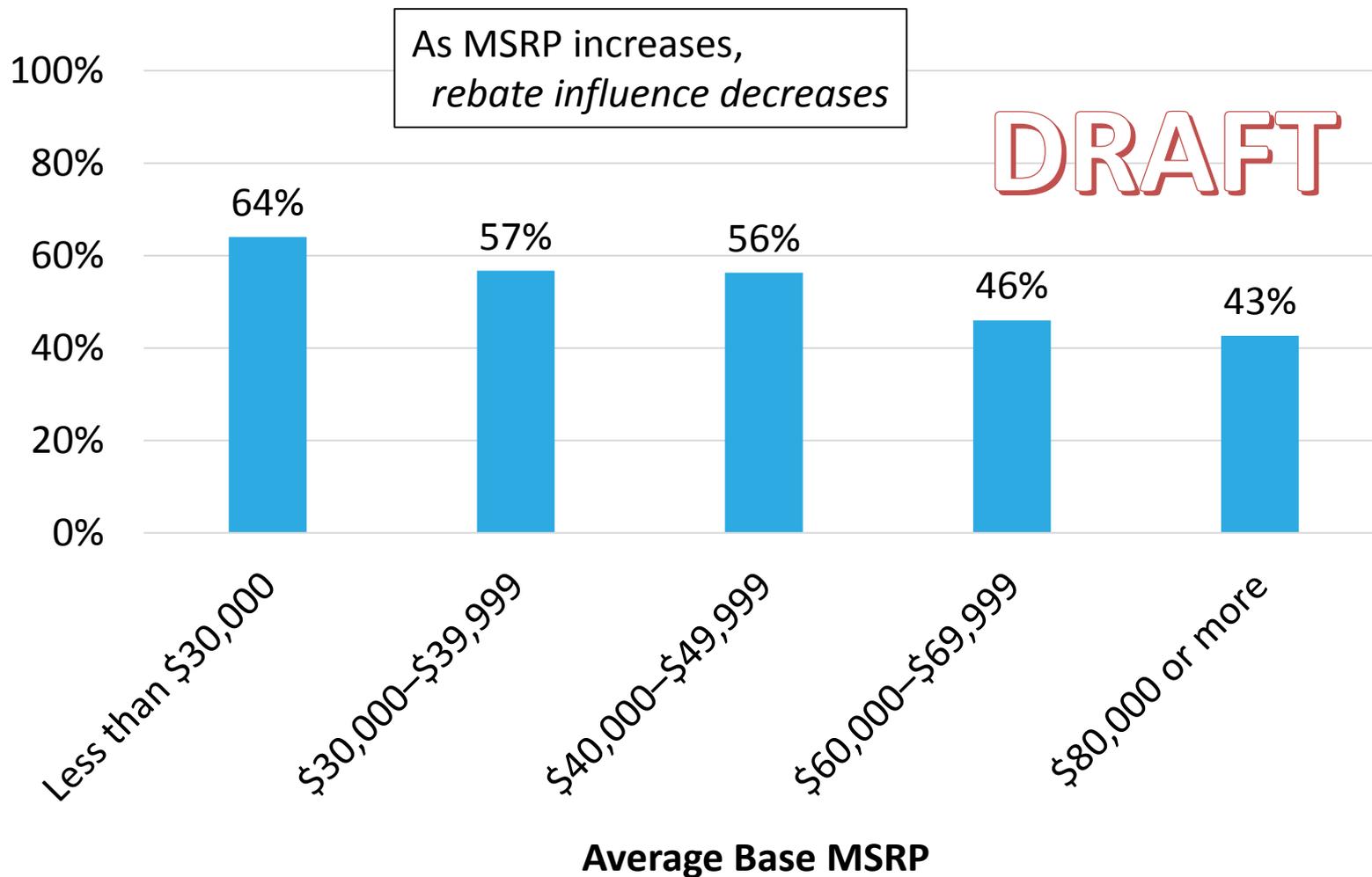
## Rebate Essentiality



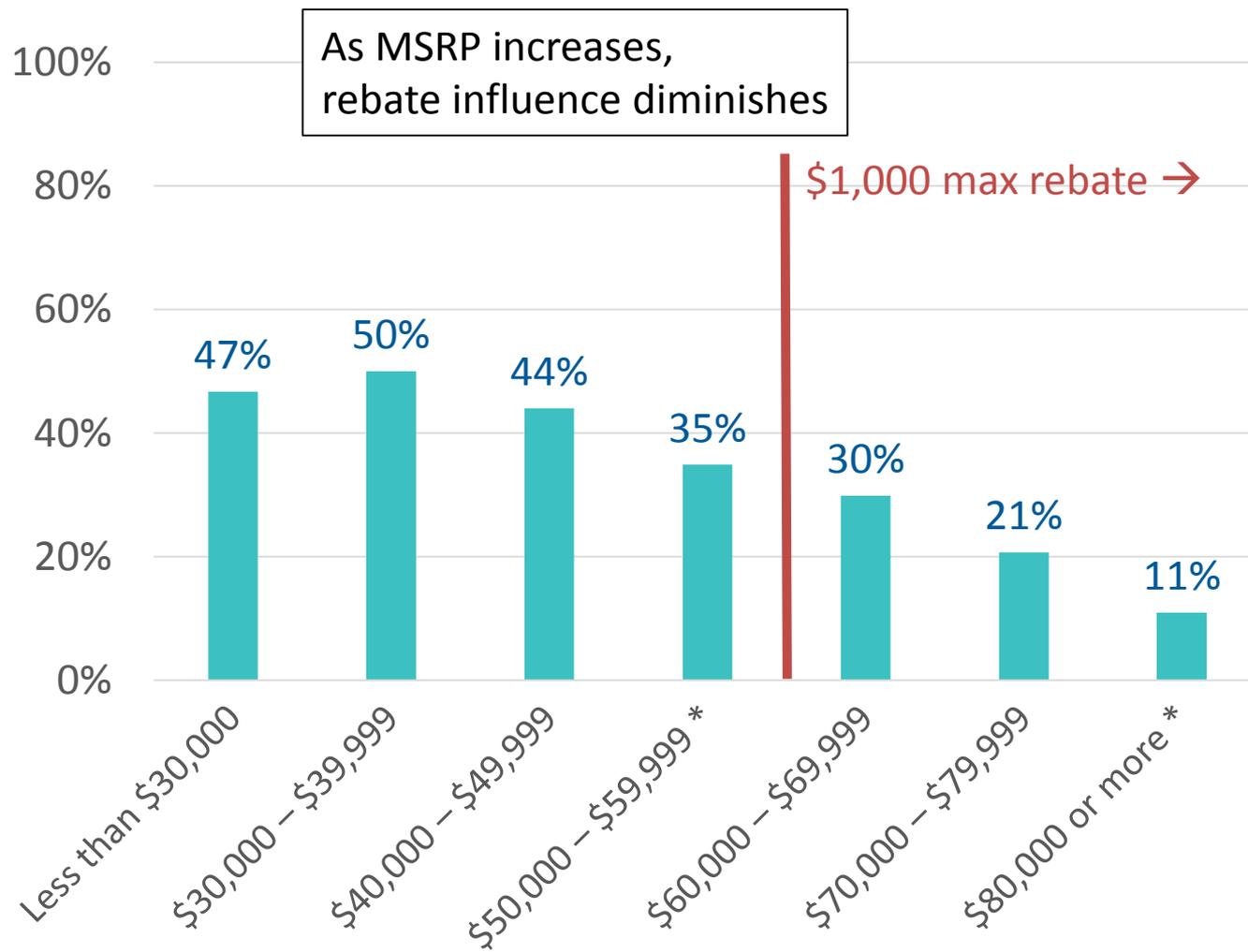
## Common paradigm



# Rebate Essentiality Reflects Interesting Trends



# Rebate Essentiality Reflects Interesting Trends



Excerpts adapted from the presentation available on the [program reports page](#) at CleanVehicleRebate.org ...

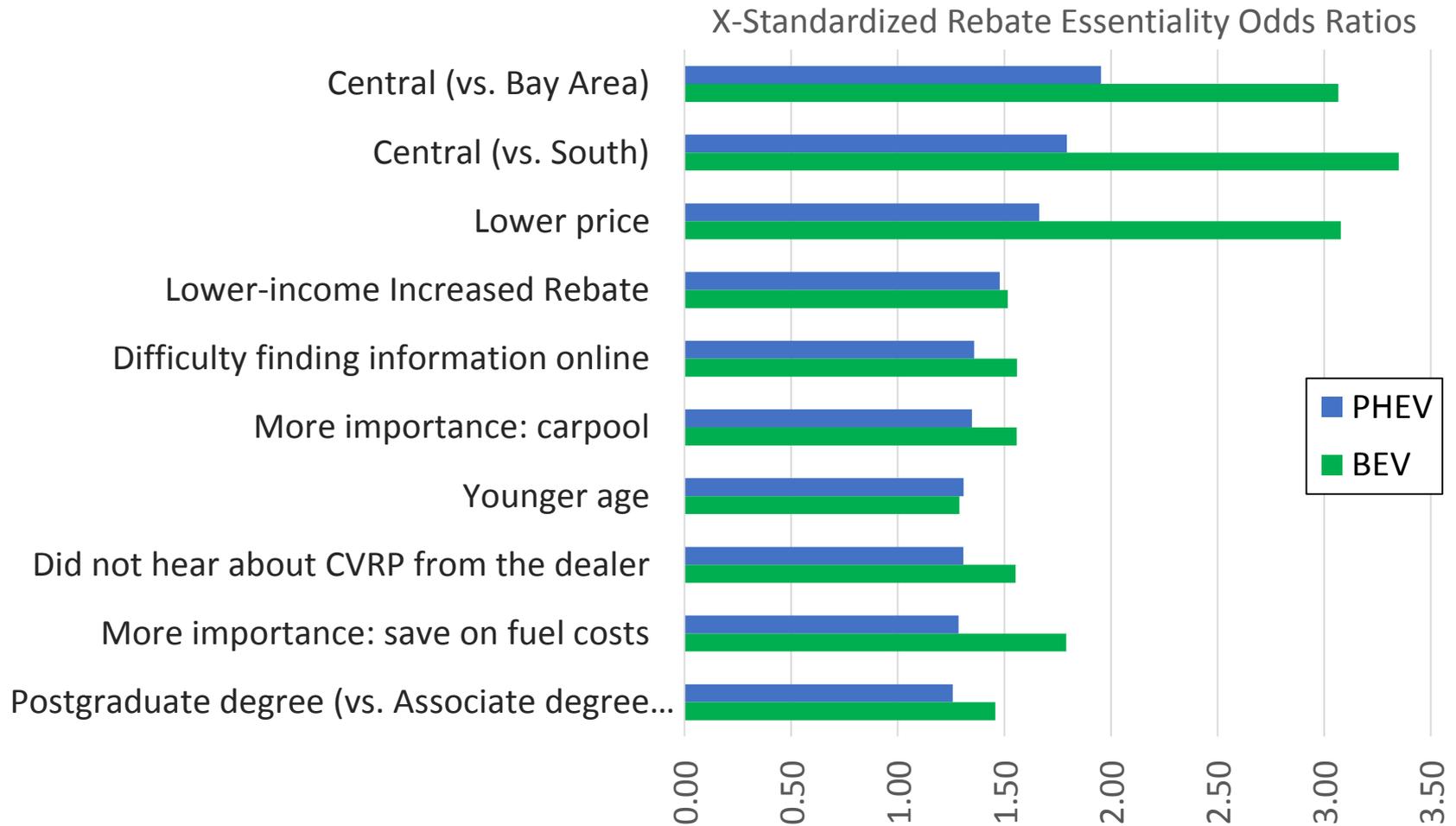
# Targeting EV Outreach and Incentives to Cost-Effective “Rebate-Essential” Consumers

EVS 31, 3 October 2018

Brett Williams, M.Phil. (cantab), Ph.D. – Senior Principal Advisor, EV Programs

John Anderson – Research Analyst

# Targeting Rebate-Essential Consumers: Odds-Increasing Factors for PHEV and BEV Consumers



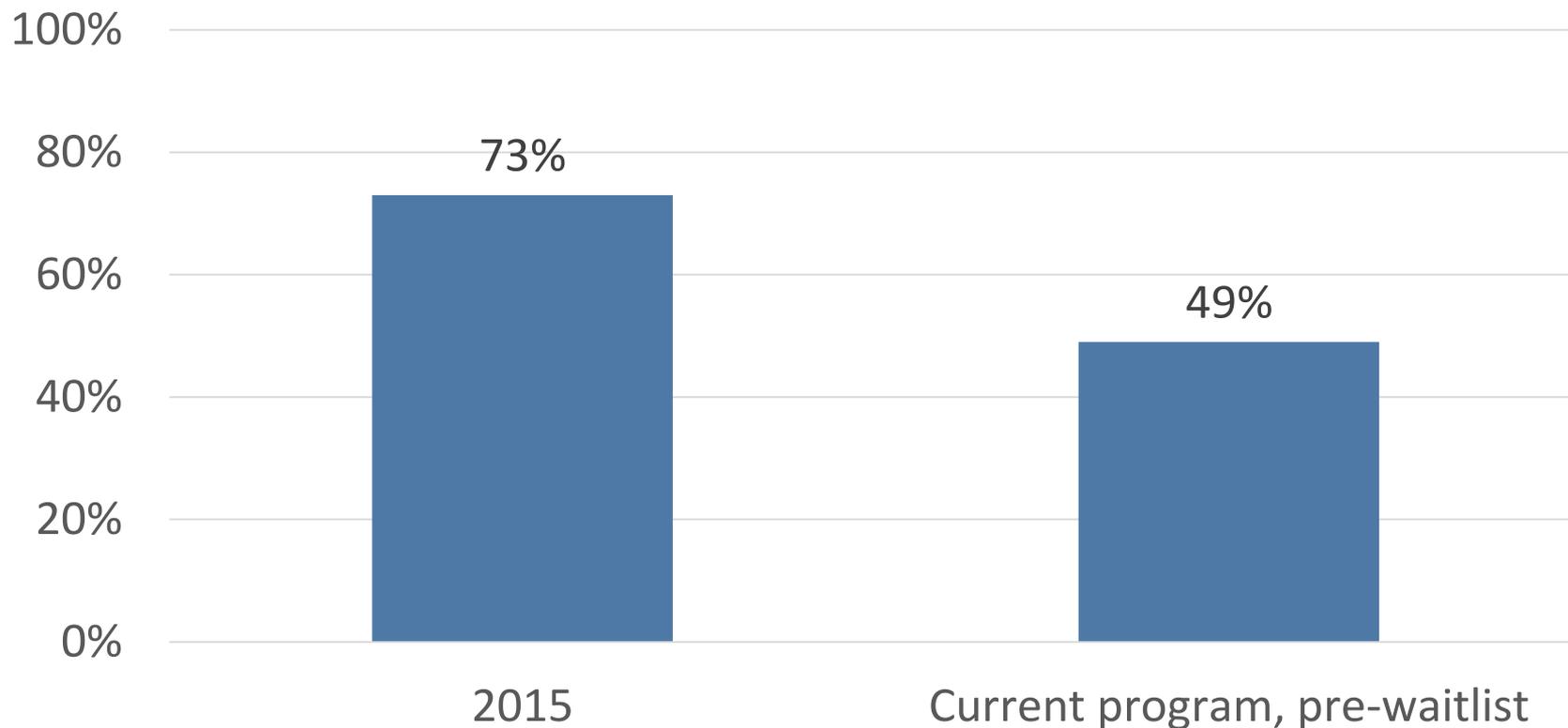
All are significant factors ( $p < 0.05$ )



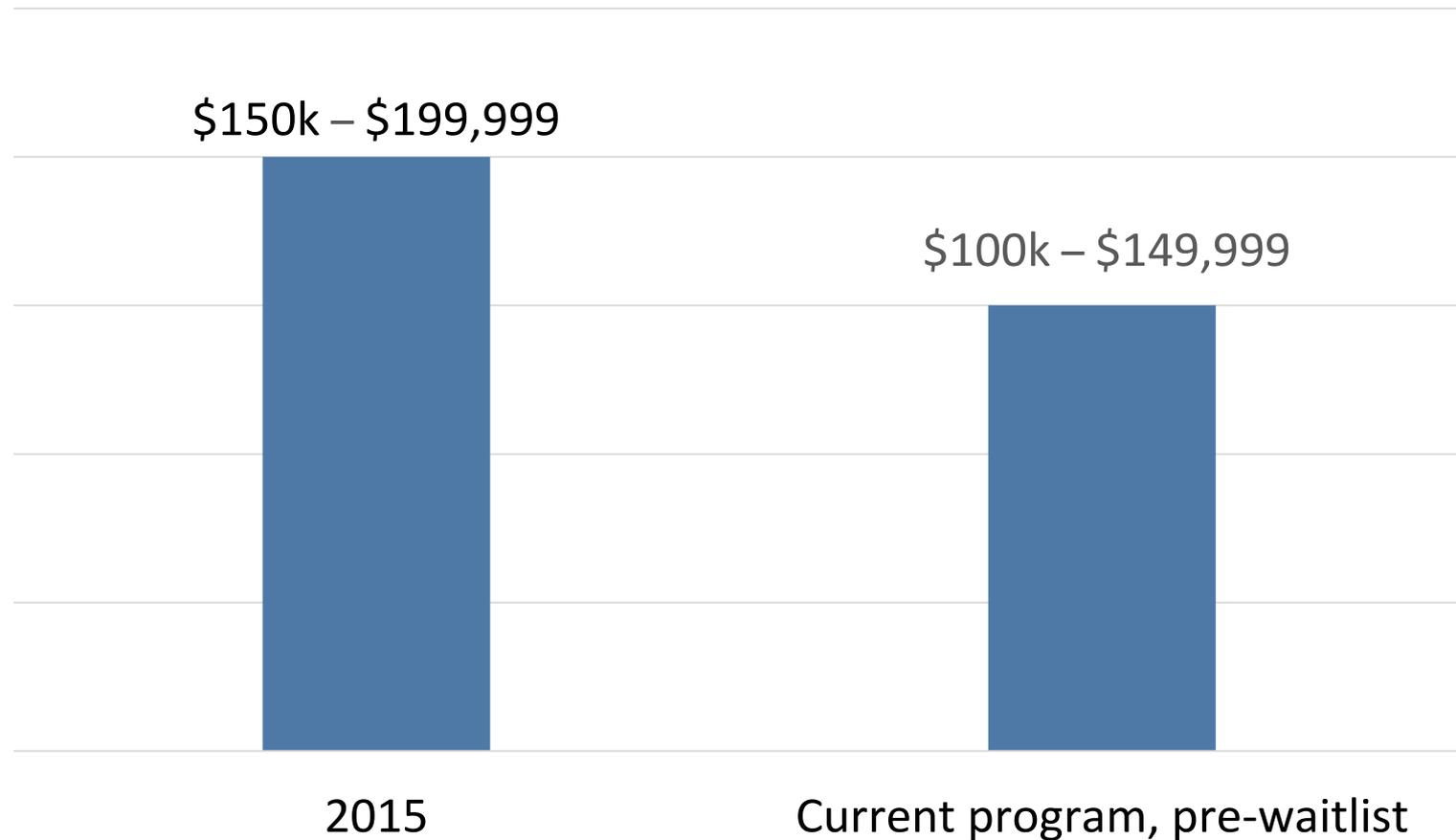
# Income Criteria: Before and After

# Percent-of-EV-market-rebated decreased

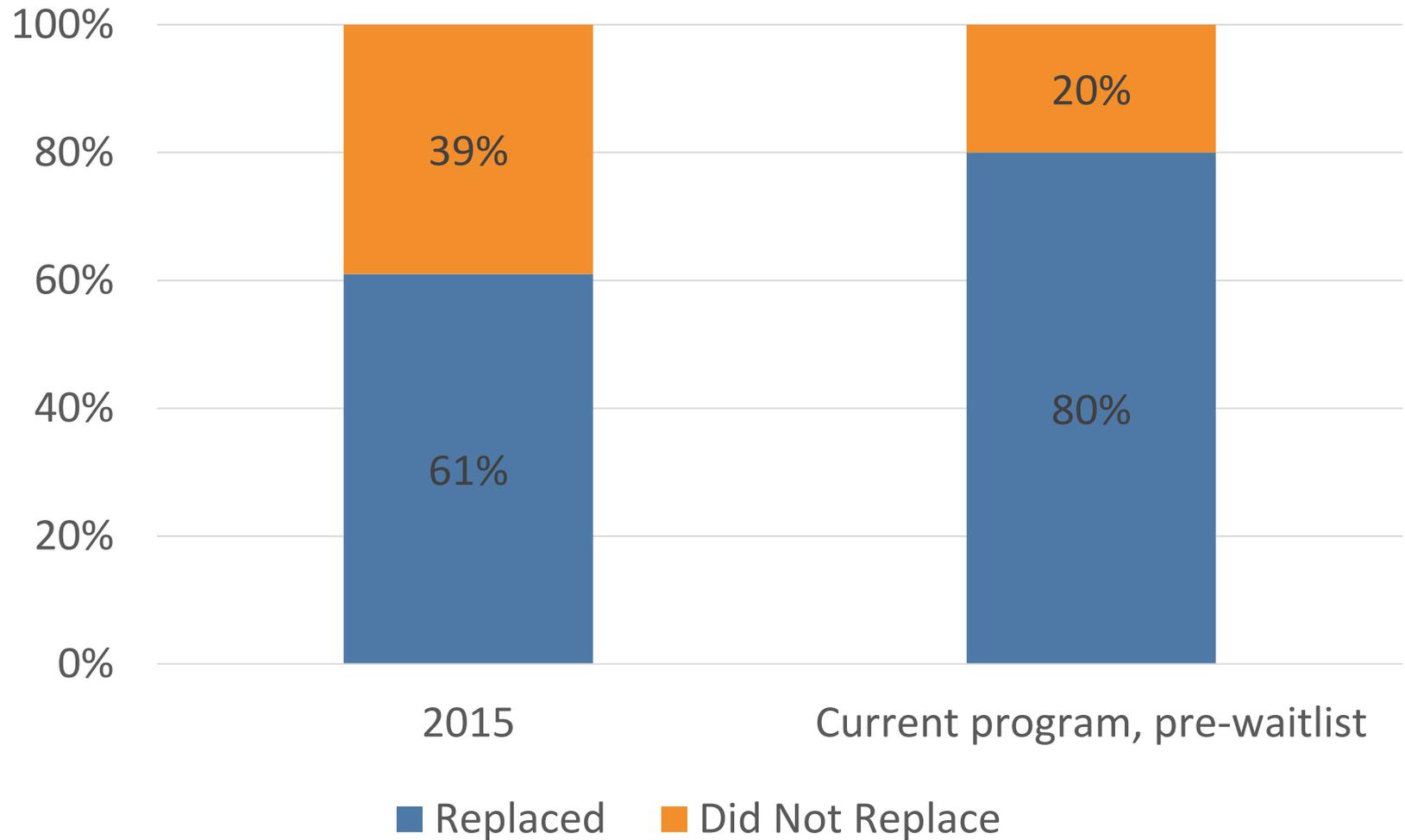
(only individual consumers shown)



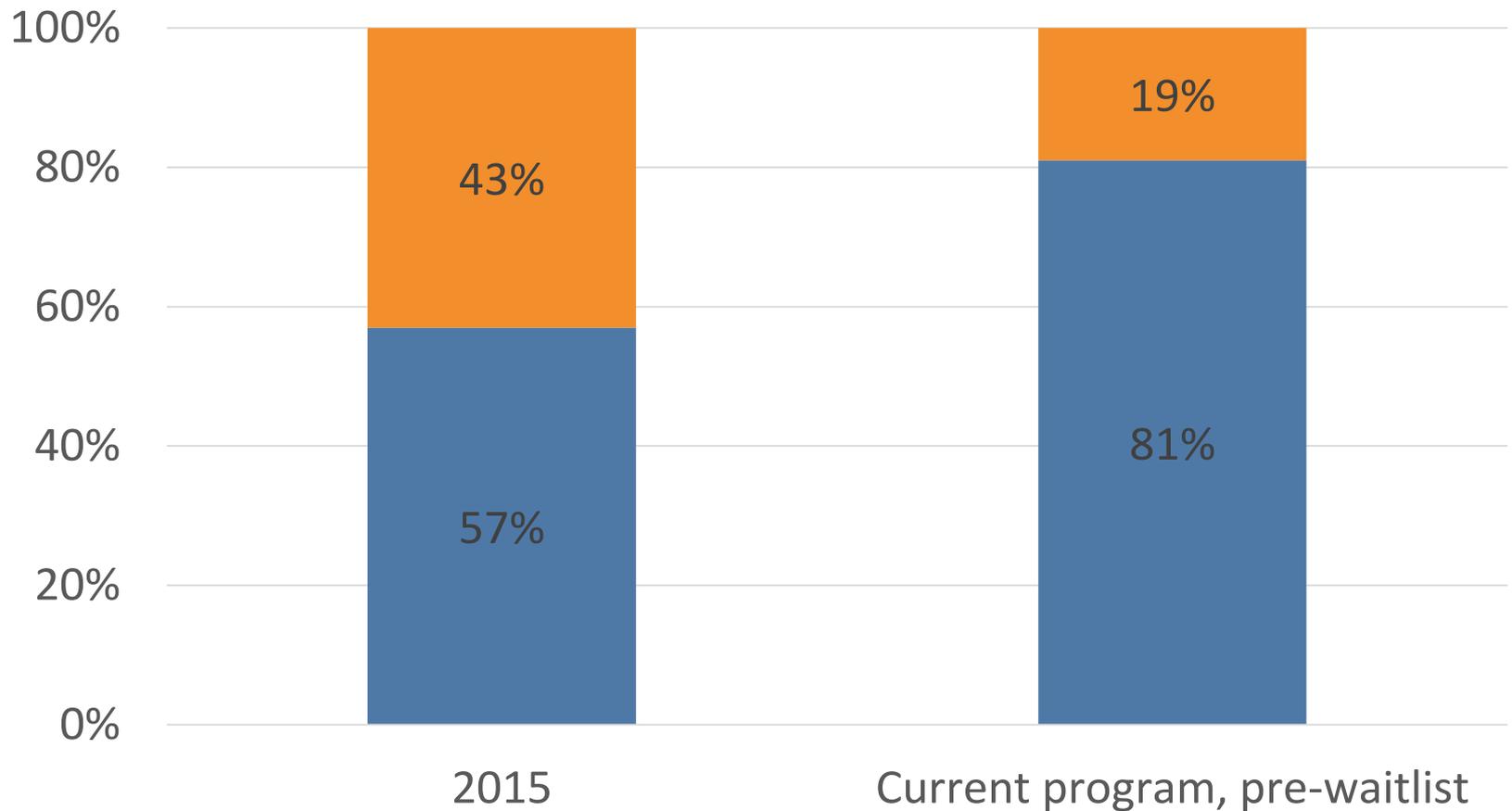
# Median income decreased



# Vehicle replacement increased



# Particularly for low-income communities



**DRAFT**

■ Replaced ■ Did Not Replace

# Next Steps

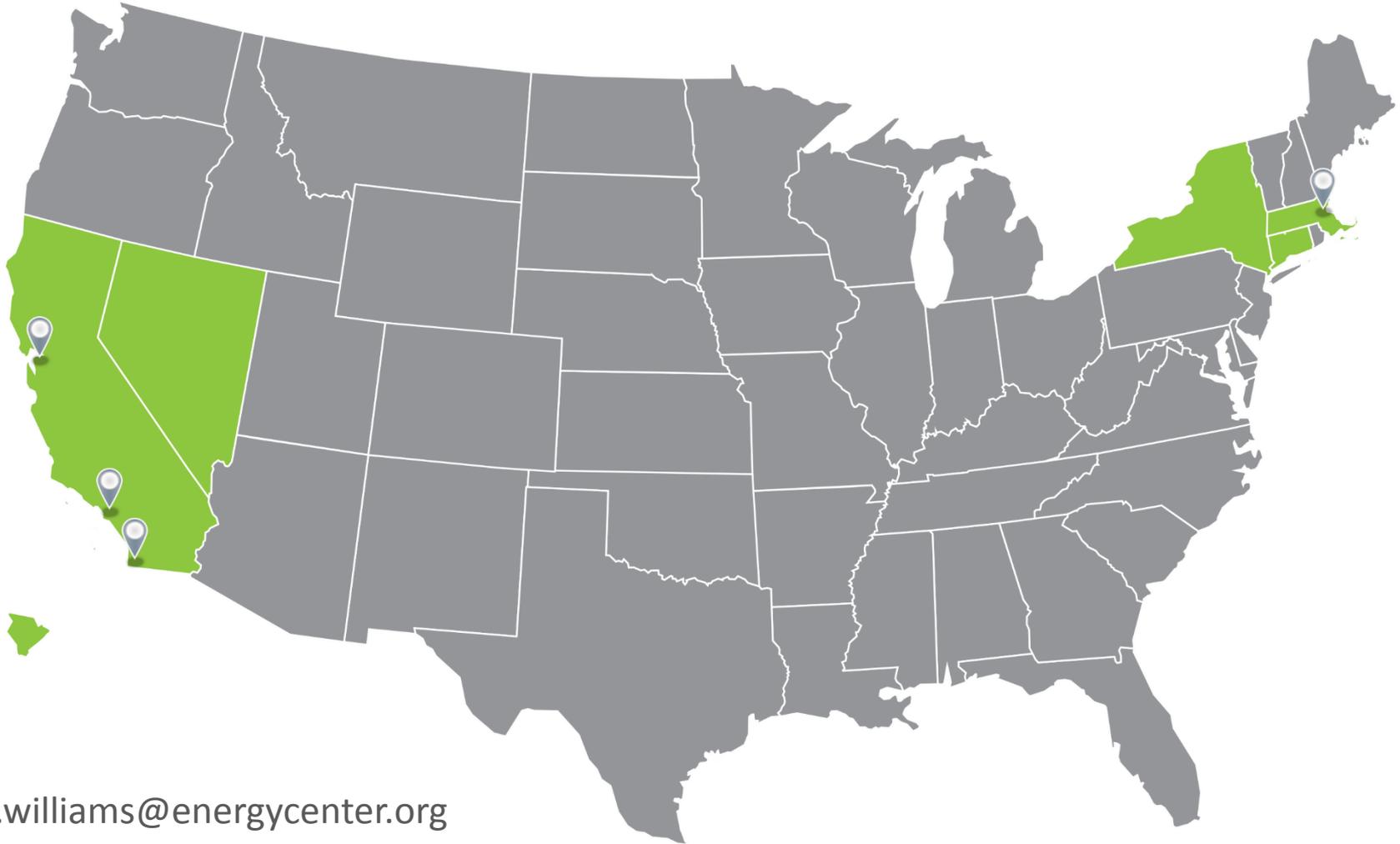
- Regression discontinuity?
- Propensity scoring?

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.

# Questions

*Time to Discuss??*

# How can we help?



brett.williams@energycenter.org

Presentation available at: <https://cleanvehiclerebate.org/>

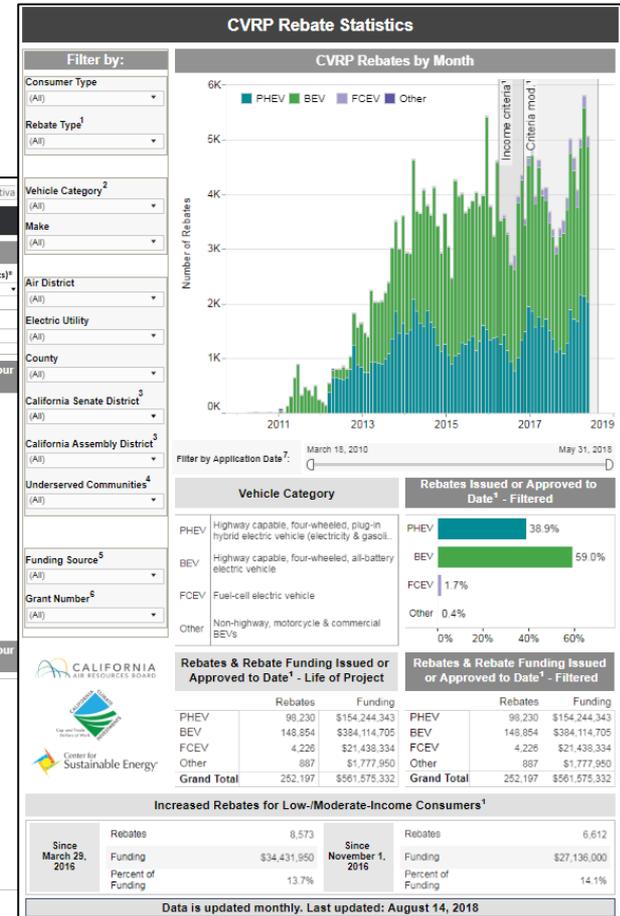
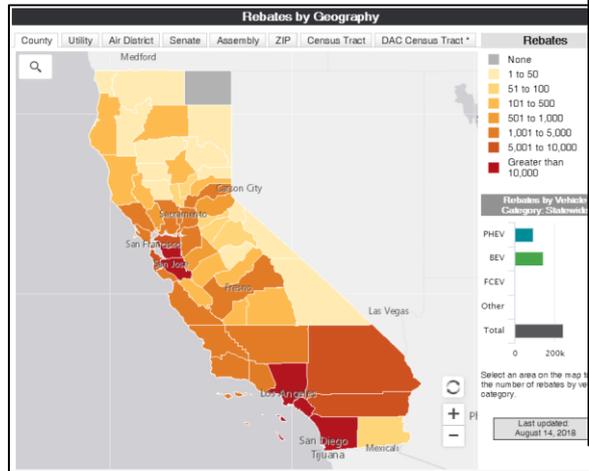
A close-up photograph of a person's hand plugging a charging cable into the port of an electric vehicle. The scene is set outdoors at sunset, with a bright sun in the upper right corner creating a lens flare effect. The background is slightly blurred, showing a city street with buildings and a bicycle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

# Online Resources & Extra Slides

# Tracking: CVRP Transparency Tools

## Interactive data dashboards and downloads:

- [Rebate statistics](#)
- [Rebate maps](#)
- [Survey results](#)



# Evaluation

## Reports, analysis, 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

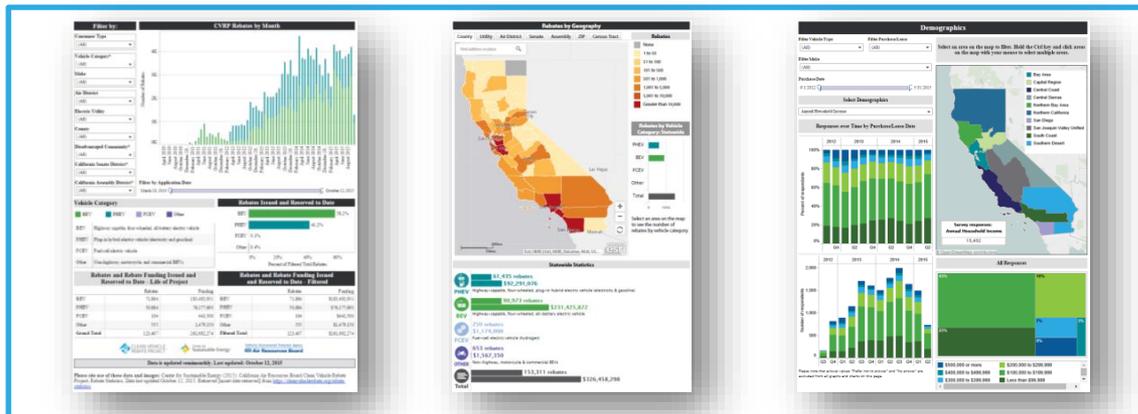


### Presentation: "Electric Vehicle Rebates in Disadvantaged Communities: Evaluating Progress with Appropriate Comparisons"

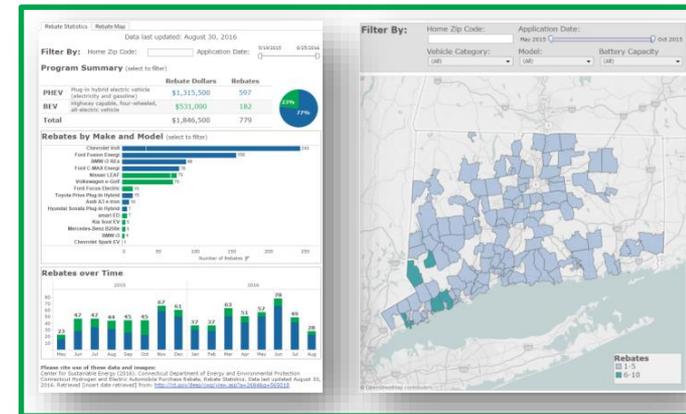
October 26, 2016

# Where can I get additional data?: CSE Transparency Tools

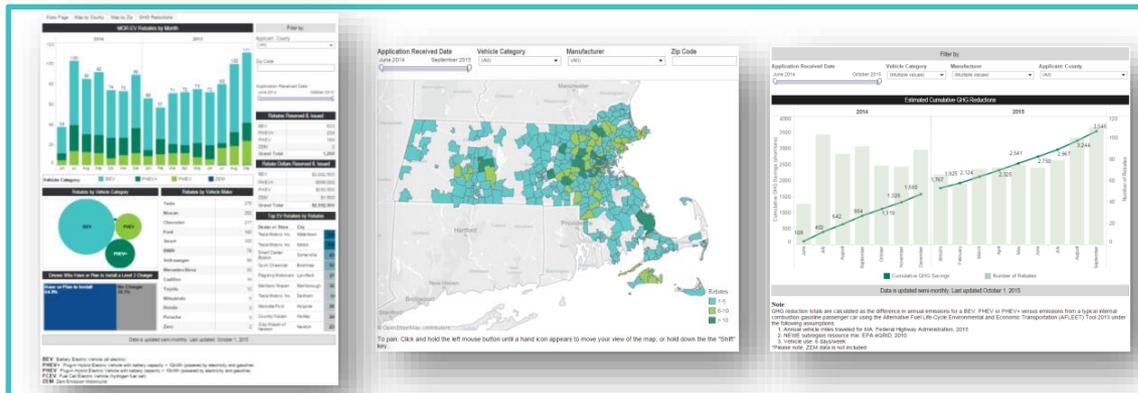
Public dashboards facilitate informed action across multiple U.S. states and regions



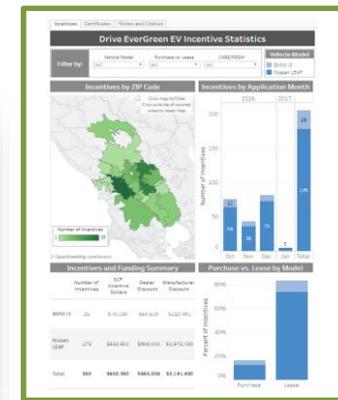
cleanvehiclerebate.org



ct.gov/deep



mor-ev.org



sonomacleanpower.org



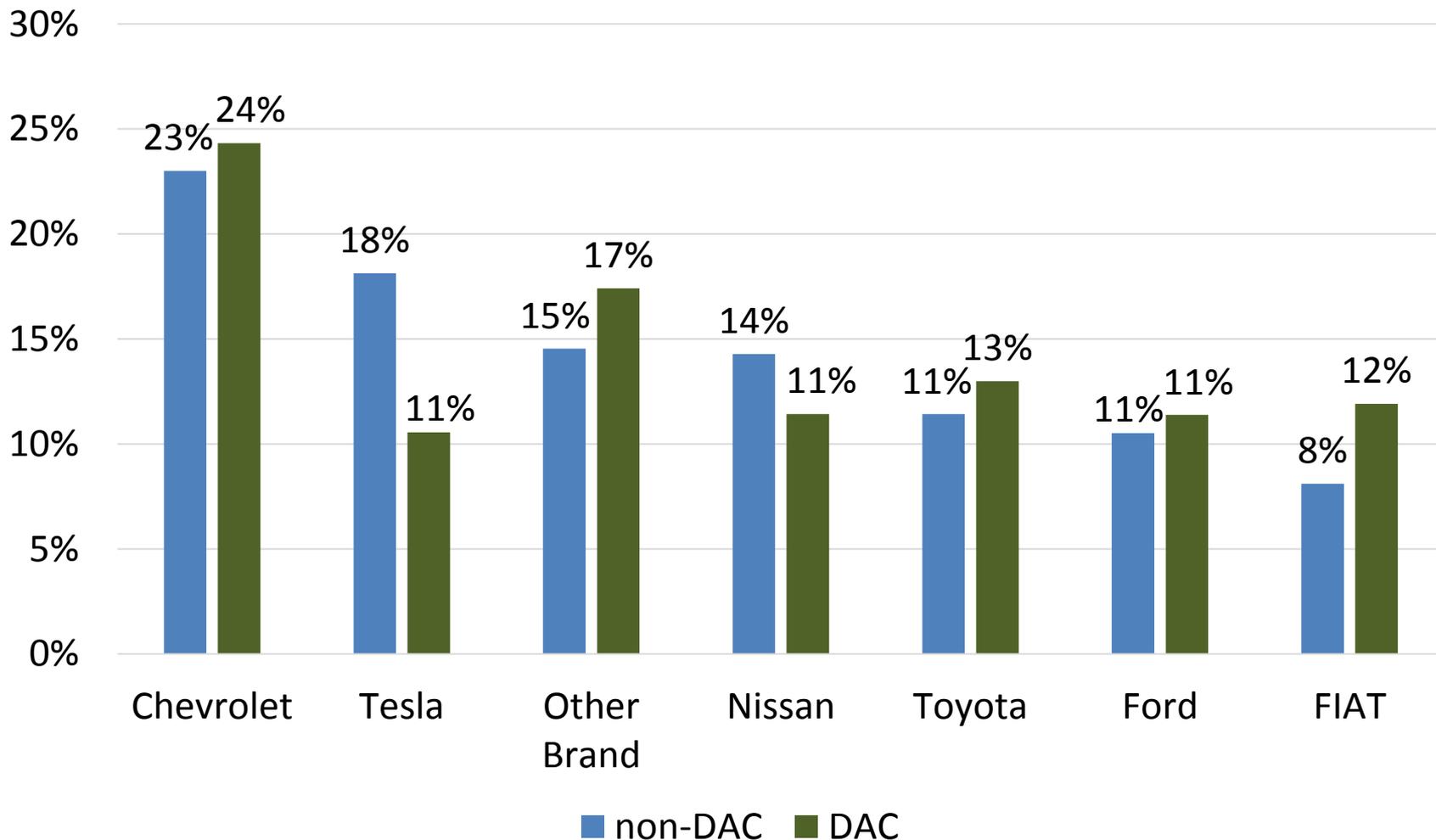
zevfacts.com

# Additional Participant Evaluation Examples

- 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)



# Rebate Share by Major Brand and Disadvantaged Community (DAC) Status



Excerpts adapted from the presentation available on the [program reports page](#) at CleanVehicleRebate.org ...



# Electric Vehicle Rebates: Exploring Indicators of Impact in Four States

EV Roadmap 11, Portland OR, 20 June 2018

Brett Williams, Ph.D. – Principal Advisor, Clean Transportation

Michelle Jones and Georgina Arreola – Analysts

Thanks also to Jaclyn Vogel and others at CSE

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

	 CALIFORNIA CLEAN VEHICLE REBATE PROJECT™	 <b>MOR-EV</b> Massachusetts Offers Rebates for Electric Vehicles	 <b>CHEAPR</b> Connecticut Hydrogen and Electric Automobile Purchase Rebate	 <b>NEW YORK STATE</b>	<b>Total</b>
<b>Vehicle Purchase/ Lease Dates</b>	Dec. 2010 – May 2017	July 2014 – October 2017	May 2015 – June 2017	March 2017 – Nov. 2017	Dec. 2010 – Nov. 2017
<b>Survey Responses (total n)*</b>	40,438	2,549	819	817	44,623
<b>Program Population (N)</b>	185,367	5,754	1,583	3,937	196,641

# Data comparability: Program designs vary



**Fuel-Cell EVs**



\$5,000

\$2,500

\$5,000

e-miles

**All-Battery EVs**



\$2,500

\$2,500

e-miles

≥ 175 \$3,000  
 ≥ 100 \$2,000  
 < 100 \$500

≥ 120 \$2,000

≥ 40 \$1,700

**Plug-in Hybrid EVs**



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

≥10 kWh \$2,500  
 <10 kWh \$1,500

≥ 40 \$2,000  
 < 40 \$500

≥ 20 \$1,100

< 20 \$500

**Zero-Emission Motorcycles**



\$900

\$750

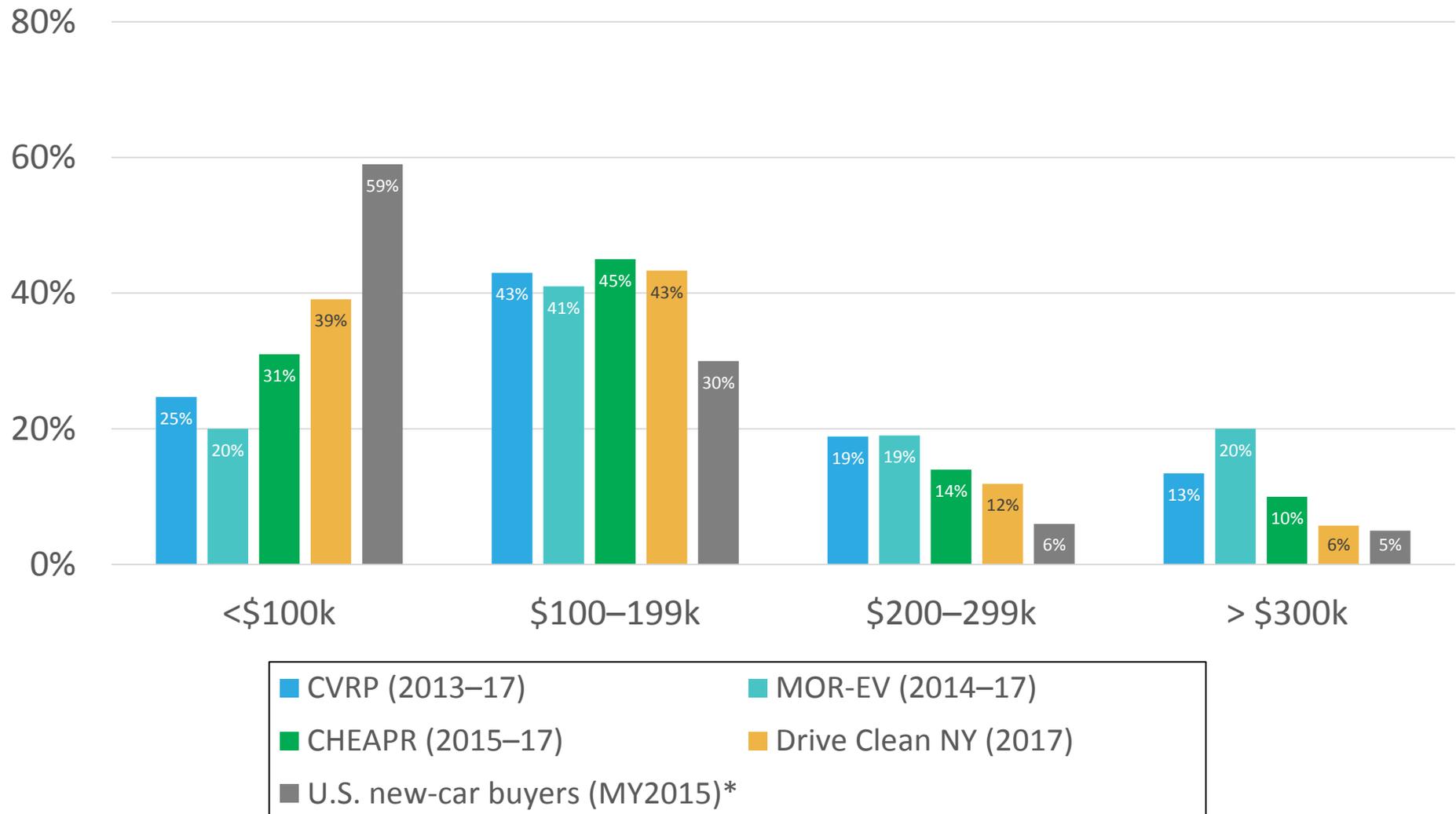
e-miles ≥ 20 only;  
 Consumer income cap and increased rebates for lower-income households

MSRP ≥ \$60k = \$1,000 max., no fleet rebates

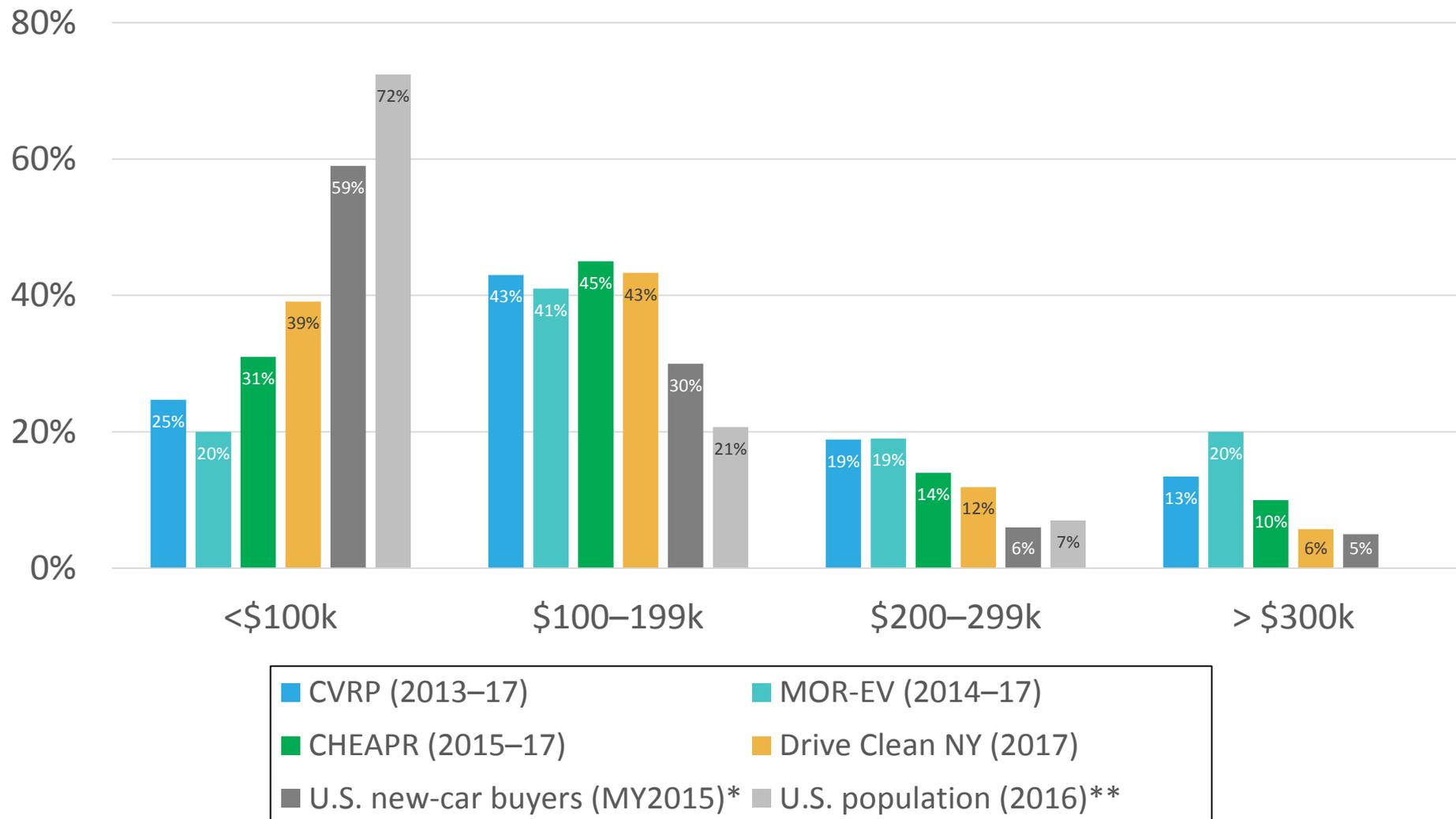
MSRP ≤ \$60k only; dealer assignment; \$150 dealer incentive (\$300 previous)

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

# Most Rebate Recipients Have *Moderate* Household Incomes



# The Best Comparison is to New Car Buyers, *Not the U.S. Population*

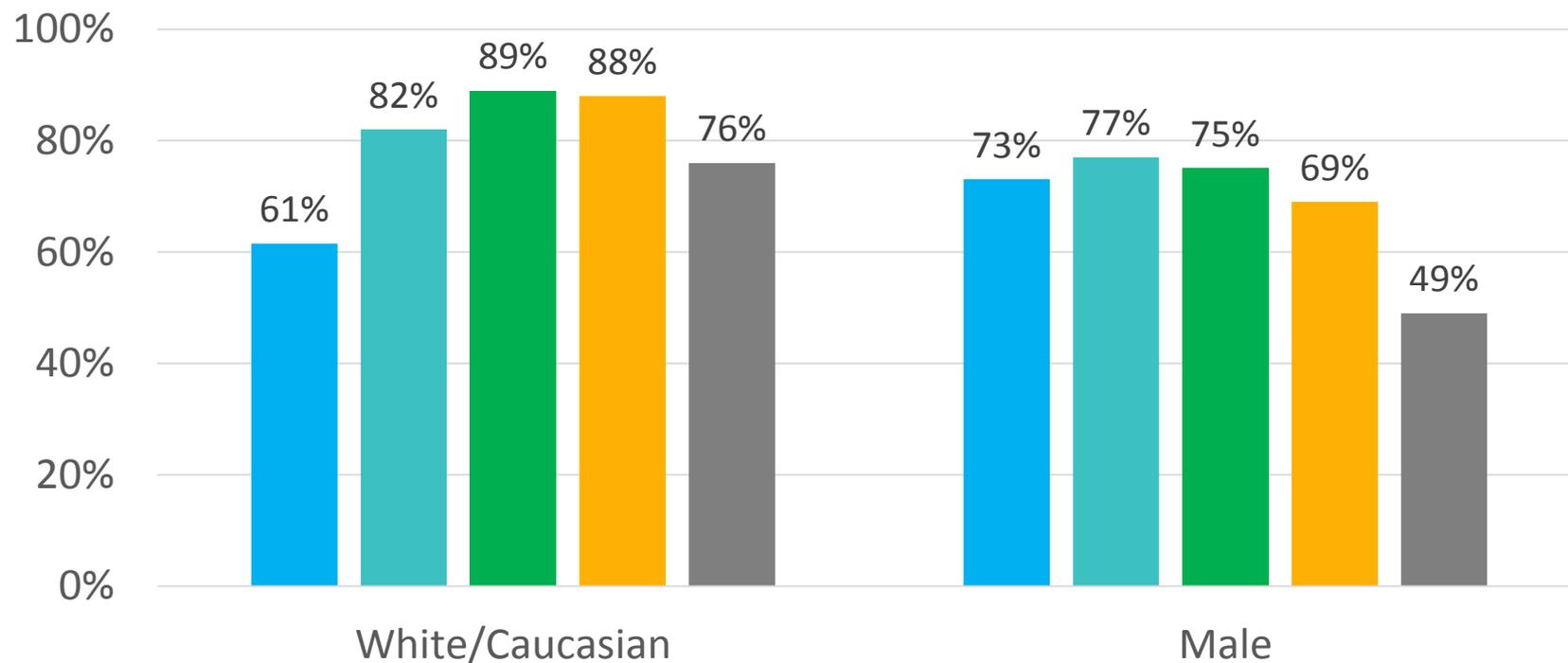


44,623 total survey respondents weighted to represent 196,641 participants

\* Personal correspondence, Prof. Bunch (UCD)

\*\* U.S. Census Data

# Are White Males Over-Represented?



■ CVRP (2015-2017)

■ MOR-EV (2014-2017)

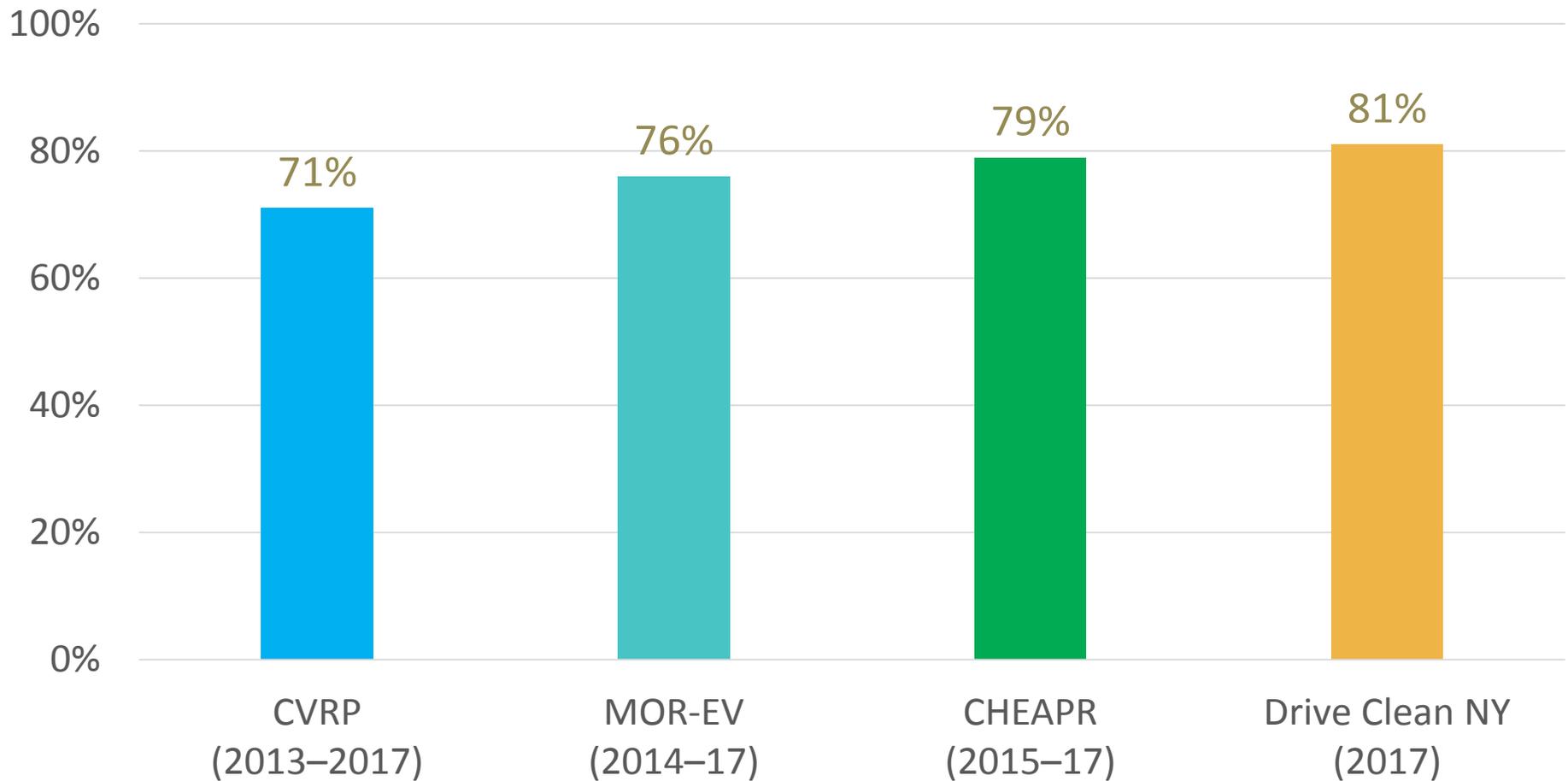
■ CHEAPR (2015-2017)

■ Drive Clean NY (2017)

■ CA vehicle-purchase "intenders" (CHTS 2012)

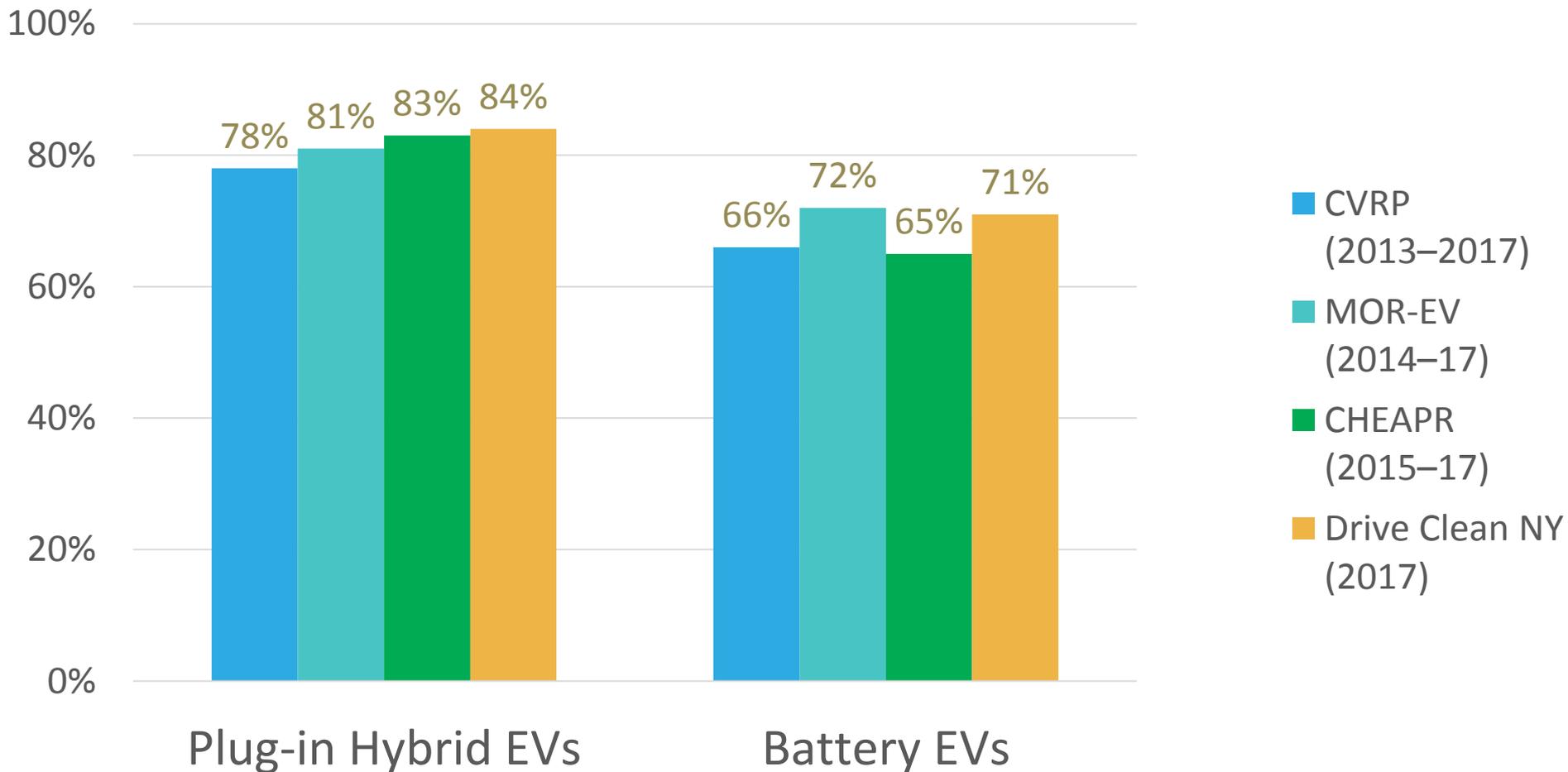
# Do EVs get used?

## Replaced a vehicle with their rebated **clean vehicle**

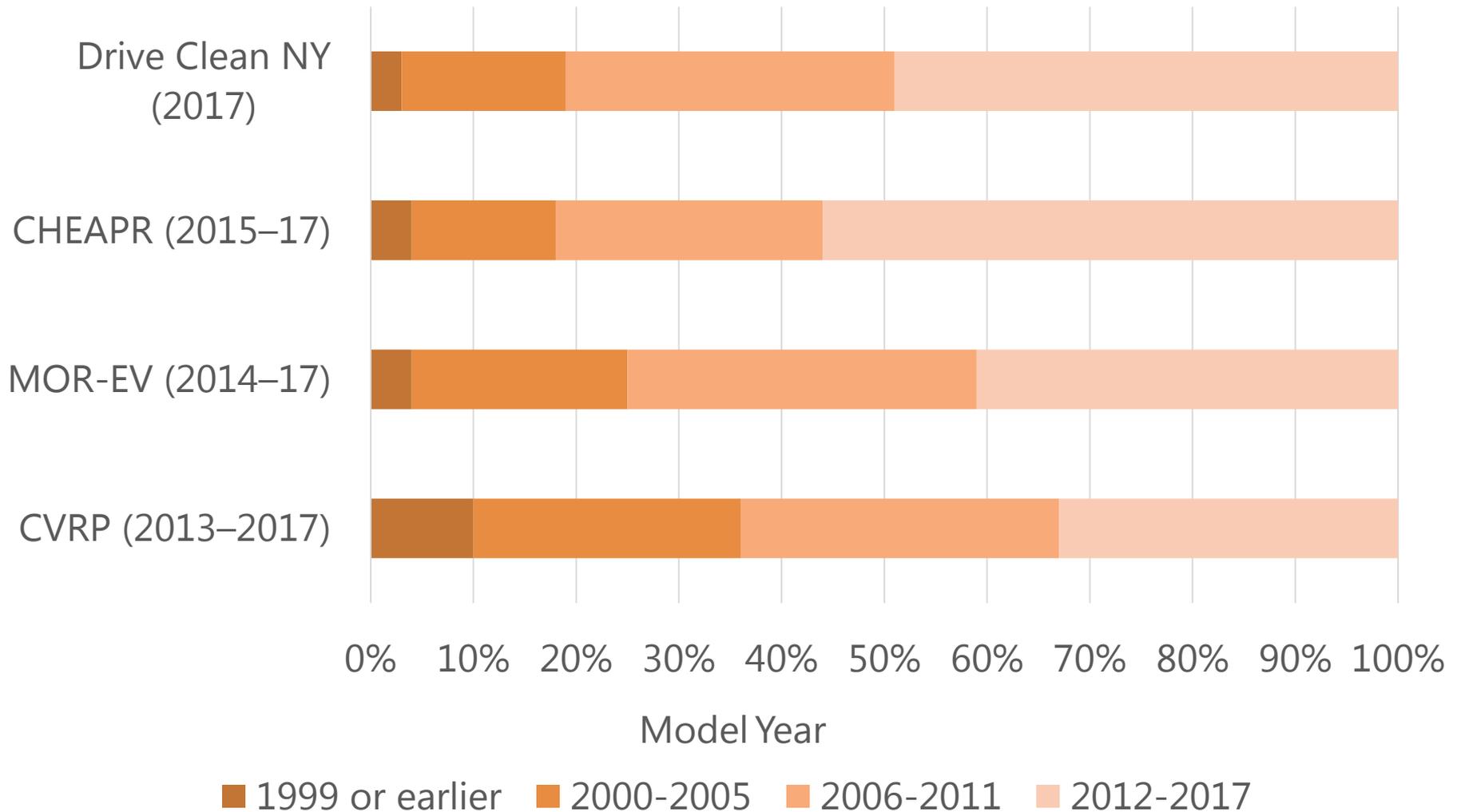


# Do EVs get used?: by Tech Type

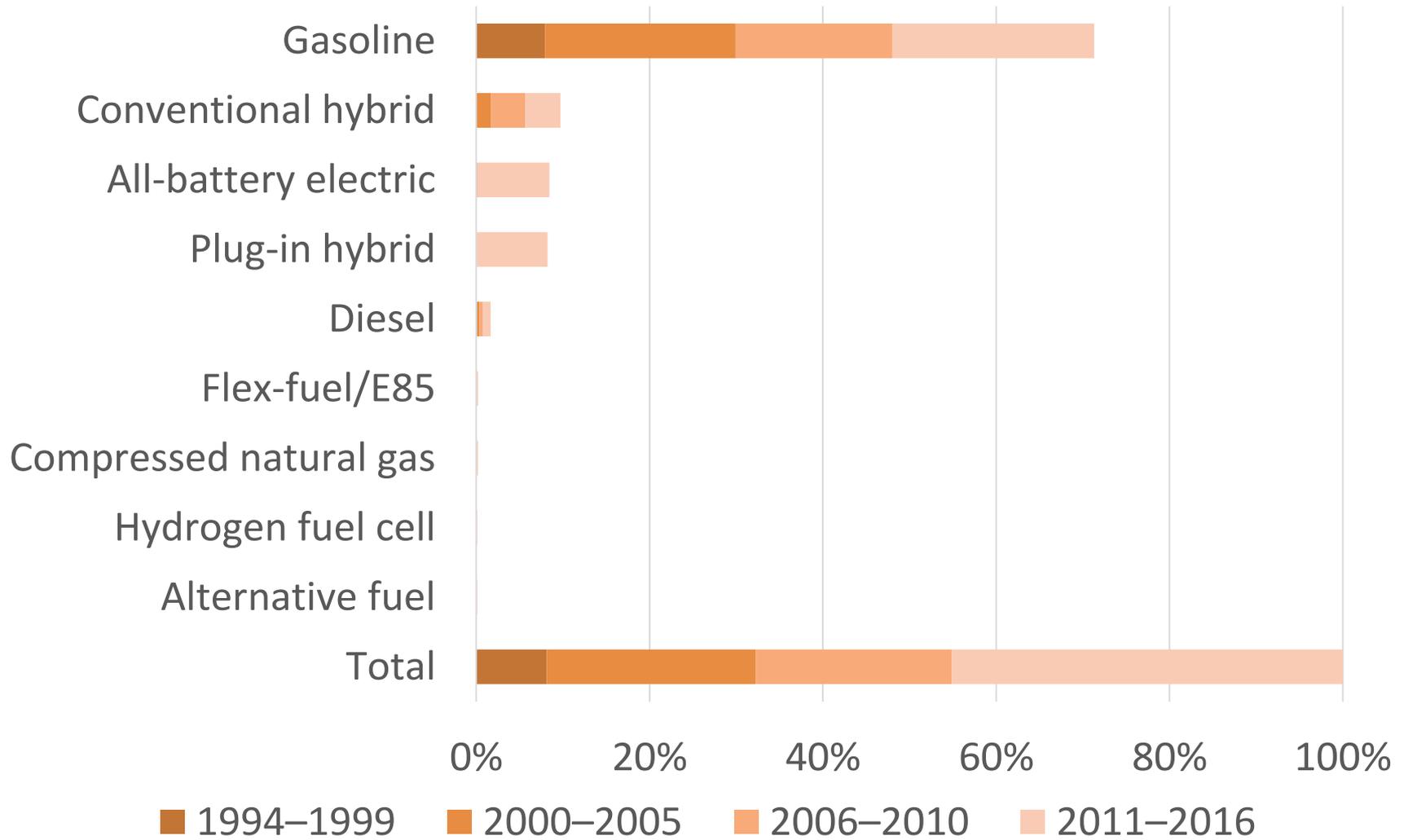
## Replaced a vehicle with their rebated EV



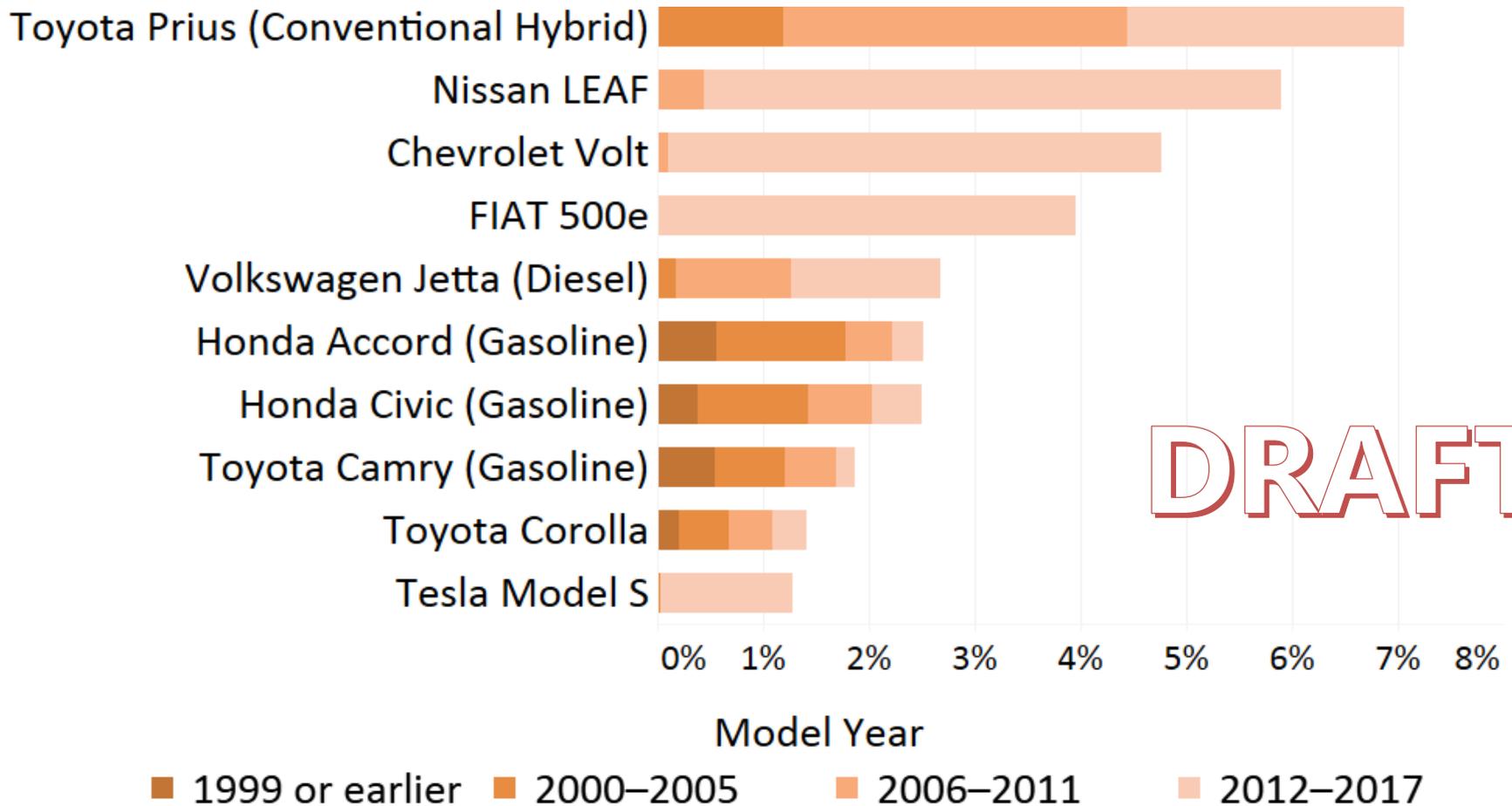
# What vehicles have rebates helped replace?



# What vehicles have rebates helped replace?



# PEV-Replaced Vehicle Distribution: Top 10 Models



# Methodology:

## Characterizing Rebate-Essential Consumers

	<b>Rebate Essentials</b>	
<b>Research Objective</b>	Identify characteristics associated with increased rebate influence	
<b>Strategic Purpose</b>	Informs targeting resources at consumers who otherwise would not adopt	
<b>Model</b>	Binary logistic regression	
<b>Outcome variable:</b>	“Would you have purchased or leased your PEV without the CVRP rebate?” [yes, no]	
<b>Predictor variables:</b>	Consumer, household, vehicle, and transactional data	
<b>Data</b> Nov 2016 – May 2017	Plug-in hybrid (PHEV) (n=2,235)	All-battery (BEV) (n=3,105)

# Methodology: “Before and After”

- Data used:
  - Foundational dataset
    - CVRP rebate statistics, CalEnviroScreen Disadvantaged community (DAC) geodatabase, CVRP consumer survey data.
  - Polk EV registration data
- Data was split into 5 date ranges based on vehicle purchase date.
  - Pre-Income cap: Start of CVRP through 12/31/2015
  - Pre-cap market: 2015
  - Run-up: 1/1/2016 through 3/28/2016
  - Transition (from first income provision): 3/29/2016 through 10/31/2016
  - Post-income cap, pre-waitlist: 11/1/2016 through 5/31/2017
- The focus of the analysis is on the pre-cap market and the post-income cap, pre-waitlist range.

# “Before” and “After”: Data Summary

## Foundational Dataset

	<b>CVRP Rebates</b>	<b>Survey Respondents</b>
<b>“Before” = 2015*</b>	44,823	11,269
<b>“After” = Current program up until waitlist (Nov 2016 – May 2017)</b>	26,819	5,616

## Polk CA EV Registration Data

	<b>EV Registrations</b>
<b>“Before” = 2015*</b>	61,813
<b>“After” = Current program up until waitlist (Nov 2016 – May 2017)</b>	54,301

# How can we help?

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 [CleanVehicleRebate.org](https://CleanVehicleRebate.org)

