

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

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Thanks also to Jaclyn Vogel and others at CSE



# Outline

- Context: Programs and Data
- Program Impact:
  - Consumers Rebated
  - Behaviors Influenced
  - Market Implications
- Summary


Extra Slides and Links

A close-up photograph of a person's hand plugging a charging cable into the port of a silver 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. In the background, a city street is visible with a bicycle rack and other vehicles. The overall atmosphere is clean and modern, representing sustainable urban transportation.





## **Context: EV Rebate Programs and Data**

# EV Incentive Programs: Rebate Design



	CALIFORNIA CLEAN VEHICLE REBATE PROJECT	MOR-EV Massachusetts Offers Rebates for Electric Vehicles	CHEAPR Connecticut Hydrogen and Electric Automobile Purchase Rebate	NEW YORK STATE
<b>Fuel-Cell EVs</b> 	\$5,000	\$2,500	\$5,000	<u>e-miles</u> ≥ 120     \$2,000 ≥ 40       \$1,700 ≥ 20       \$1,100 < 20       \$500
<b>All-Battery EVs</b> 	\$2,500	\$2,500	<u>e-miles</u> ≥ 175     \$3,000 ≥ 100     \$2,000 < 100     \$500	
<b>Plug-in Hybrid EVs</b> 	\$2,500 (i3 REx) \$1,500	≥10 kWh    \$2,500 <10 kWh    \$1,500	≥ 40       \$2,000 < 40       \$500	
<b>Zero-Emission Motorcycles</b> 	\$900	\$750		
	e-miles ≥ 20 only; Consumer income cap and increased rebates	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

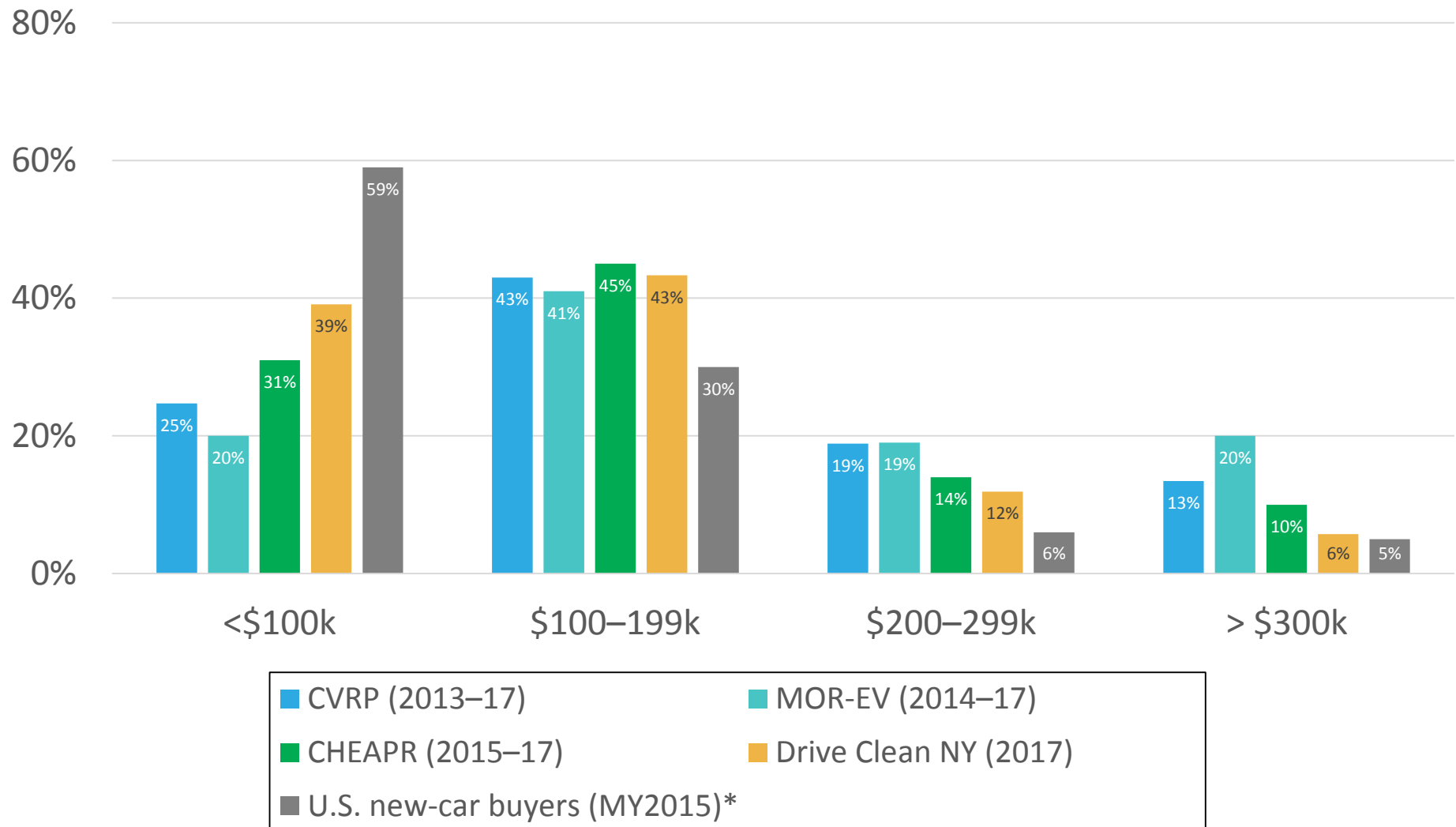
# Data Summary (Rebates to Individuals Only)

	 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

A close-up photograph of a person's hand plugging a charging cable into a car's charging port. The scene is set outdoors during 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 a bicycle rack. The overall color palette is warm, dominated by oranges, yellows, and browns.

## Consumers Rebated

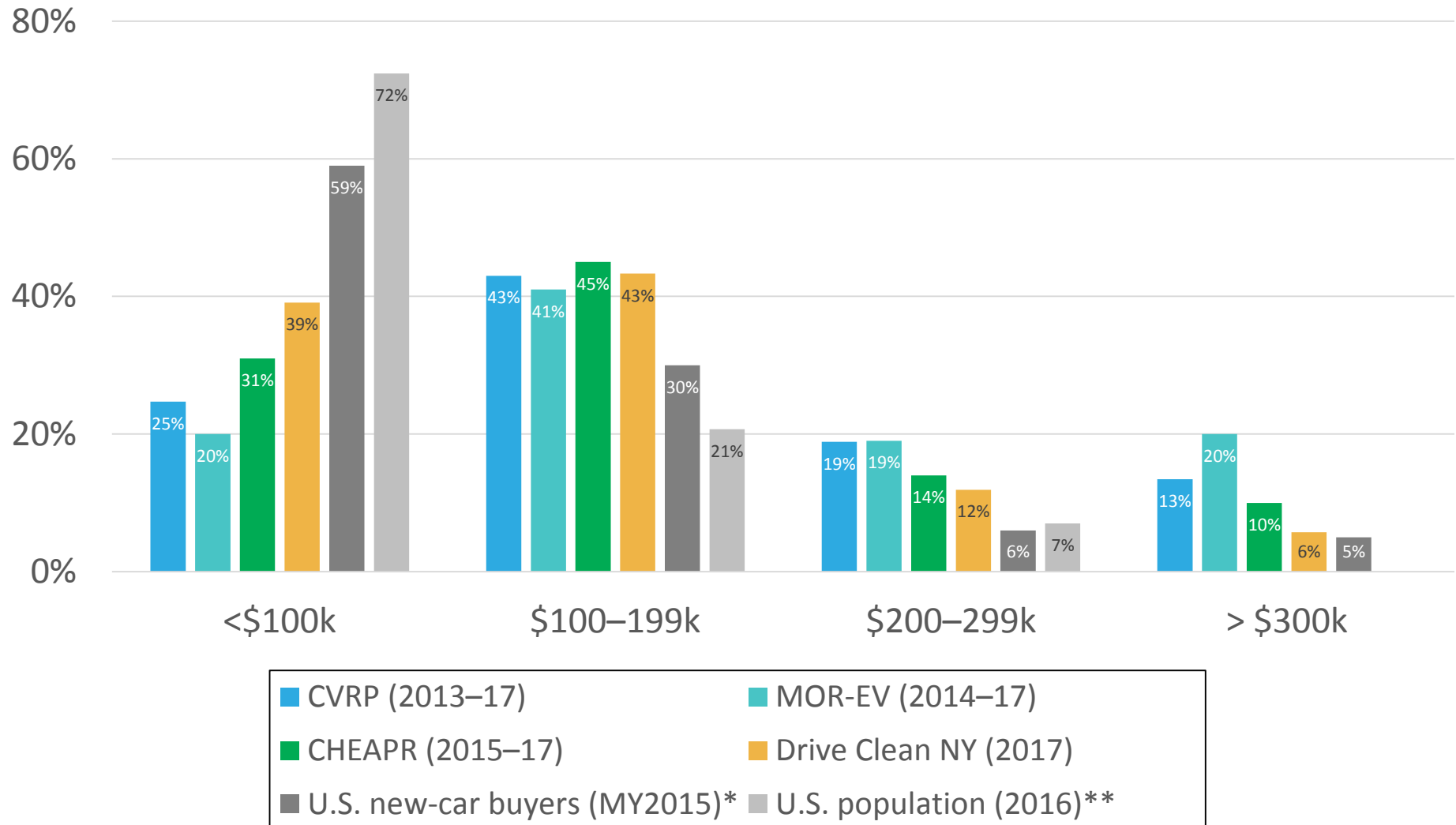
# Respondents by Household Income



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

\* Personal correspondence, Prof. Bunch (UCD)

# Respondents by Household Income: Inappropriate Comparison



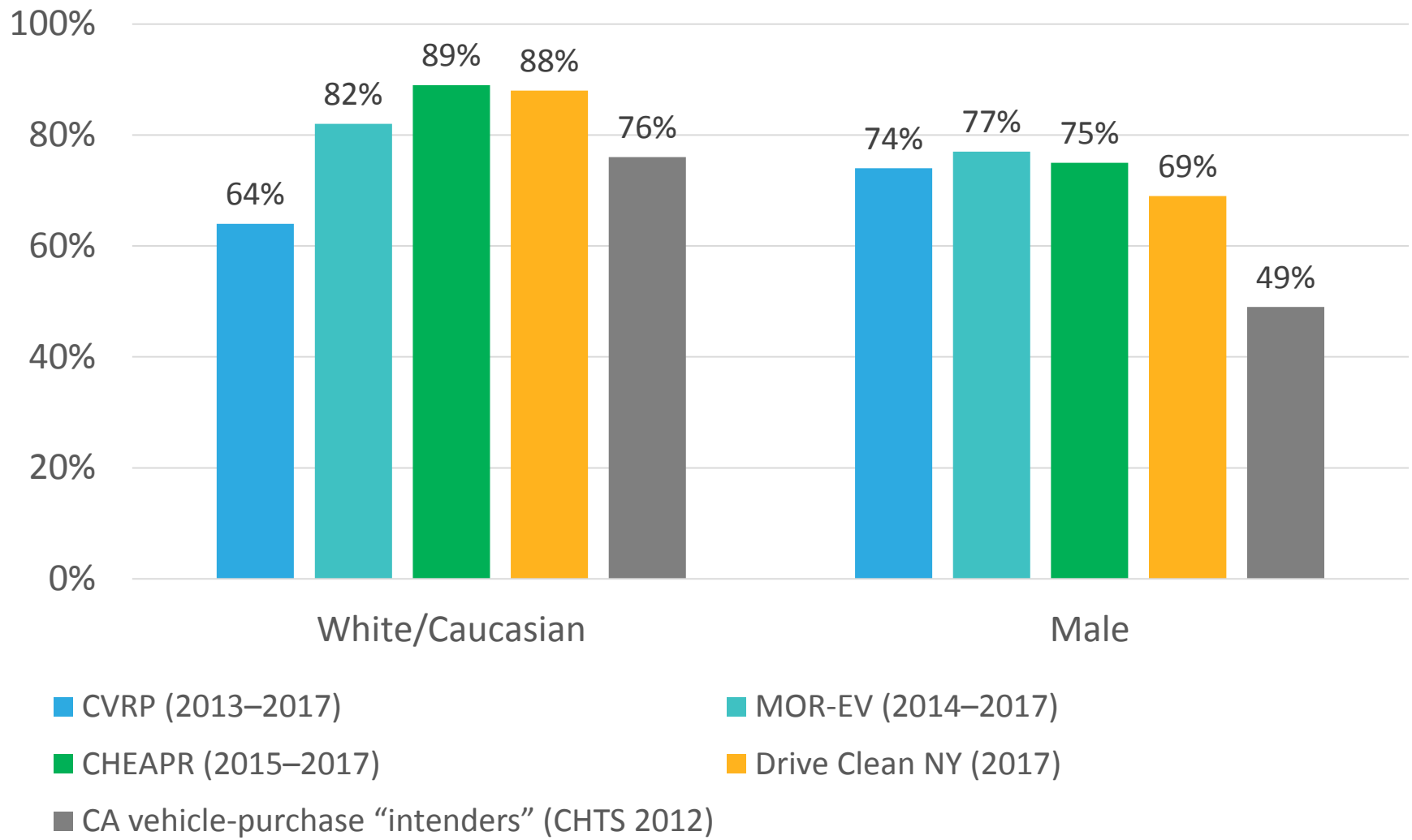
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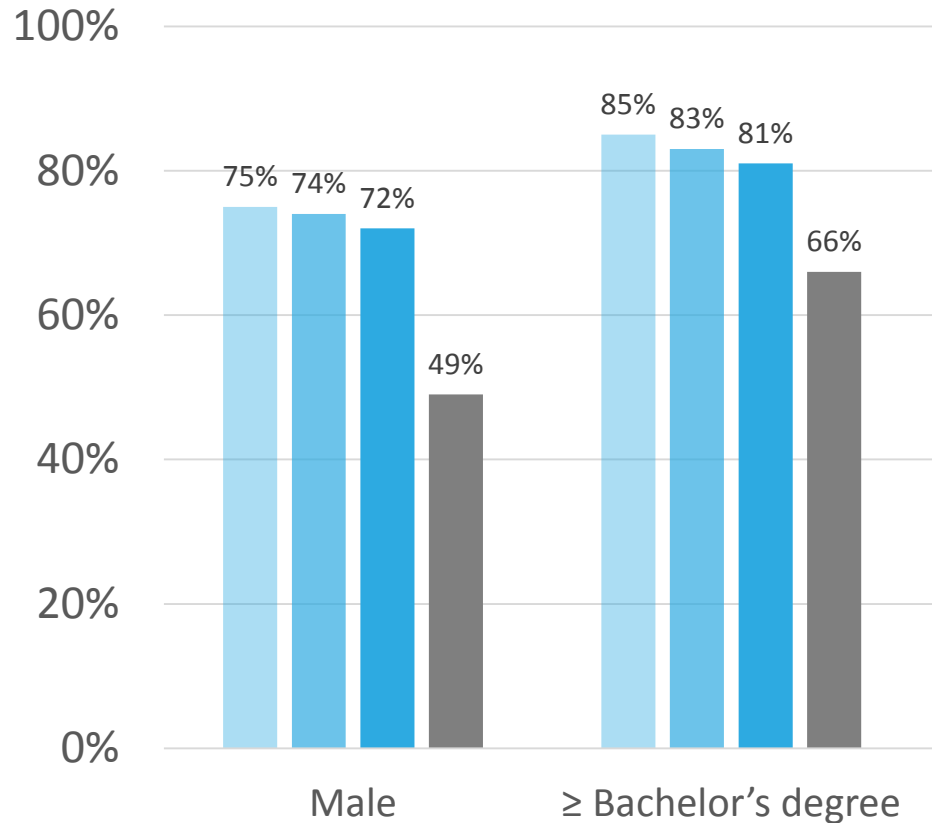
\*\* U.S. Census Data



# Majority Characteristics

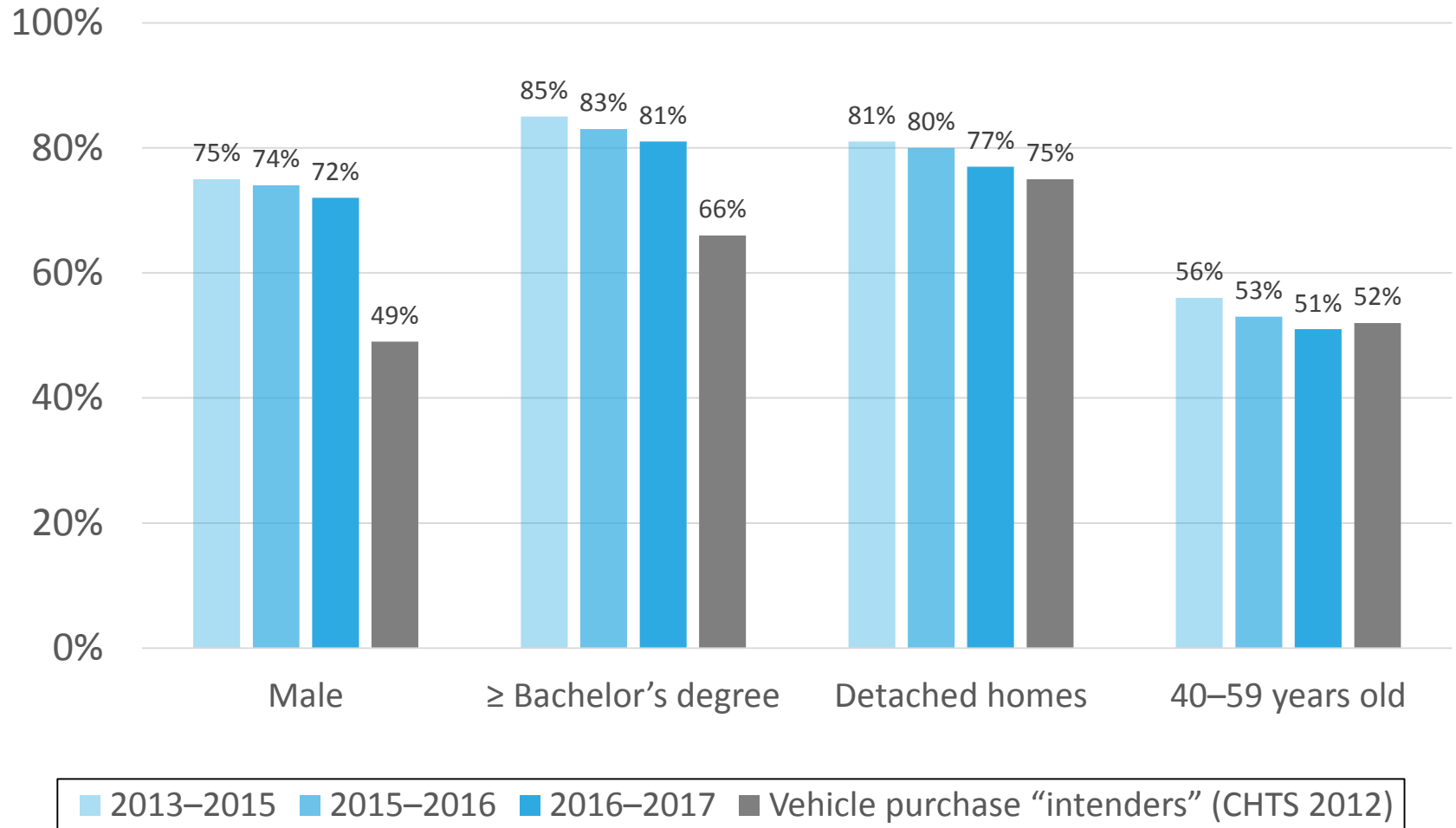


# Majority Characteristics: Trend



■ 2013–2015 ■ 2015–2016 ■ 2016–2017 ■ Vehicle purchase “intenders” (CHTS 2012)

# Majority Characteristics: Trend

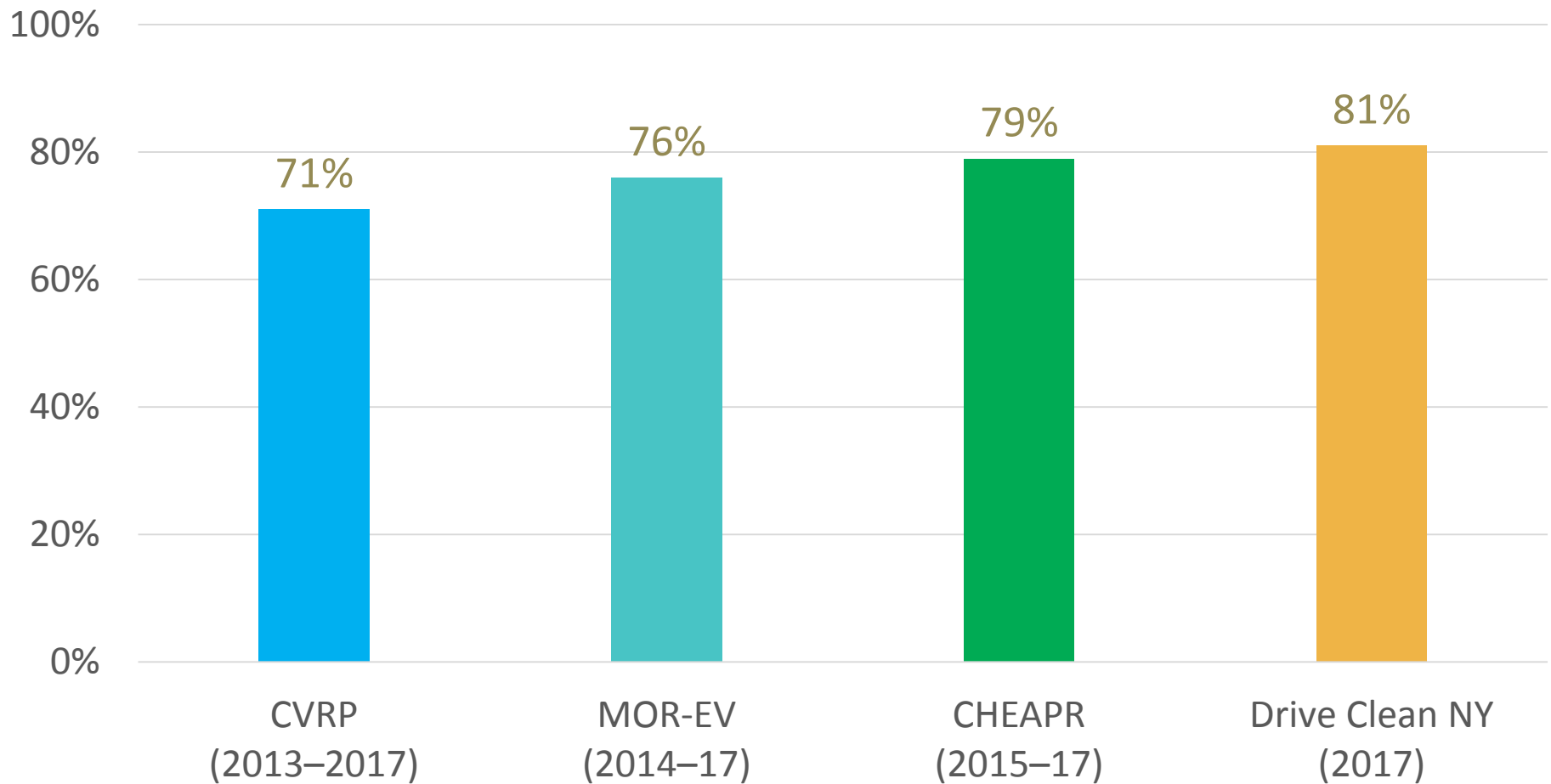


A close-up photograph of a person's hand holding a charging cable connected to an electric vehicle. The scene is set outdoors in a city street during sunset, with a bright sun in the upper right corner creating a lens flare. In the background, a bicycle is parked on the sidewalk, and a building is visible.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

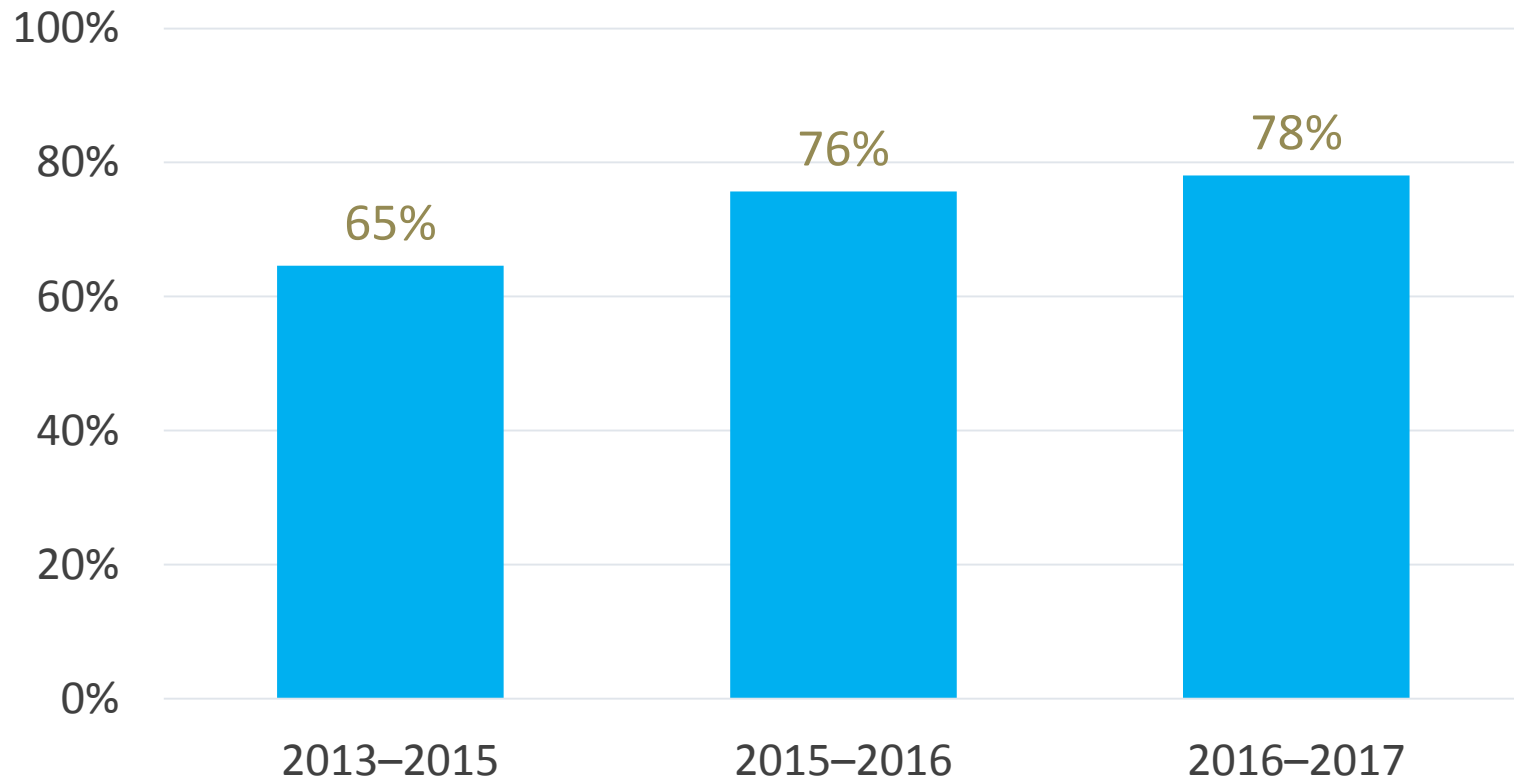
## Behaviors Influenced

# Do EVs get used?

## Replaced a vehicle with their rebated clean vehicle

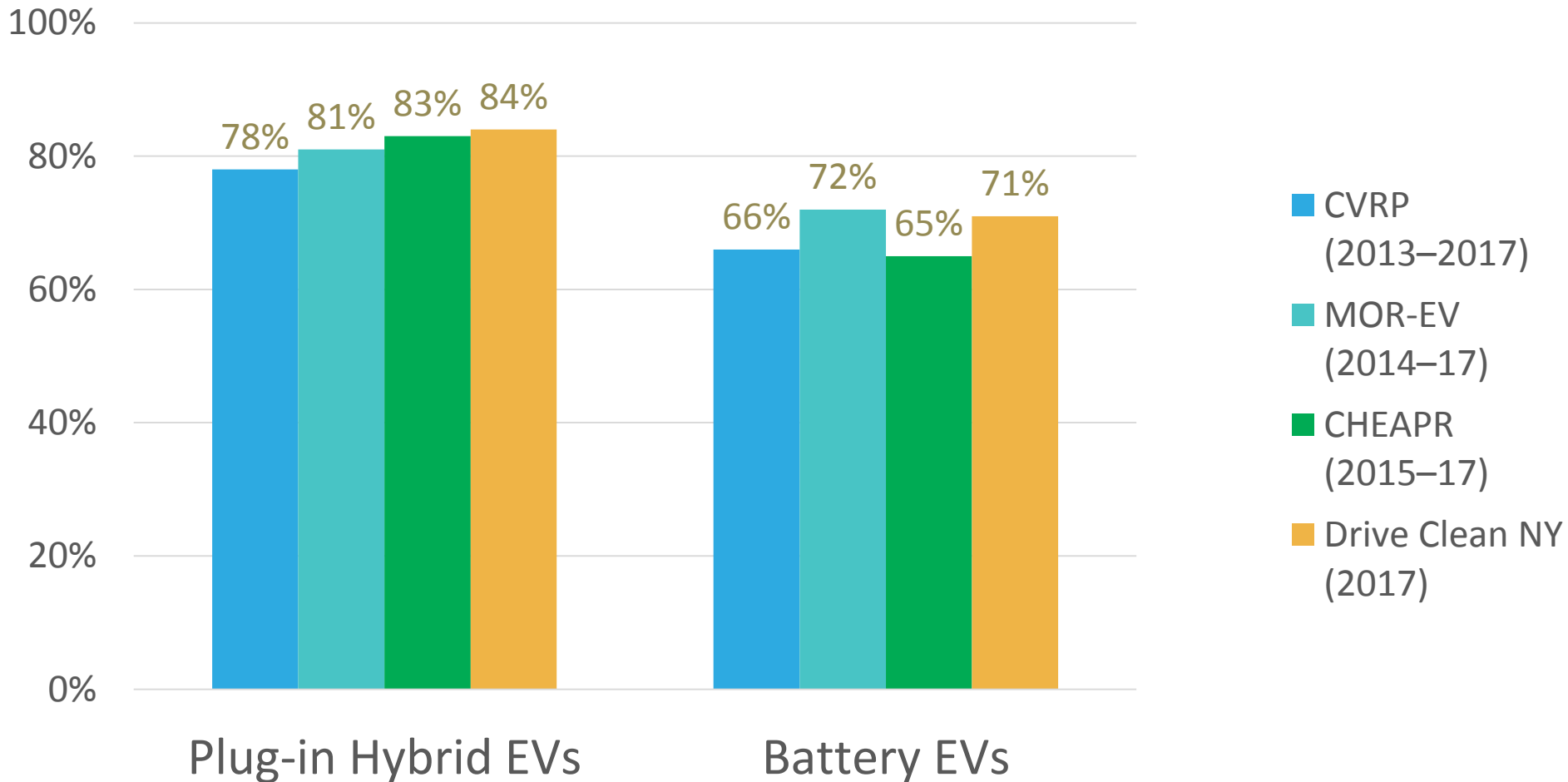


## Replaced a vehicle with their rebated EV

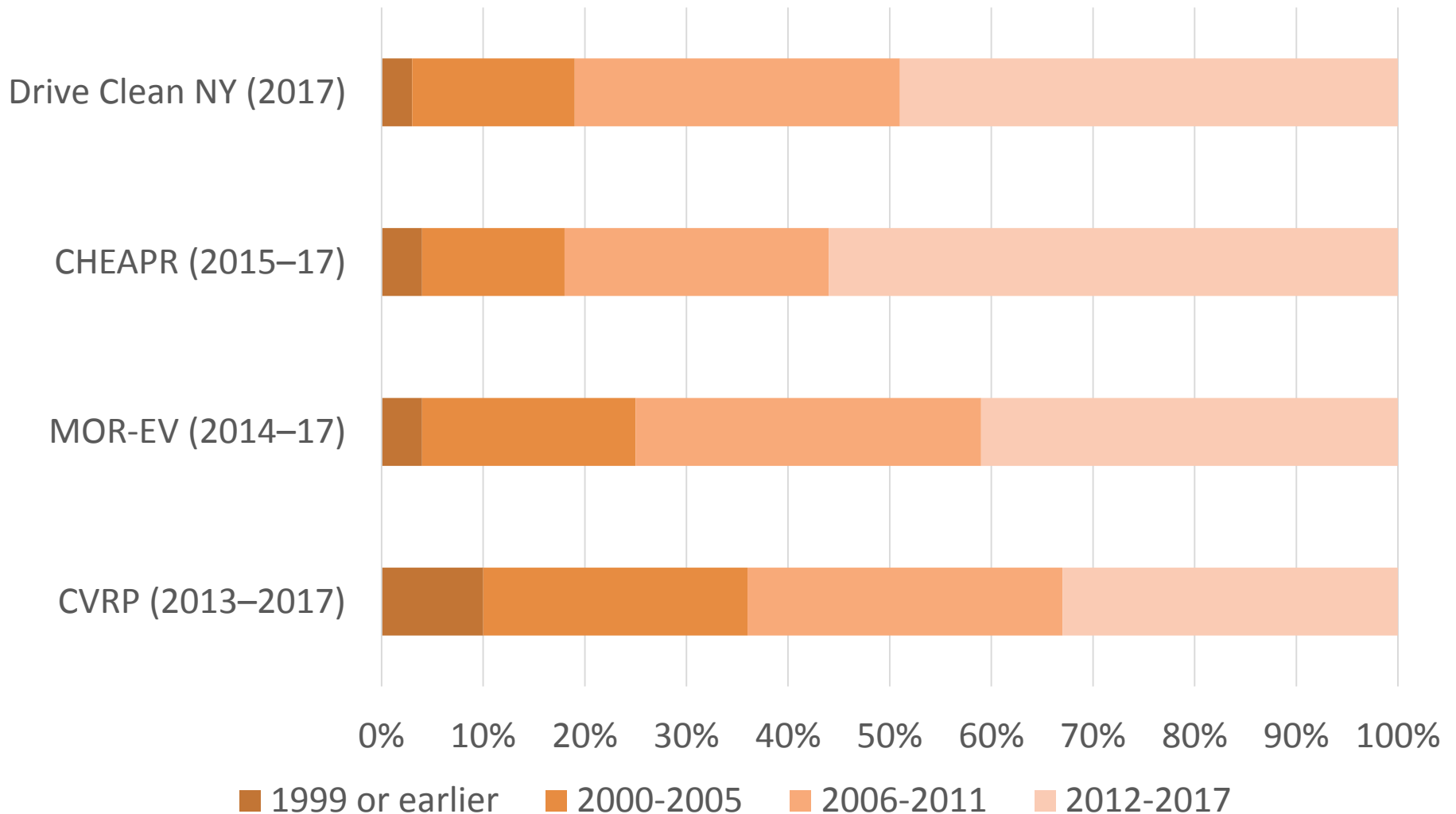


# Do EVs get used?: by Tech Type

## Replaced a vehicle with their rebated EV



# What vehicles have rebates helped replace?



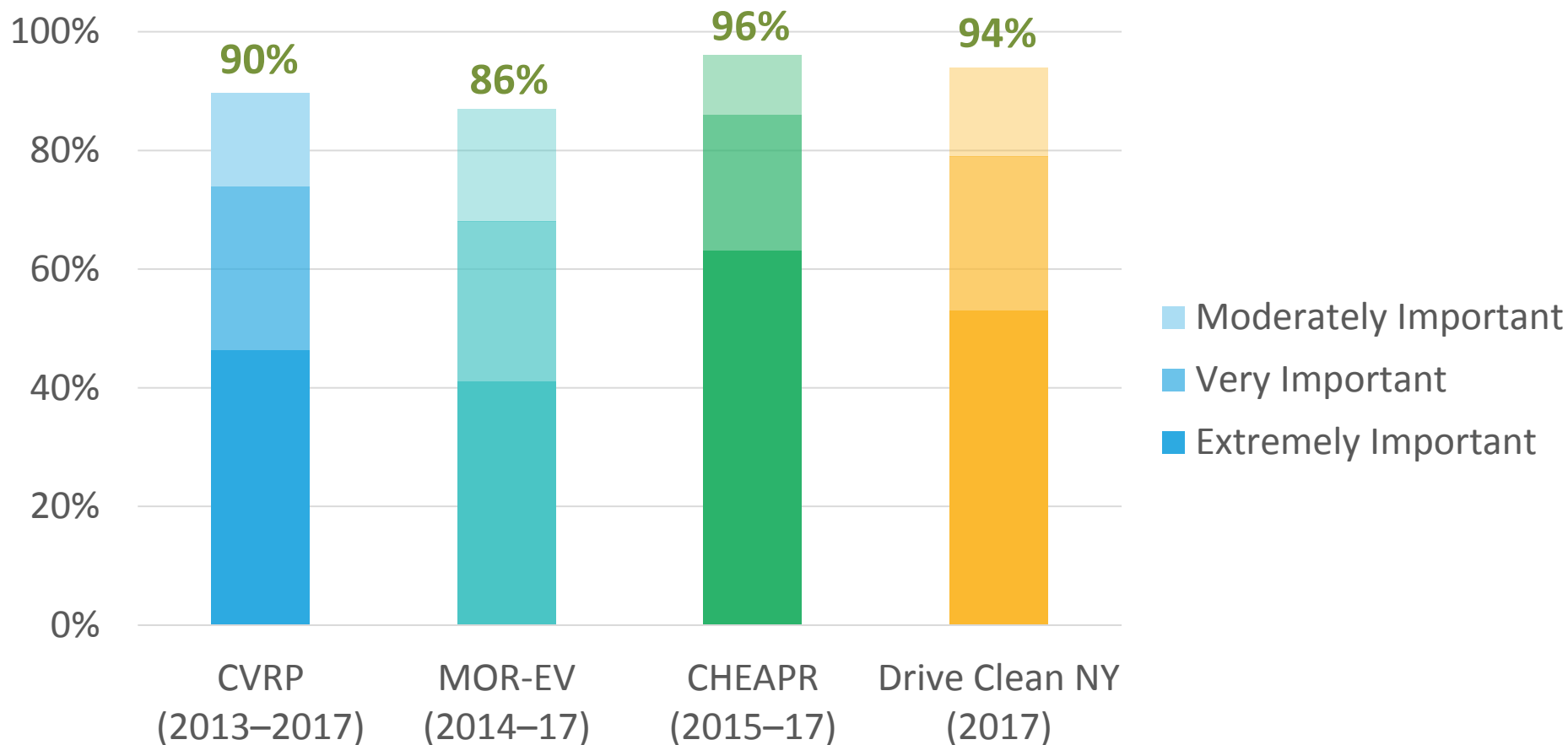


A close-up photograph of a person's hand holding a charging cable connected to an electric vehicle. The scene is set in a city street during sunset, with a bright sun in the upper right corner creating a lens flare. In the background, a bicycle is parked on the sidewalk, and a building is visible. The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

## Market Implications

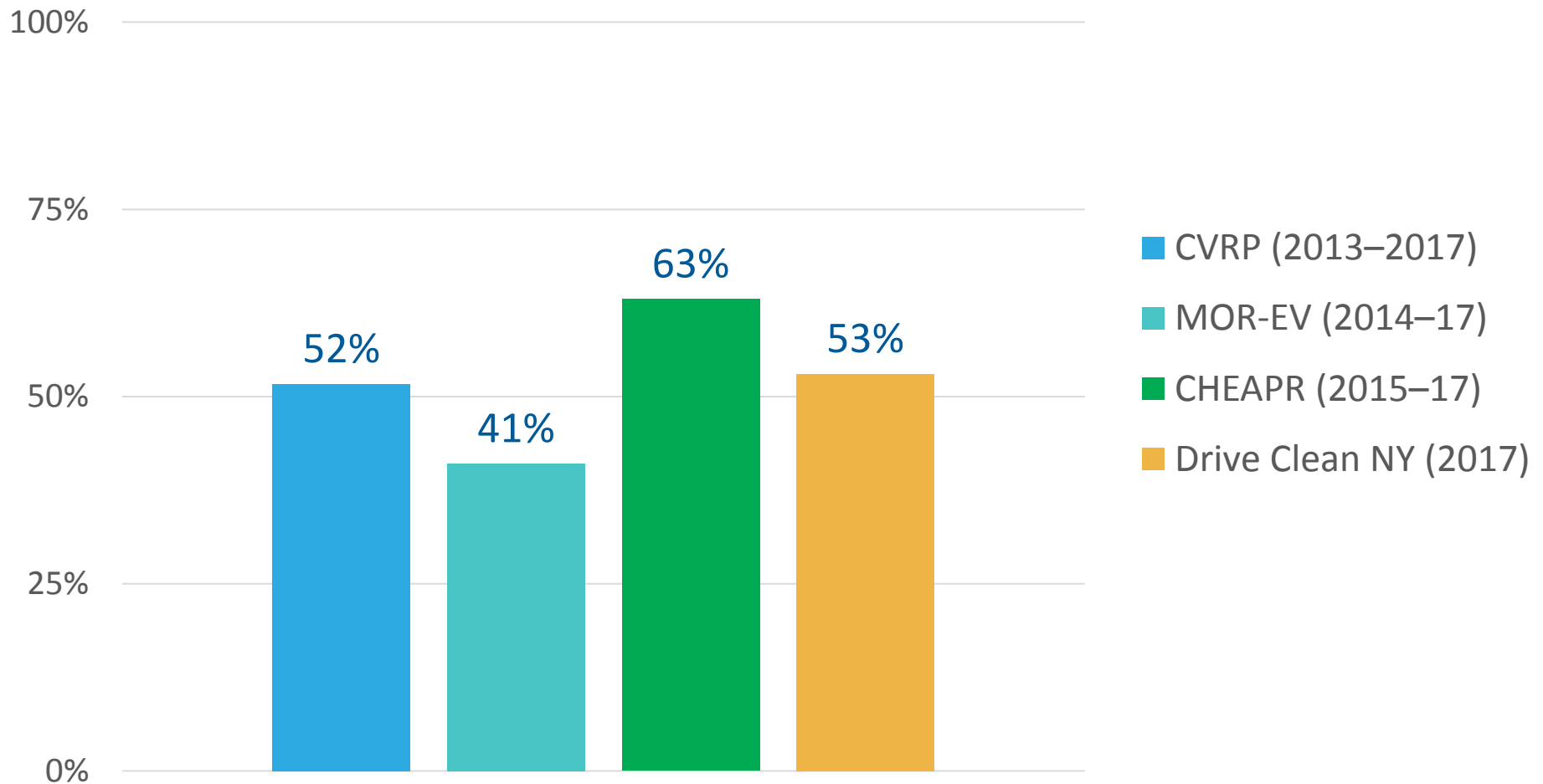
# Rebate Influence: Importance

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



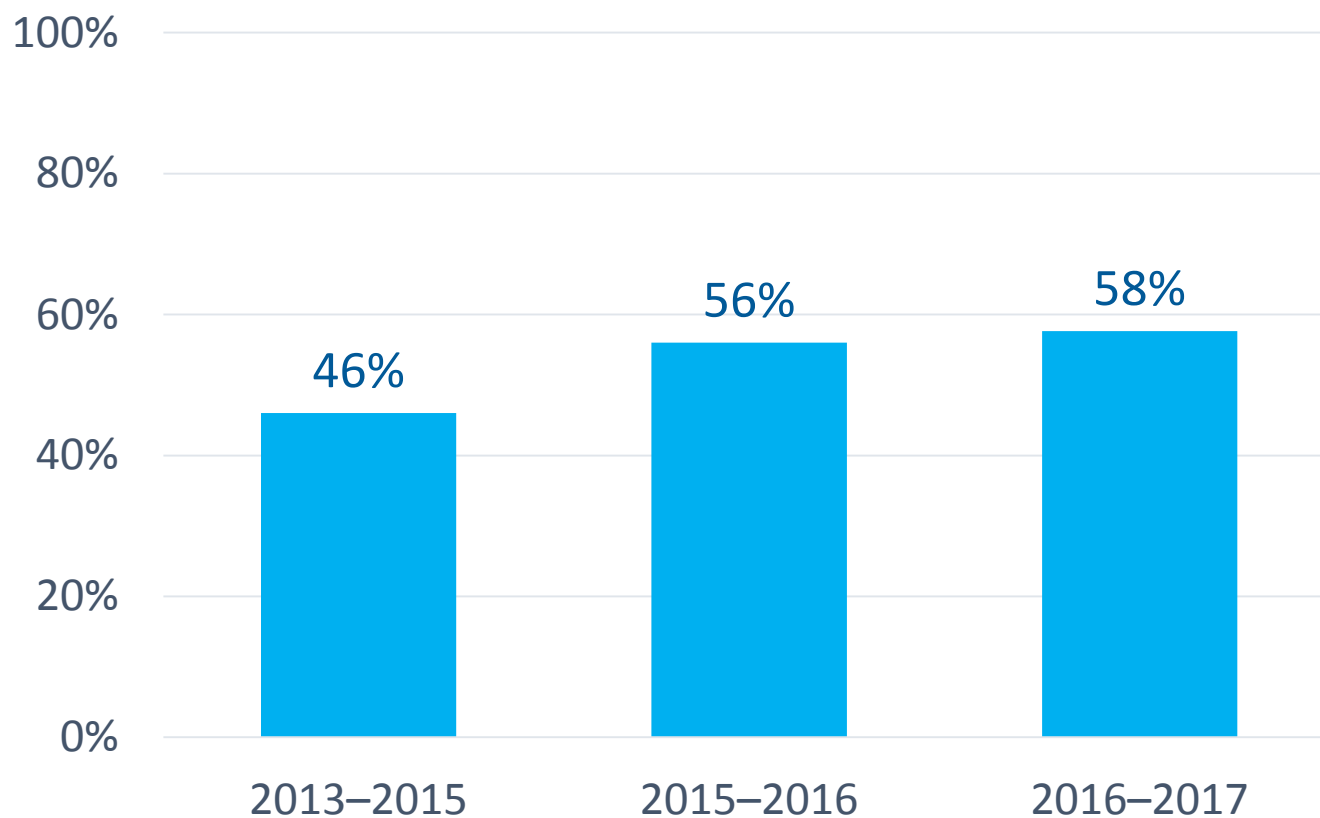
# Rebate Influence: Essentiality

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



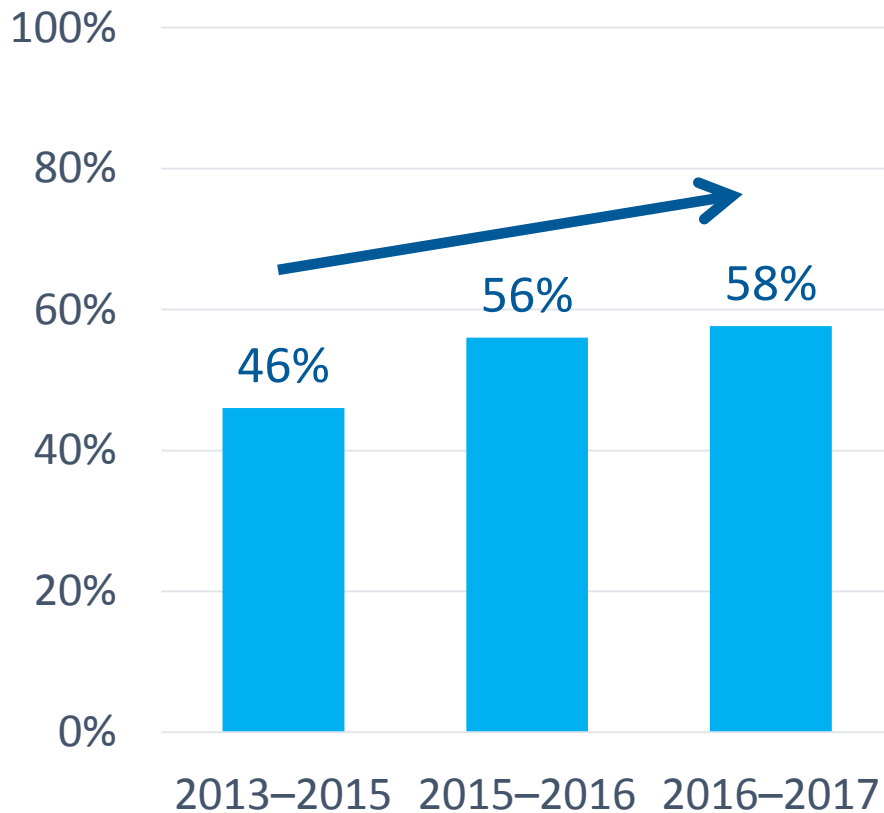
# Rebate Essentiality: Trend

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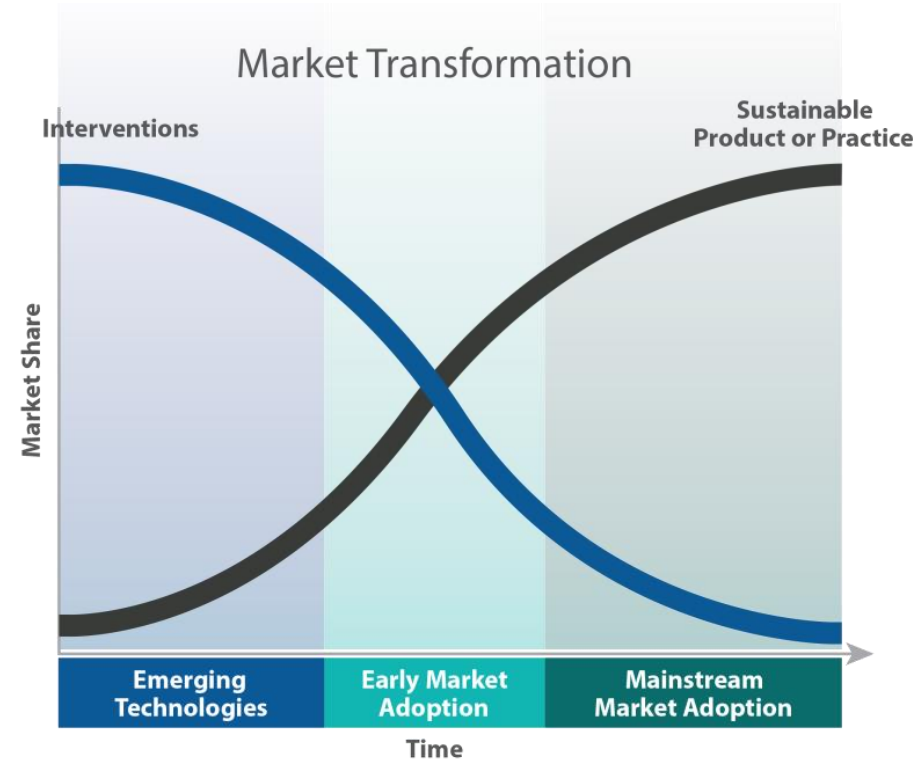


**Rebate  
Essential**

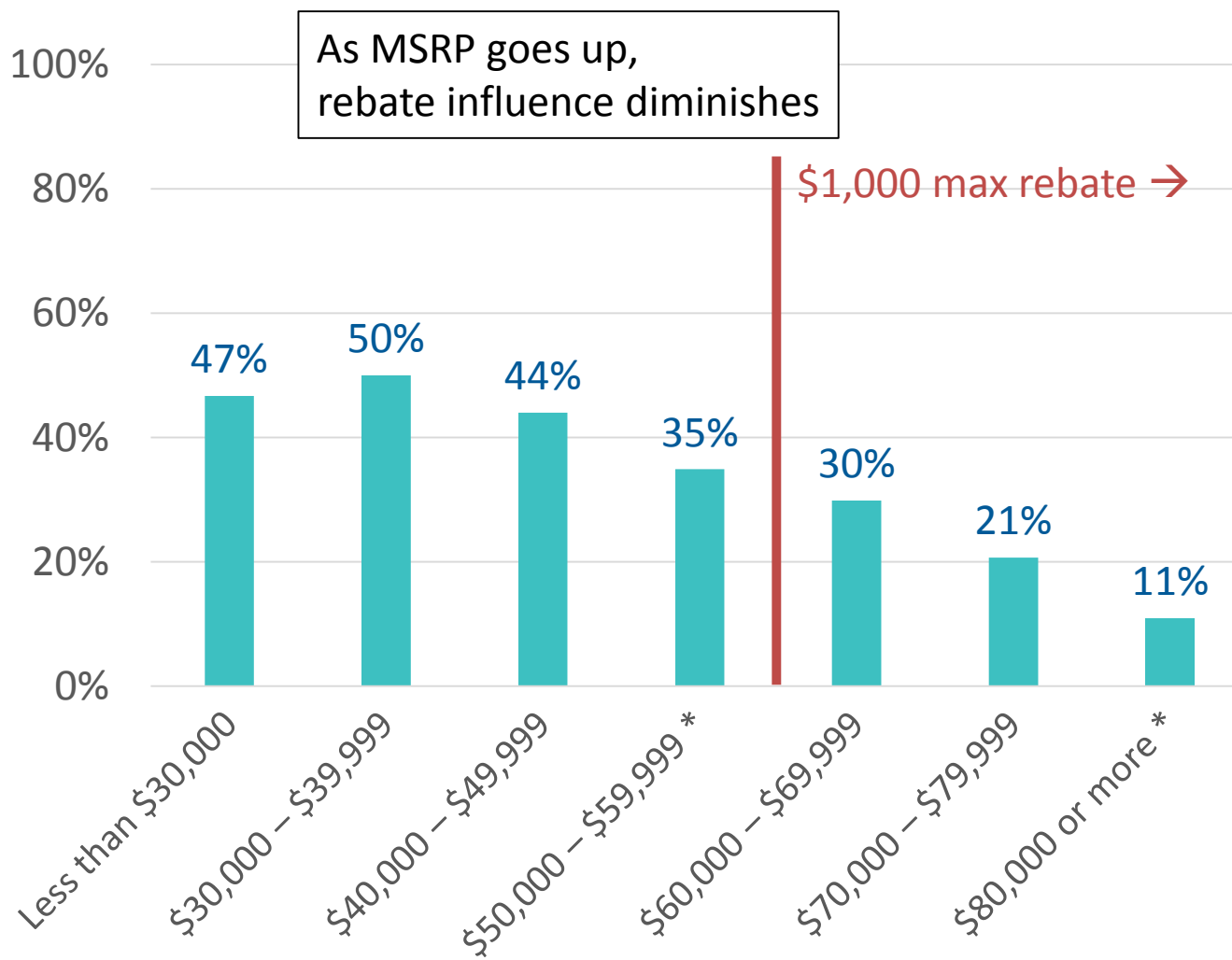
### Rebate Essentiality



### Common paradigm



# Percent of MOR-EV Respondents that are “Rebate Essential” by Base MSRP



# Rebate Essential Consumers are Different

- 2016 BECC talk
- 2017 TRR [paper](#) and TRB [poster](#)...



## Target Consumers: "Rebate Essentials"

Consumers most influenced by the rebate:

**Demographics:** male, non-white, higher education, lower household income, perhaps younger and larger households

**Motivations and interest:** less motivated by environmental impacts, more motivated by saving money on fuel, carpool lane access, and perhaps 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 dealer

**Vehicle characteristics:** lower price, bought (vs. lease)

## Differences – PHEV Consumers

The odds are higher for PHEV consumers that are younger, more motivated by energy independence and buying rather than leasing.

## Differences – BEV Consumers

The odds are higher for BEV consumers in larger households and MUDs, with no solar or workplace charging, and living in central California.

PHEV Odds Ratio	BEV Odds Ratio	Explanatory Variable
<b>Consumer demographics</b>		
		Male
1.38	1.18	Non-white ethnicity
1.25	1.23	Graduate degree (vs. 2nd-highest: Bachelor's)
1.08	1.11	Bachelor's degree (vs. 2nd: some college or less)
-	-	Lower household income (\$50k)
1.05	1.04	Younger (years)
1.007	-	More people in household (#)
-	1.07	
<b>Housing and region</b>		
-	1.19	Multi-unit dwelling (vs. non-MUD)
-	1.003	No solar (vs. 2nd-highest: planning solar)
-	1.18	No workplace charging (vs. 2nd-highest: WPC)
-	1.51	Central CA (vs. 2nd-highest: Far South CA)
-	-	No workplace charging (vs. access to WPC)
-	-	Central CA (vs. 2nd-highest: South CA)
<b>Reasons and interest</b>		
1.24	1.33	More motivated by saving money on fuel
1.04	1.12	More motivated by carpool lane access
1.08	1.08	Less motivated by reducing environmental impacts
1.09	-	More motivated by energy independence
-	-	More motivated by vehicle performance
1.41	1.29	Lower initial interest in EVs
Yes	Yes	Rebate essential
<b>Information gathering</b>		
1.22	1.18	Found it more difficult to find information on EVs
1.19	1.15	Spent more time researching EVs online
1.18	1.17	Did not hear about the rebate from the dealer
<b>Transactional factors</b>		
1.000019	1.000016	Vehicle price is lower (\$)
1.27	-	Buy (vs. lease)
1.14	-	Chevy PHEV (vs. 2nd-highest: Toyota)
-	1.04	Nissan BEV (vs. 2nd-highest: FIAT)
-	-	Ford (vs. 2nd-highest: other)
-	-	FIAT (vs. 2nd-highest: Nissan)
-	1.001	Acquisition date (days)

A close-up photograph of a person's hand holding a white and black charging cable, plugging it into the charging port of a silver electric car. The scene is set outdoors in a city street during sunset, with a bright sun in the upper right corner creating a lens flare. In the background, a bicycle is parked on the sidewalk, and a building with a green sign is visible. The overall atmosphere is warm and modern.

# Summary



# Summary

- Some consumer differences, particularly gender, remain
  - Compared to new-car buyers, many differences may be smaller than expected
  - Trending in the right direction
- $\sim 4/5^{\text{ths}}$  of rebated EVs replace older, more polluting vehicles
  - PHEVs and other “uncompromised” vehicles replace vehicles at particularly high rate
  - $\sim 1/2$  of replaced vehicles are  $> 5$  years old
- Rebate rated **moderately to extremely important to  $9/10^{\text{ths}}$  of rebated purchases/leases, essential to  $> 1/2$**
- Indicators of impact are increasing over time

# Thank You for Your Attention





What would you like to know more about?  
What decisions are you facing?  
[brett.williams@energycenter.org](mailto:brett.williams@energycenter.org)

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

A close-up photograph of a person's hand holding a charging cable connected to a white electric vehicle. The scene is set outdoors at sunset, with a bright sun in the upper right corner creating a lens flare effect. In the background, a public charging station and a bicycle are visible, suggesting an urban environment.

## **Extra Slides & Additional Online Resources**

# Majority Characteristics

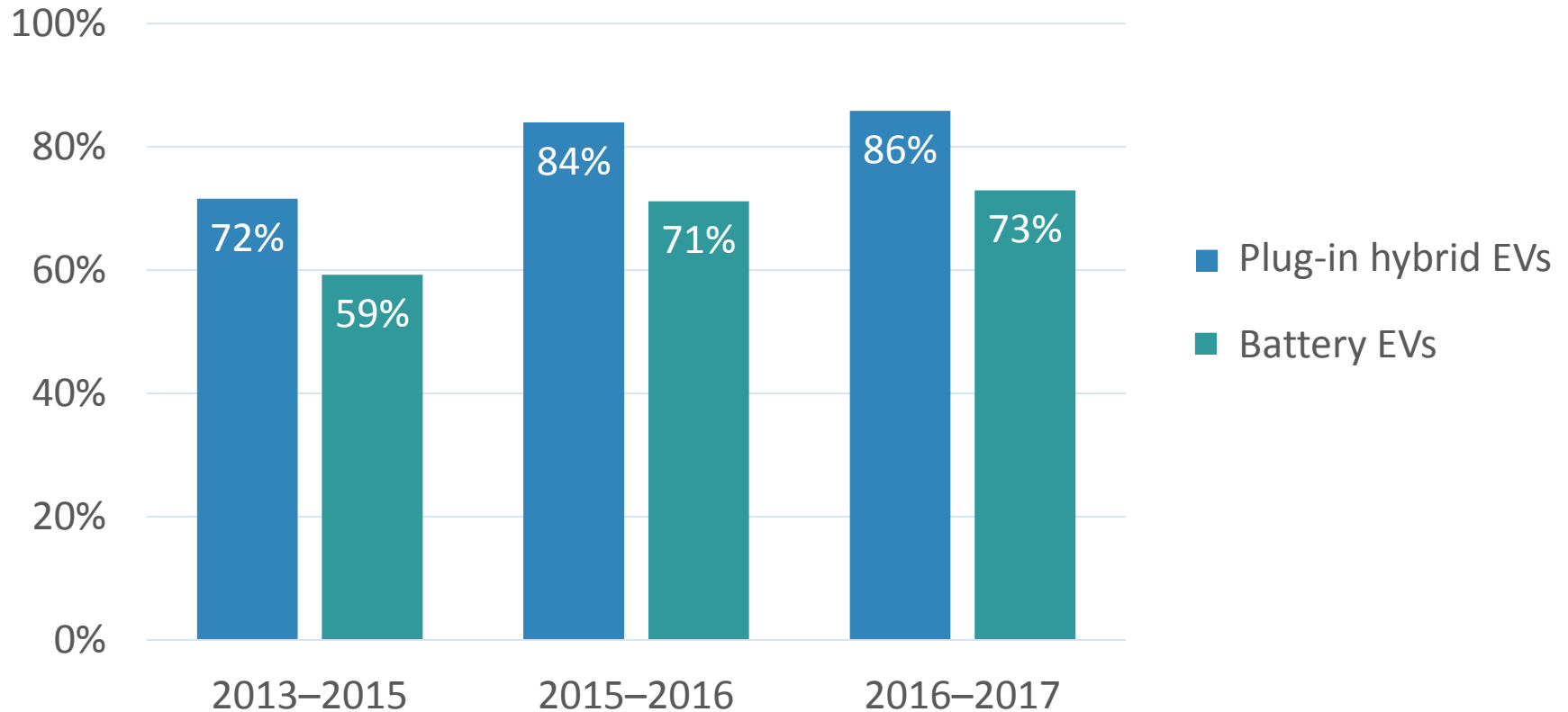
	CA vehicle purchase/lease "intenders" (CHTS 2012)	 CALIFORNIA CLEAN VEHICLE REBATE PROJECT	 MOR-EV Massachusetts Offers Rebates for Electric Vehicles	 CHEAPR Connecticut Hydrogen and Electric Automobile Purchase Rebate	 NEW YORK STATE
White/Caucasian	76%	64%	82%	89%	88%
Male	49%	74%	77%	75%	69%
≥ Bachelor's degree	66%	83%	90%	79%	73%
Detached homes	75%	80%	83%	84%	84%
40–59 years old	52%	54%	52%	46%	45%

# Majority Characteristics: Trend

	CVRP 2013–2015	CVRP 2015–2016	CVRP 2016–2017	Vehicle purchase/ lease “intenders” (CHTS 2012)
White/Caucasian	64%	65%	61%	76%
Male	75%	74%	72%	49%
≥ Bachelor’s degree	85%	83%	81%	66%
Detached homes	81%	80%	77%	75%
40–59 years old	56%	53%	51%	52%

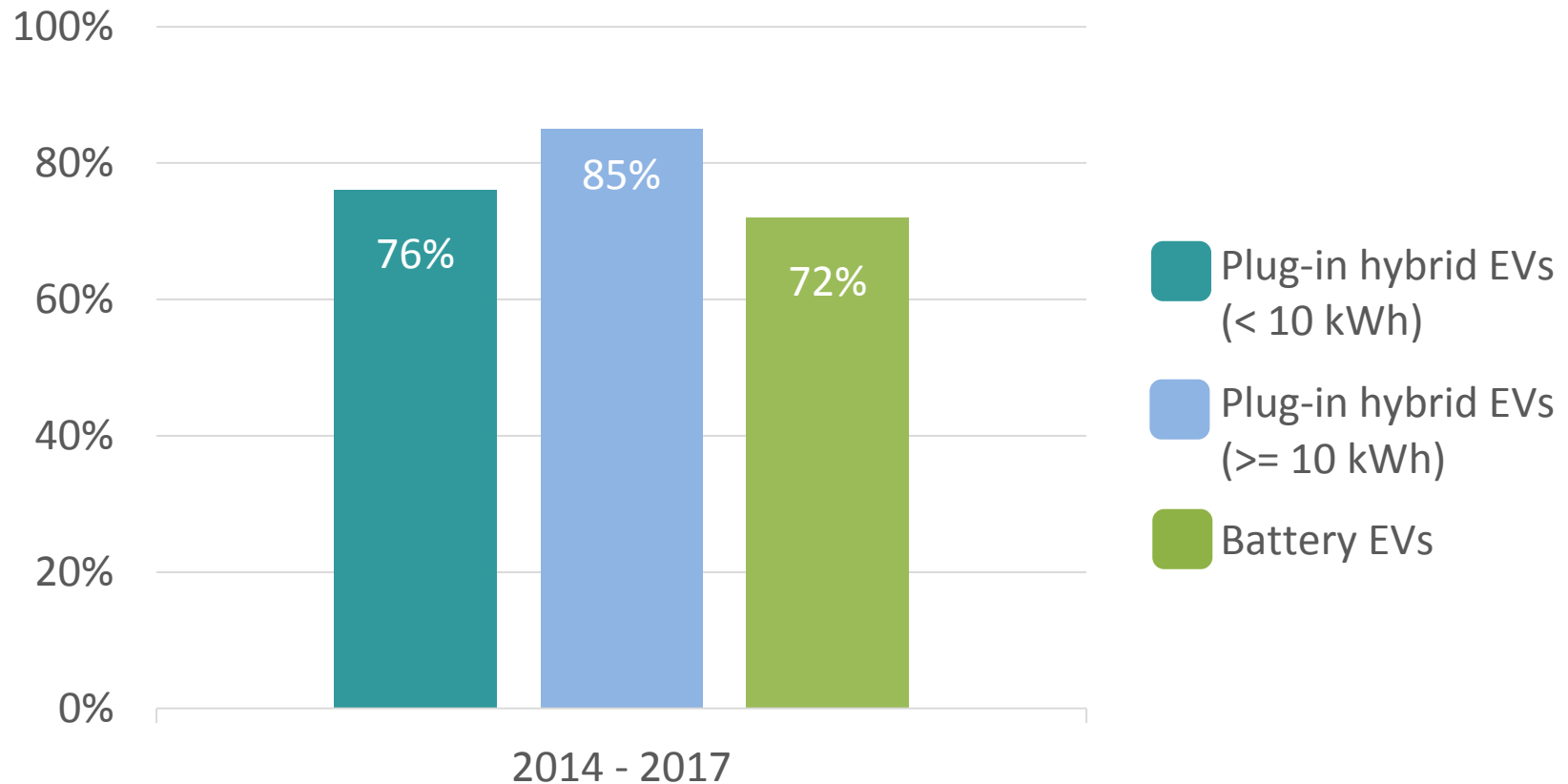
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## Replaced a vehicle with their rebated EV



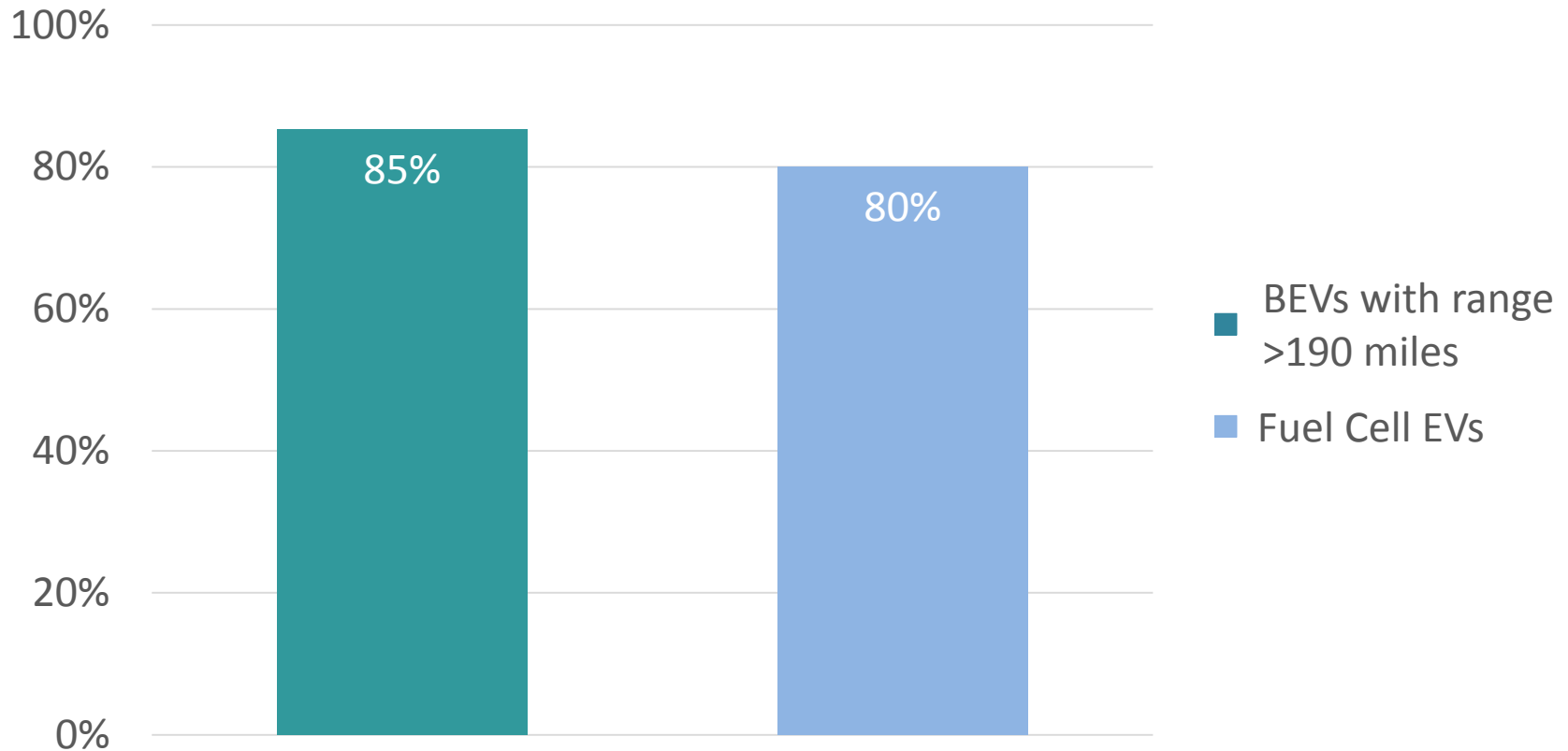
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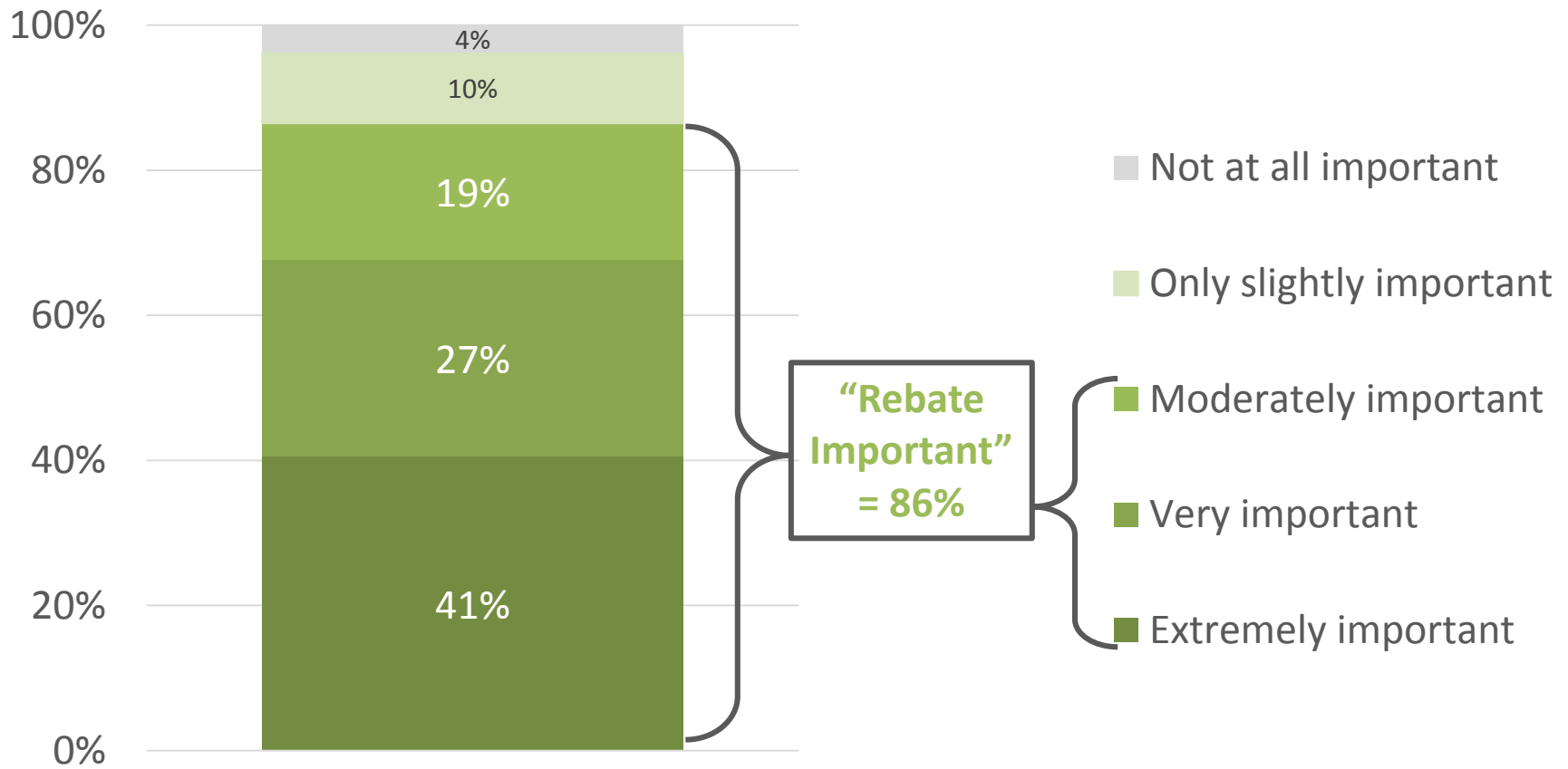
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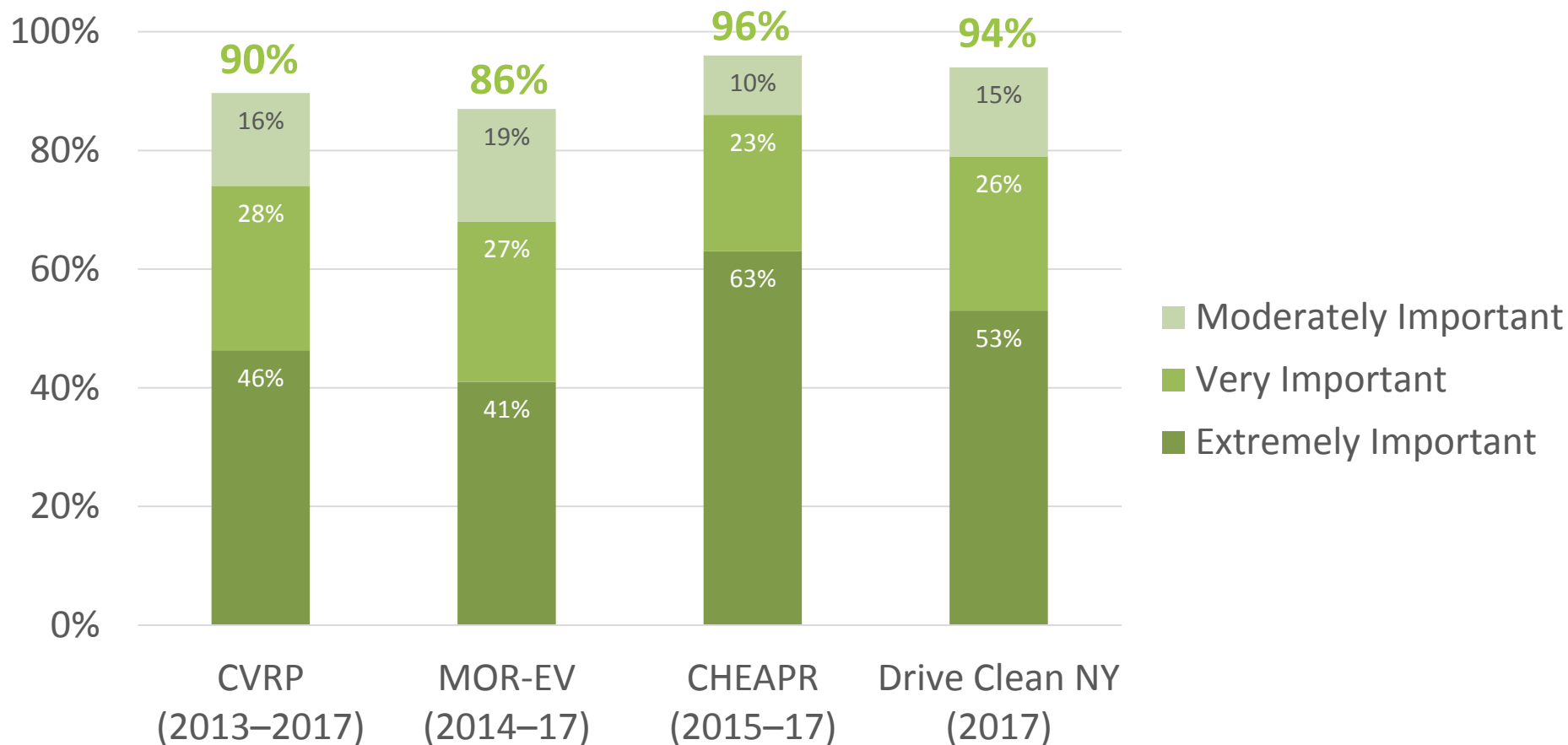


How **important** was the State Rebate (MOR-EV) in **making it possible** for you to acquire your clean vehicle?



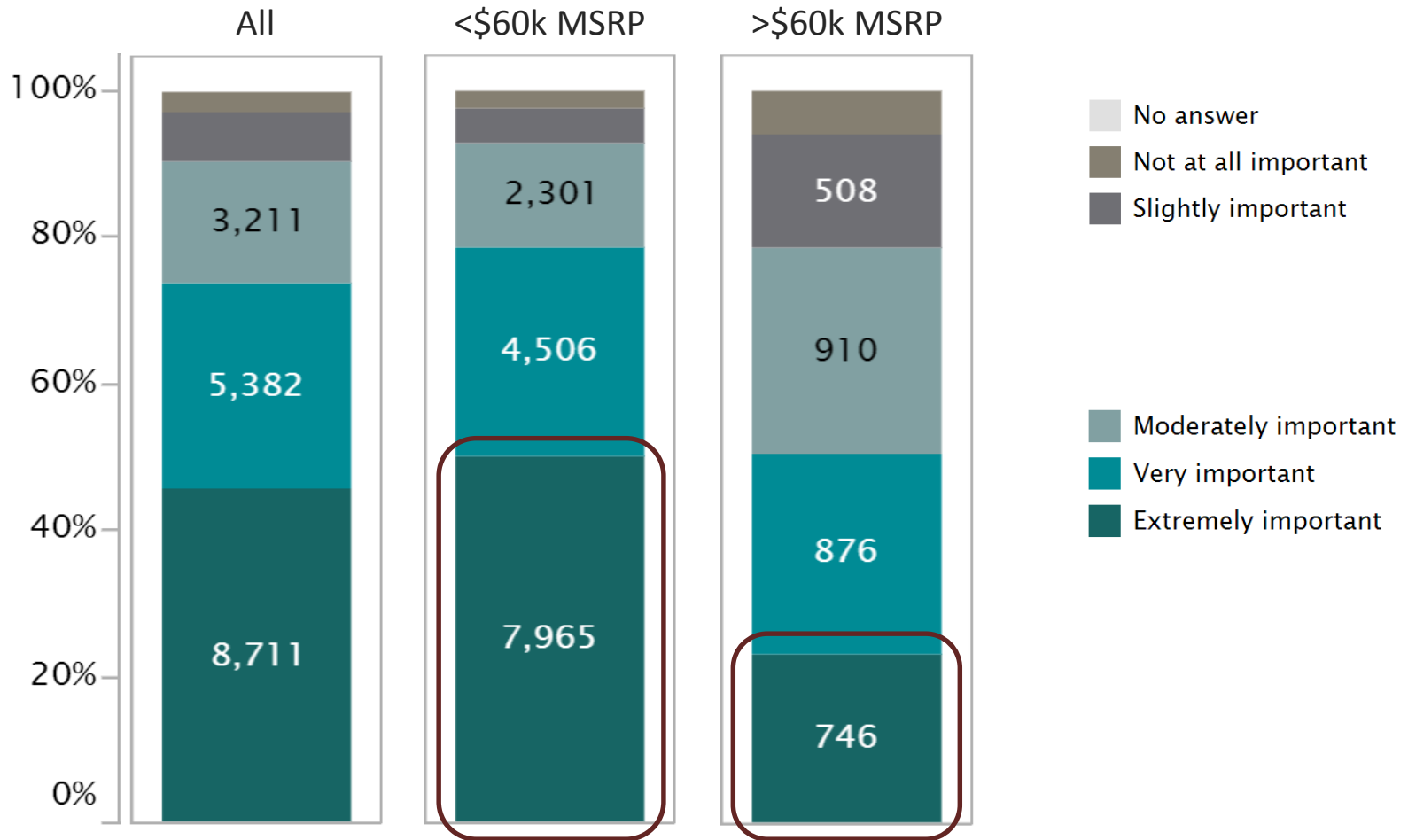
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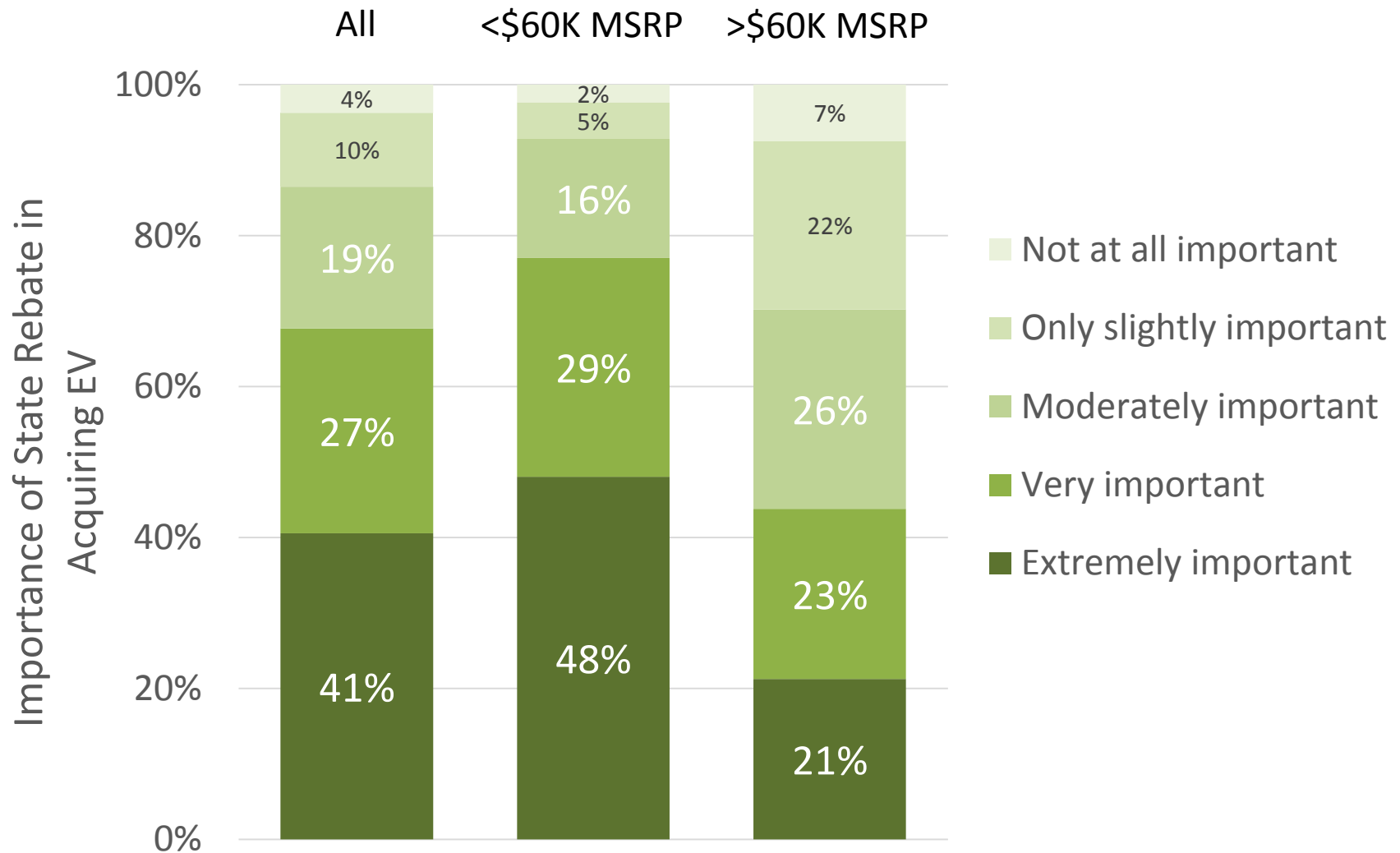


# Rebate importance is lower for consumers of expensive vehicles

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



# Rebate Importance by Vehicle Price



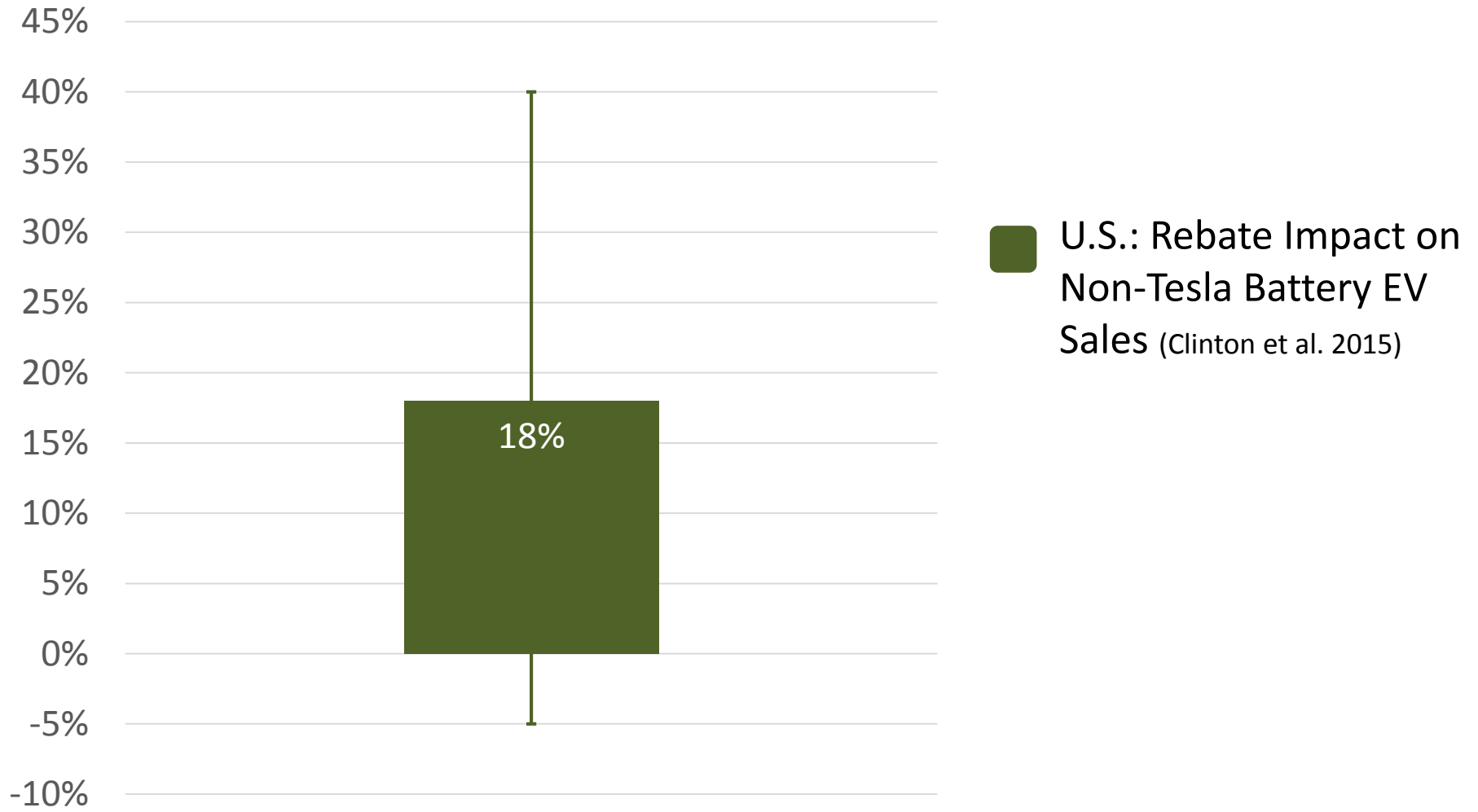
# Getting the most out of stated-preference data

- “Importance” can be a useful indicator
  - High response rate
- But it is difficult to define and encapsulates a complex array of factors
- If seeking an even more conservative metric...
  - Difficult to avoid truthfulness bias in stated-preference data, but do have a metric that is:
    - Even less subject to recall bias
    - More clear cut
    - More “counterfactual” ...

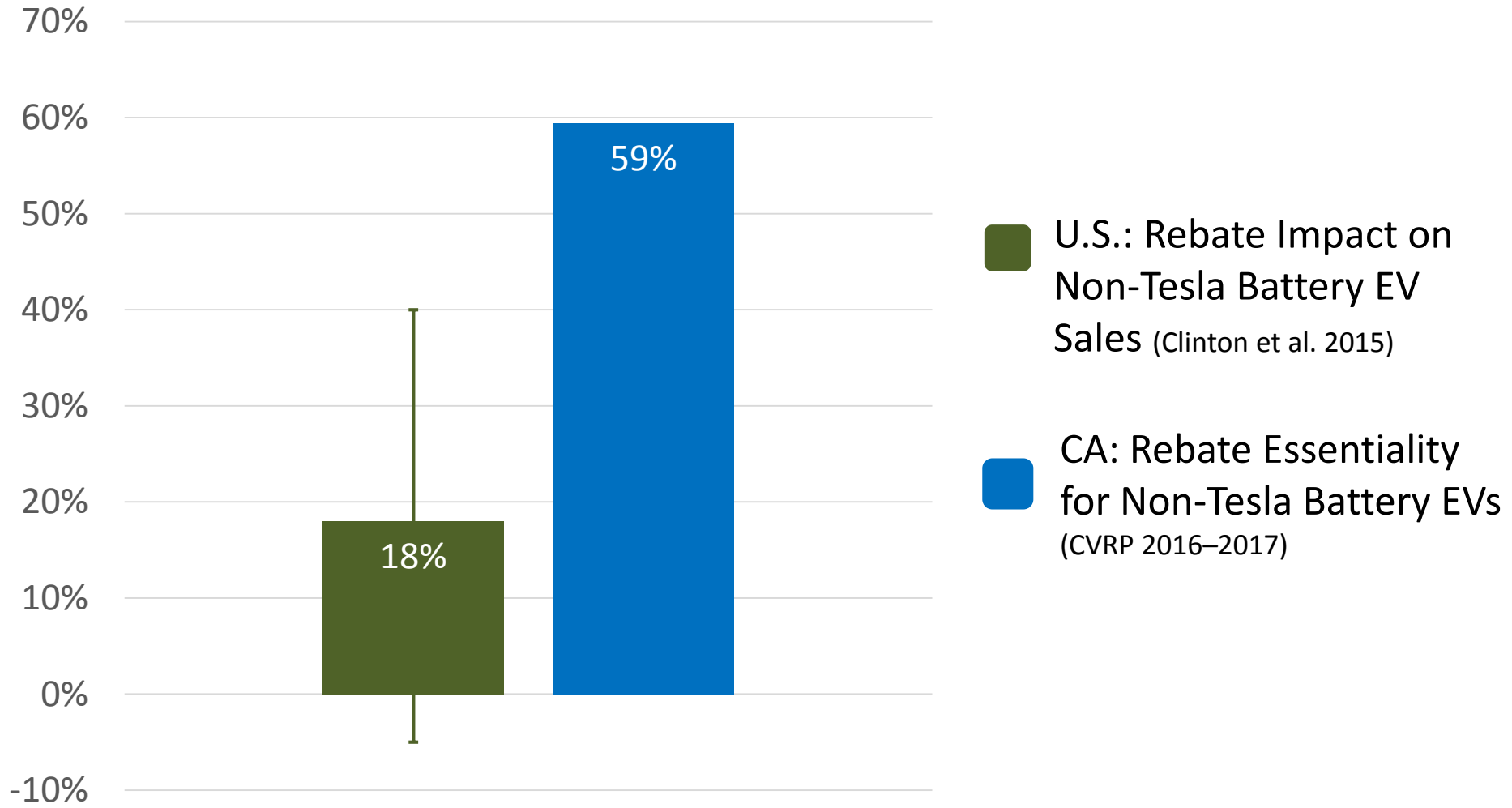
## Rebate Essentiality

Author/Year	Variables Examined	Effect/Size
Sierzchula et al. (2014)	Country financial incentives – Global PEV market share	+ **
Jin et al. (2014)	Monetized non-financial BEV incentives – BEV sales	+ ***
	BEV financial subsidies – BEV sales	+
	Monetized non-financial PHEV incentives – PHEV sales	Not significant
DeShazo et al. (2014)	CA state rebate design – PEV sales	+
Narassimhan & Johnson (2014)	Purchase rebate – BEV registrations	+ *
	Purchase rebate - PHEV registrations	Not significant
Lutsey et al. (2015)	Monetized BEV benefits - BEV share	+ **
	Monetized PHEV benefits - PHEV share	Not significant
Clinton et al. (2015)	State rebate - BEV sales (Tesla & LEAF)	Not significant
	State rebate - BEV sales (LEAF)	Not significant
	State rebate - BEV sales (Tesla Only)	- **
Zhou et al. (2016)	Purchase incentives - BEV: Total Market	+ ***
	Purchase incentives - BEV: Mass Market (<\$40,000)	+ ***
	Purchase incentives - BEV: Mid Market (\$40-50,000)	Not significant
	Purchase incentives - BEV: Luxury (>\$60,000)	- ***
	Purchase incentives - PHEV: Total Market	+ **
	Purchase incentives - PHEV: Mass Market (<\$40,000)	+ **
	Purchase incentives - PHEV: Mid Market (\$40-50,000)	Not significant
Lutsey et al. (2016)	Purchase incentives - PHEV: Luxury (>\$60,000)	Not significant
	State incentive (top 50 MSA) - BEV vehicle shares	Not significant
	State incentive (top 50 MSA) - PHEV vehicle shares	+ **
	State incentive (top 50 MSA) - PEV vehicle shares	Not significant
	State incentive (top 200 MSA) - BEV vehicle shares	+ **
	State incentive (top 200 MSA) - PHEV vehicle shares	+ **
Jenn et al. (2017)	State incentive (top 200 MSA) - PEV vehicle shares	+ **
	Individual credit (rebate or tax credit) - EV registrations	Not significant
	Individual credit (rebate or tax credit) w/knowledge of incentives - EV registrations	+**

# External vs. Internal Perspectives on Rebate Impact



# External vs. Internal Perspectives on Rebate Impact

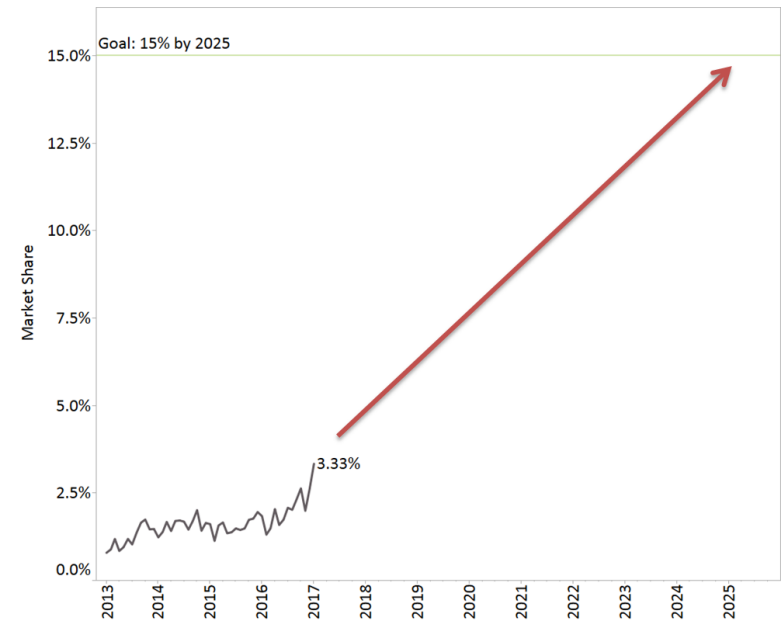




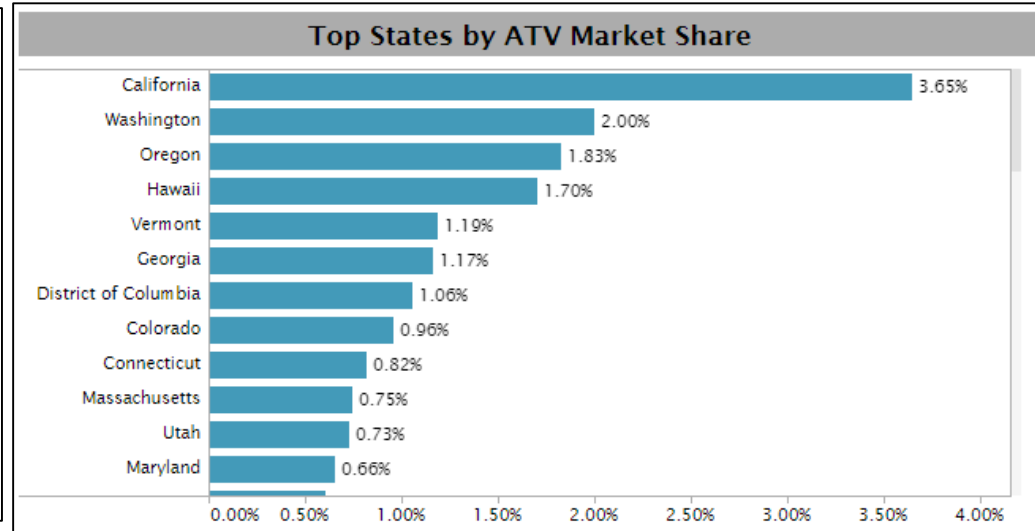
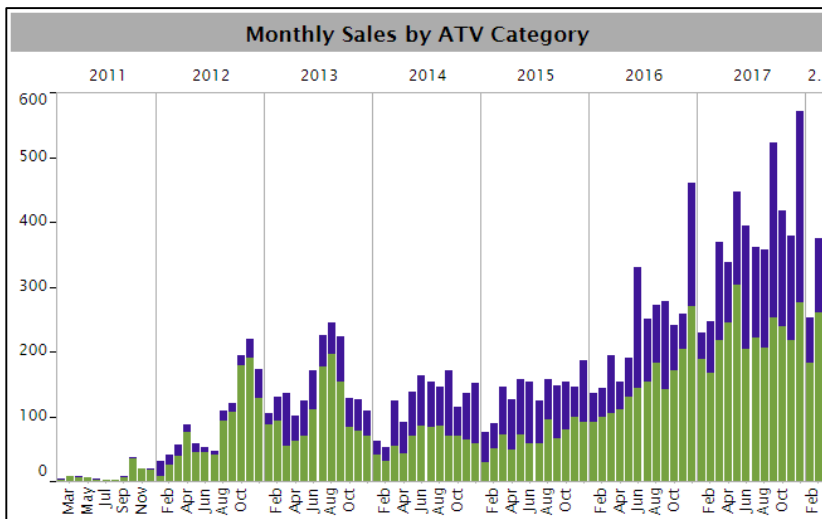
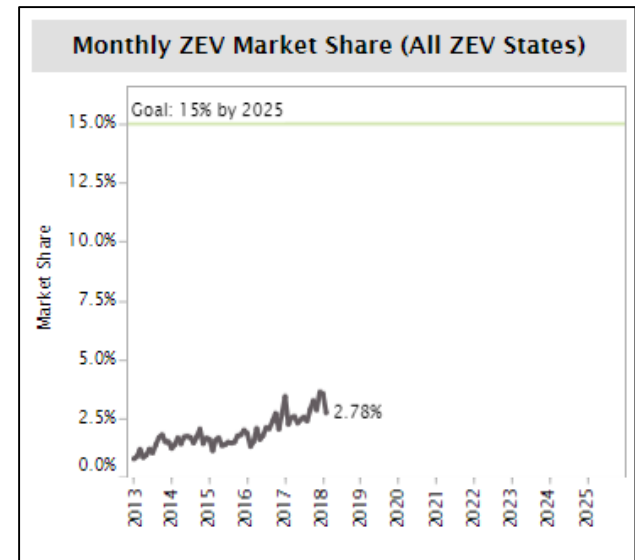
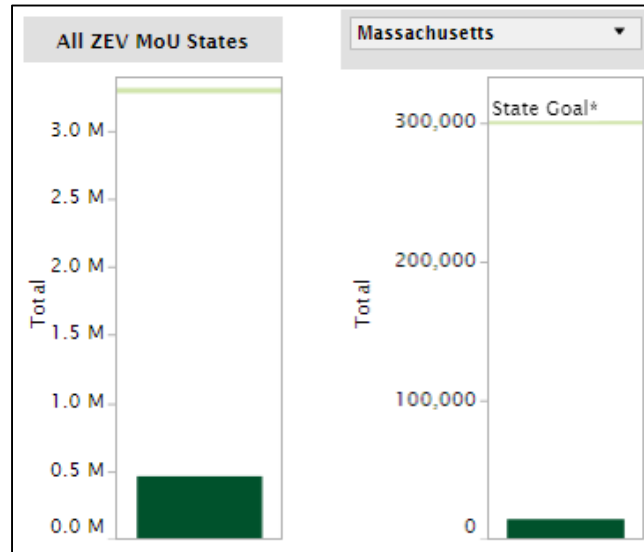
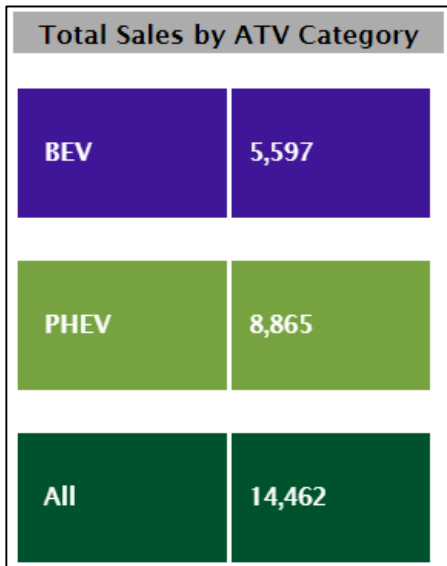
# Why are added vehicle volumes important?

Volume is a proxy for a variety of market benefits, e.g.:

- For producers
  - Economies of scale
  - OEM learning-by-doing
  - Supply-chain creation
- For dealers
  - Salesperson familiarity
  - Supply on the lot
- For consumers
  - Consumer awareness and understanding
    - Parking lots as “second showrooms”
  - Information spillovers
  - Consumer learning-by-doing
    - Charging confidence
  - Adoption network effects
- For society
  - Use potential
    - Positive environmental externalities



# Status: Massachusetts (thru Feb. 2018)



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



- **Disadvantaged Communities**

- [\(AEA pres 2016\)](#)
- [\(CVRP DAC infographic, 2017\)](#)

- **Information Channels**

- [\(EV Roadmap pres, 2016\)](#)



- **Target Segments**

- [\(TRR 2016 research paper\)](#)
- [\(AEA 2016 pres\)](#)
- [\(TRB 2017 poster\)](#)

# Additional Participant Evaluation Examples

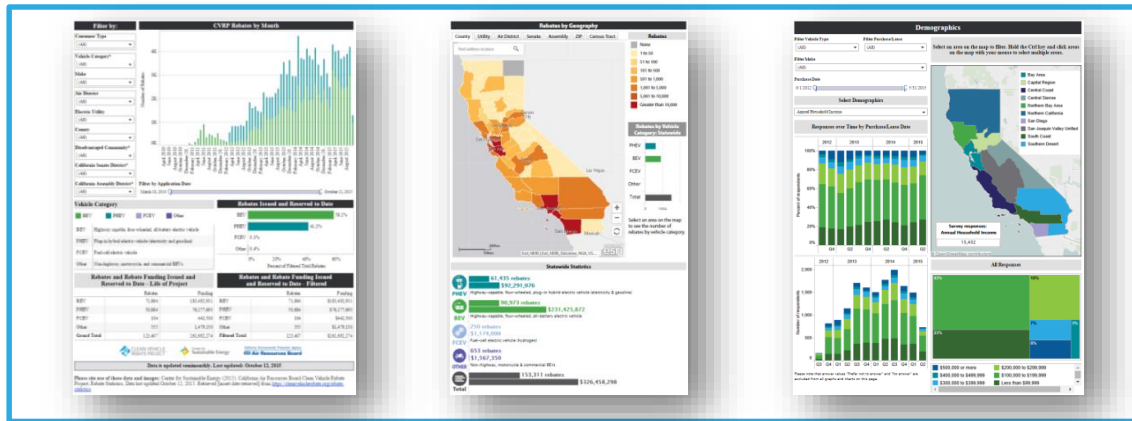
- Progress in **Disadvantaged Communities** ([AEA pres 2016](#))
- **Information Channels** ([EV Roadmap pres, 2016](#))
  - Exposure & importance of various channels, consumer time spent researching various topics
- **Infographics**
  - Overall ([CVRP infographic, 2016](#))
  - Disadvantaged Communities ([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)



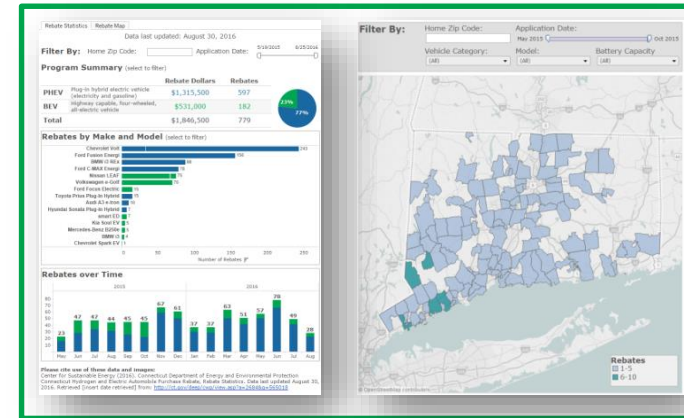
# Where can I get additional data?: Transparency Tools

## Public dashboards facilitate informed action

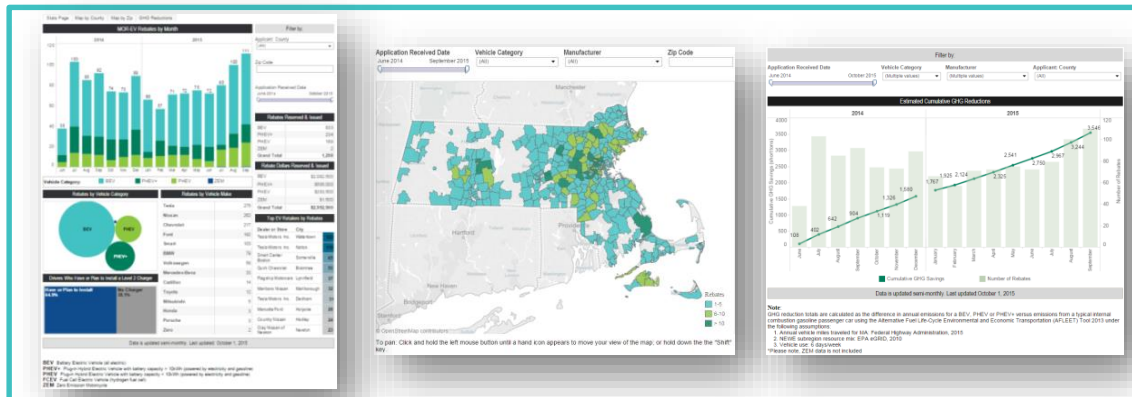
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- >19,000 survey responses statistically represent >91,000 consumers
- >\$525M in rebates processed



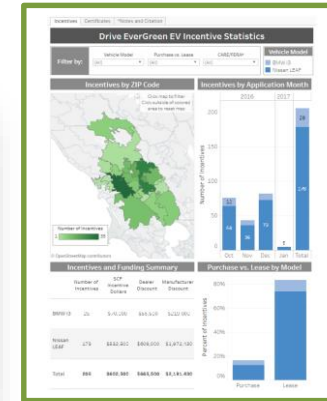
cleanvehiclerebate.org



ct.gov/deep



mor-ev.org



sonomacleanpower.org

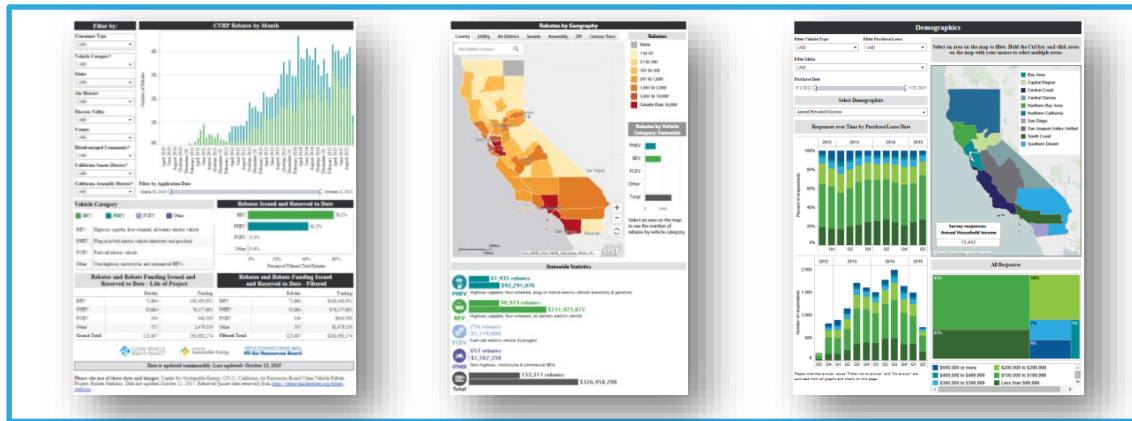


zevfacts.com

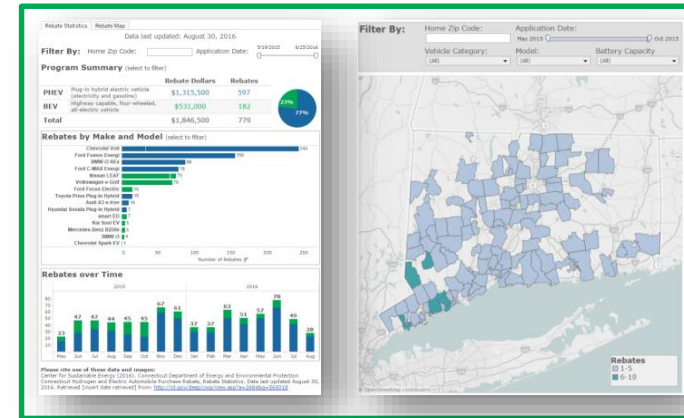
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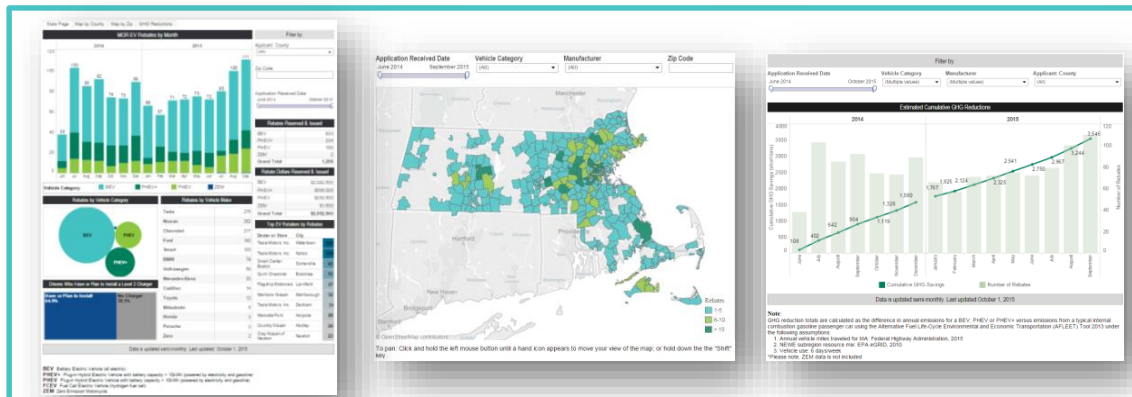
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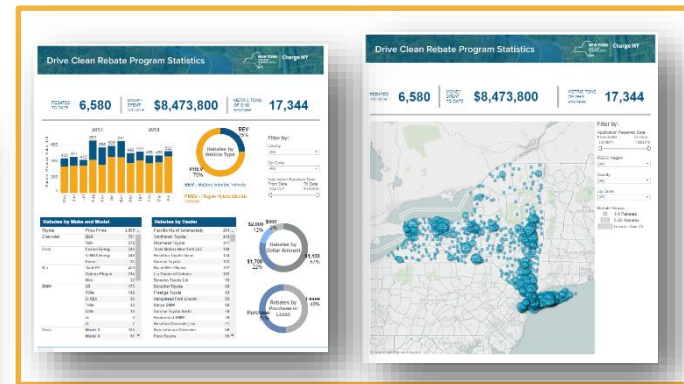
[cleanvehiclerebate.org](http://cleanvehiclerebate.org)



[ct.gov/deep](http://ct.gov/deep)



[mor-ev.org](http://mor-ev.org)



[nyscrda.ny.gov/All-Programs/Programs/Drive-Clean-Rebate/Rebate-Data](http://nyscrda.ny.gov/All-Programs/Programs/Drive-Clean-Rebate/Rebate-Data)

