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*with thanks to J. Bowers and others at the Center for Sustainable Energy (CSE)*



# Outline: Vehicle Replacement (during the onset of COVID-19)



- I. Context: Program Design, Market Dynamics, & Data
- II. Vehicle Replacement
  - A. Replacement Rates
  - B. Vehicle Age & Types Replaced
- III. Summary & Select Findings

## Additional Details & Resources

EVs = light-duty plug-in hybrid, battery, and fuel-cell electric vehicles  
(PHEVs, BEVx vehicles, BEVs, and FCEVs)



The background image shows a close-up of a hand plugging a charging cable into a white electric vehicle. The scene is set outdoors during the day, with a bright sun in the upper right corner creating a lens flare effect. In the background, a city street is visible with a building and a bicycle parked on the sidewalk.

# Context

Program Design, Market Dynamics, & Data



# Base Rebate Amount for Most Individuals Decreased \$500



	as of Mar. 2010	as of Jun. 2011	as of Jul. 2013	as of Jun. 2014	as of Mar. 2016	as of Nov. 2016	as of Dec. 2019
Fuel-Cell EVs 	\$3,000– \$5,000 ‡	\$1,500– \$2,500 ‡	\$2,500	\$5,000	\$5,000 *	\$5,000**	\$4,500***
Battery EVs † 	\$3,000– \$5,000 ‡	\$1,500– \$2,500 ‡	\$2,500	\$2,500	\$2,500 *	\$2,500**	\$2,000***
Plug-in Hybrid EVs 	\$3,000	\$1,500	\$1,500	\$1,500	\$1,500 *	\$1,500**	\$1,000***
Zero-Emission Motorcycles 	\$1,500	\$900	\$900	\$900	\$900	\$900	\$750
Neighborhood EVs	\$1,500	\$900	\$900	\$900	\$900	None eligible	None eligible
Commercial Zero-Emission Vehicles	\$20,000						

† Includes range-extended battery electric vehicles.  
‡ Amounts varied by ZEV type. For definitions, see CCR 1962.1.  
\* Lower-income consumers eligible for an additional \$1,500.  
\*\* Lower-income consumers eligible for an additional \$2,000.  
\*\*\* Lower-income consumers eligible for an additional \$2,500.

# Program Design Shapes Outcomes

  = in effect during 2020



<p><b>as of Mar. 2010</b></p> <ul style="list-style-type: none"> <li>• Incentive stacking permitted</li> <li>• 36-month ownership requirement</li> <li>• Rebates per year limit = 20</li> </ul>	<p><b>as of Dec. 2013</b></p> <ul style="list-style-type: none"> <li>• Rebates per year limit = 2</li> </ul> <p><b>as of May 2014</b></p> <ul style="list-style-type: none"> <li>• 18-month application window</li> </ul>	<p><b>as of Dec. 2014 / Jan. 2015</b></p> <ul style="list-style-type: none"> <li>• 30-month ownership requirement (retroactive)</li> <li>• Total rebate limit = 2</li> </ul>	<p><b>as of Mar. 2016</b></p> <ul style="list-style-type: none"> <li>• \$250k–\$500k income cap (PEVs)</li> <li>• +\$1,500 for income-qualified households (<math>\leq 300\%</math> FPL), excluding ZEMs</li> </ul>	<p><b>as of Nov. 2016</b></p> <ul style="list-style-type: none"> <li>• \$150k–\$300k income cap (PEVs)</li> <li>• +\$2,000 for income-qualified households (<math>\leq 300\%</math> FPL), excl. ZEMs</li> <li>• <math>\geq 20</math> UDDS electric miles</li> </ul>
<p><b>as of Jan. 2018</b></p> <ul style="list-style-type: none"> <li>• \$150k–\$300k income cap on stacking HOV decal (only binding on FCEVs)</li> <li>• Rebate Now San Diego County preapproval pilot with point-of-sale option</li> </ul>	<p><b>as of Jan. 2019</b></p> <ul style="list-style-type: none"> <li>• Stacking with CVAP grant not permitted (retroactive)</li> </ul>	<p><b>as of Dec. 2019</b></p> <ul style="list-style-type: none"> <li>• Base MSRP <math>\leq</math> \$60k (PEVs)</li> <li>• <math>\geq 35</math> UDDS electric miles</li> <li>• +\$2,500<sup>†</sup> for income-qualified households (<math>\leq 300\%</math> FPL), excl. ZEMs</li> <li>• Total rebates limit = 1<sup>§</sup></li> <li>• 3-month application window<sup>‡</sup></li> </ul>	<p><b>as of Apr. 2020</b></p> <ul style="list-style-type: none"> <li>• Stacking with CVAP grant permitted</li> </ul> <p><b>as of Jan. 2021</b></p> <ul style="list-style-type: none"> <li>• +\$2,500 for income-qualified households (<math>\leq 400\%</math> FPL), excl. ZEMs</li> </ul>	<p><b>as of Apr. 2021</b></p> <ul style="list-style-type: none"> <li>• <math>\geq 30</math> U.S. EPA electric miles (45 UDDS)</li> <li>• Rebate Now preapproval option limited to income-qualified households, expanded to include SJ Valley</li> </ul>

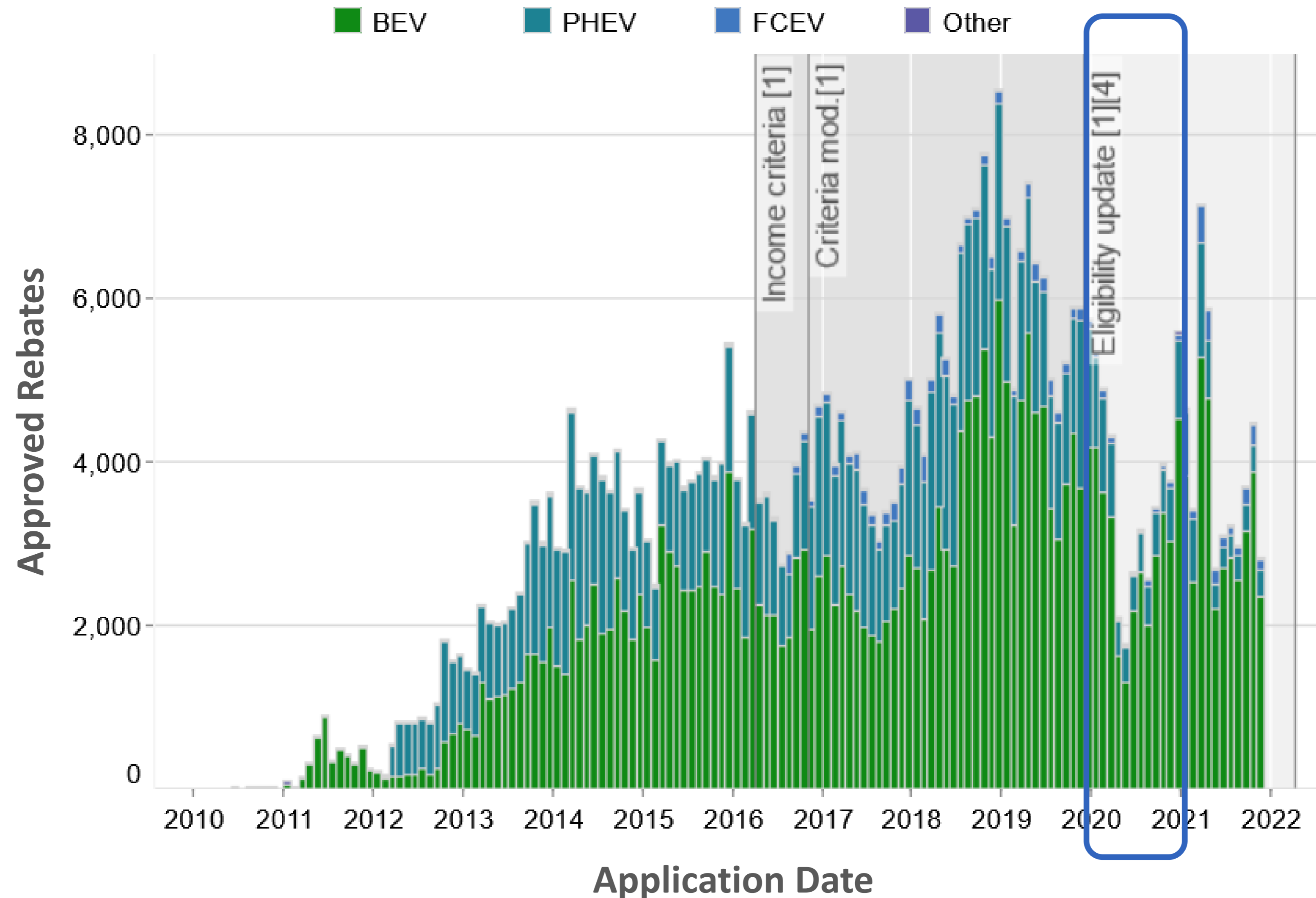
PEVs = plug-in EVs. FPL = Federal Poverty Level. ZEMs = zero-emission motorcycles. UDDS = Urban Dynamometer Driving Schedule. HOV = high-occupancy-vehicle. FCEVs = fuel-cell EVs. CVAP = Clean Vehicle Assistance Program. MSRP = manufacturer suggested retail price.

<sup>†</sup> Change due to \$500 decrease in standard rebate amounts (previous slide). <sup>§</sup> A second rebate can be approved for a FCEV if the first rebate was for a PEV.

<sup>‡</sup> COVID exemptions on application window effectively delayed implementation until 4/15/2021.

# 2020 Results/Trends Should be Interpreted with Caution (COVID)

## Applications Saw Dramatic Decline But Significant Recovery



With COVID exemptions, rebate applications for calendar year 2020 purchases/leases for individuals spanned 1/1/2020 – 4/15/2021.

12% applied in 2021.

# CVRP Consumer Survey Editions

(shows rebates to individuals for plug-in EVs\* only)

	<b>2013–2015 Edition</b>	<b>2015–2016 Edition</b>	<b>2016–2017 Edition</b>	<b>2017–2020 Edition</b>	<b>Total</b>
<b>Vehicle Purchase/ Lease Dates</b>	Sep. 2012 – May 2015	April 2015 – May 2016	May 2016 – May 2017	June 2017 – Nov. 2020	Sep. 2012 – Nov. 2020
<b>Survey Responses (total <i>n</i>)**</b>	19,460	11,611	8,957	32,524	72,552
<b>Program Population (<i>N</i>)***</b>	91,100	45,700	46,800	193,200	376,800

\*Plug-in EVs (PEVs) include PHEVs and BEVs.

\*\* Subsequently weighted to represent the program population along the dimensions of vehicle category, vehicle model, buy vs. lease, and county. Weighting dimensions for the 2017–20 Edition also included year of purchase/lease.

\*\*\* Small numbers of rebated vehicles are not represented in the time frames due to application lags. Rounded to nearest 100.



# CVRP Consumer Survey Data Used

(shows rebates to individuals for plug-in EVs only)

	2013–2015 Edition	2015–2016 Edition	2016–2017 Edition	2017–2020 Edition	2018 purchases/ leases subset	2019 purchases/ leases subset	“2020” purchases/ leases subset	Total
Vehicle Purchase/ Lease Dates	Sep. 2012 – May 2015	April 2015 – May 2016	May 2016 – May 2017	June 2017 – Nov.* 2020	Jan. 2018 – Dec. 2018	Jan. 2019 – Dec. 2019	Jan. 2020 – Nov.* 2020	Sep. 2012 – Nov. 2020
Survey Responses (total <i>n</i> )	19,460**	11,611**	8,957**	32,524**	14,757	8,991	4,331**	72,552
Program Population ( <i>N</i> )**	91,100	45,700	46,800	193,200	78,600 (filtered subset of weighted Edition)	61,300 (filtered subset of weighted Edition)	26,500	376,800

*\* ~8k 2020 purchases/leases were invited to respond to a new survey edition and are not represented in these data.*

\*\* Subsequently weighted to represent the program population along the dimensions of vehicle category, vehicle model, buy vs. lease, and county. Weighting for the 2017–20 Edition also included year of purchase/lease. The 2020 subset was also independently weighted, producing only minor differences compared to the filtering approach.

\*\*\* Small numbers of rebated vehicles are not represented in the time frames due to application lags. Rounded to nearest 100.



A close-up photograph of a person's hand plugging a charging cable into the charging port of a white electric vehicle. The scene is set outdoors at sunset, with warm, golden light and lens flare effects. In the background, a bicycle is parked on a sidewalk, and a building is visible. The overall atmosphere is calm and modern.

# Vehicle Replacement

(during the onset of COVID-19)



# Vehicle Replacement: **Select Resources** with Related Content

(reverse chronological, as of 3/2022)



## Publications

- B.D. Williams, J. Orose, M. Jones, J.B. Anderson, [Summary of Disadvantaged Community Responses to the Electric Vehicle Consumer Survey, 2013–2015 Edition](#), Clean Vehicle Rebate Project, San Diego CA, 2018.
- C. Johnson, B.D. Williams, C. Hsu, J.B. Anderson, [Summary Documentation of the Electric Vehicle Consumer Survey, 2013–2015 Edition](#), Clean Vehicle Rebate Project, San Diego CA, 2017.

## Presentations

- [Data from Statewide Electric Vehicle Rebate Programs: Vehicles, Consumers, Impacts, and Effectiveness](#)
- [CVRP CY 2019 Data Brief: Vehicle Replacement & Incentive Influence](#) (updated here)
- [Infographic: What Vehicles Are Electric Vehicles Replacing and Why?](#)
- [What Vehicles Are Electric Vehicles Replacing and Why?](#)
- [EV Purchase Incentives: Program Design, Outputs, and Outcomes of Four Statewide Programs with a Focus on Massachusetts](#)
- [Electric Vehicle Incentives and Policies](#)
- [CVRP: Data and Analysis Update](#)
- [Electric Vehicle Rebates: Exploring Indicators of Impact in Four States](#)
- [Supporting EV Commercialization with Rebates: Statewide Programs, Vehicle & Consumer Data, and Select Findings](#)
- [Yale Webinar: Supporting EV Commercialization with Rebates: Statewide Programs, Vehicle & Consumer Data, and Findings](#)





# Vehicle Replacement Rates

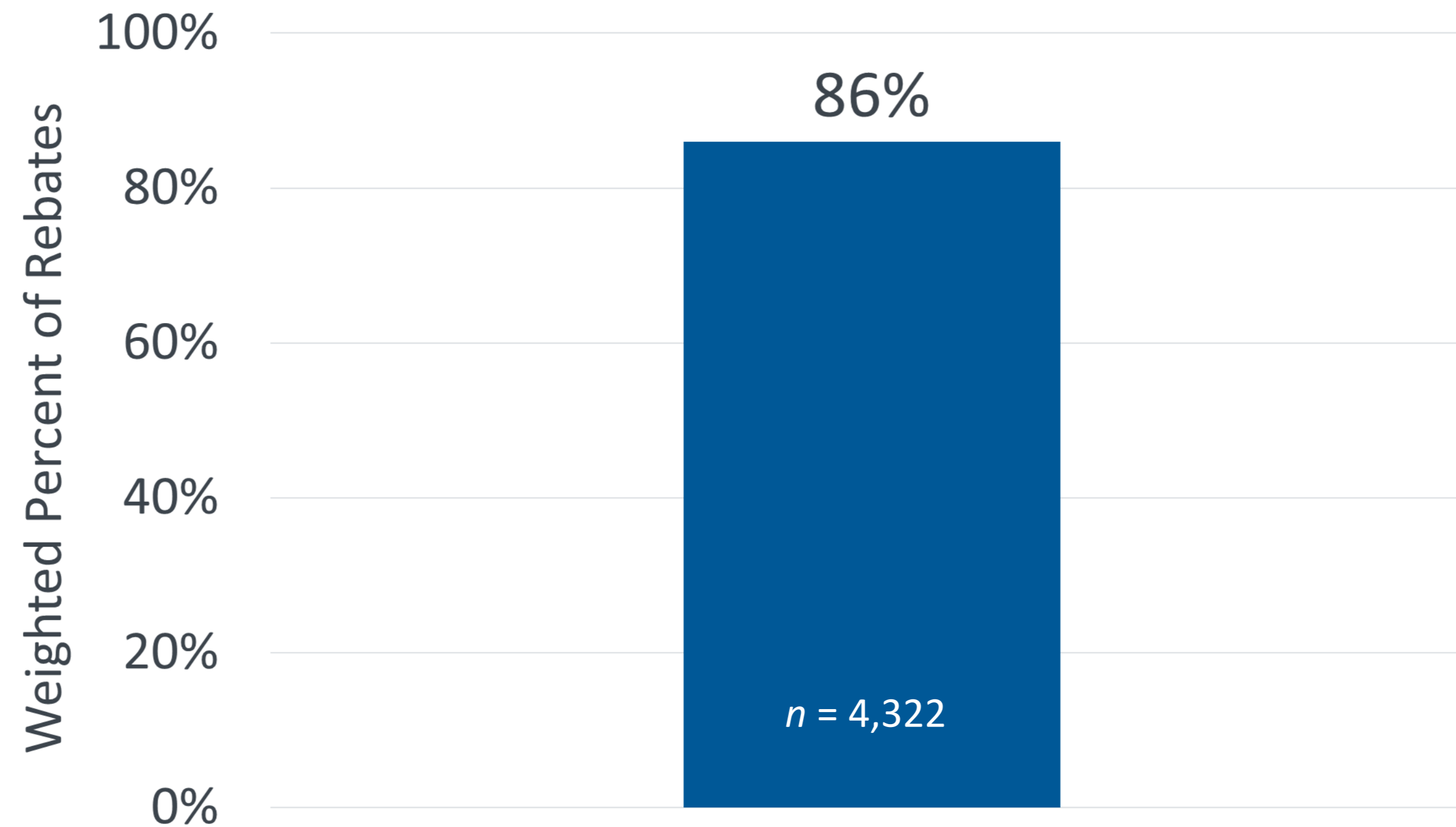
(during the onset of COVID-19)



# Do EVs Get Used?

## 2020 Purchases/Leases

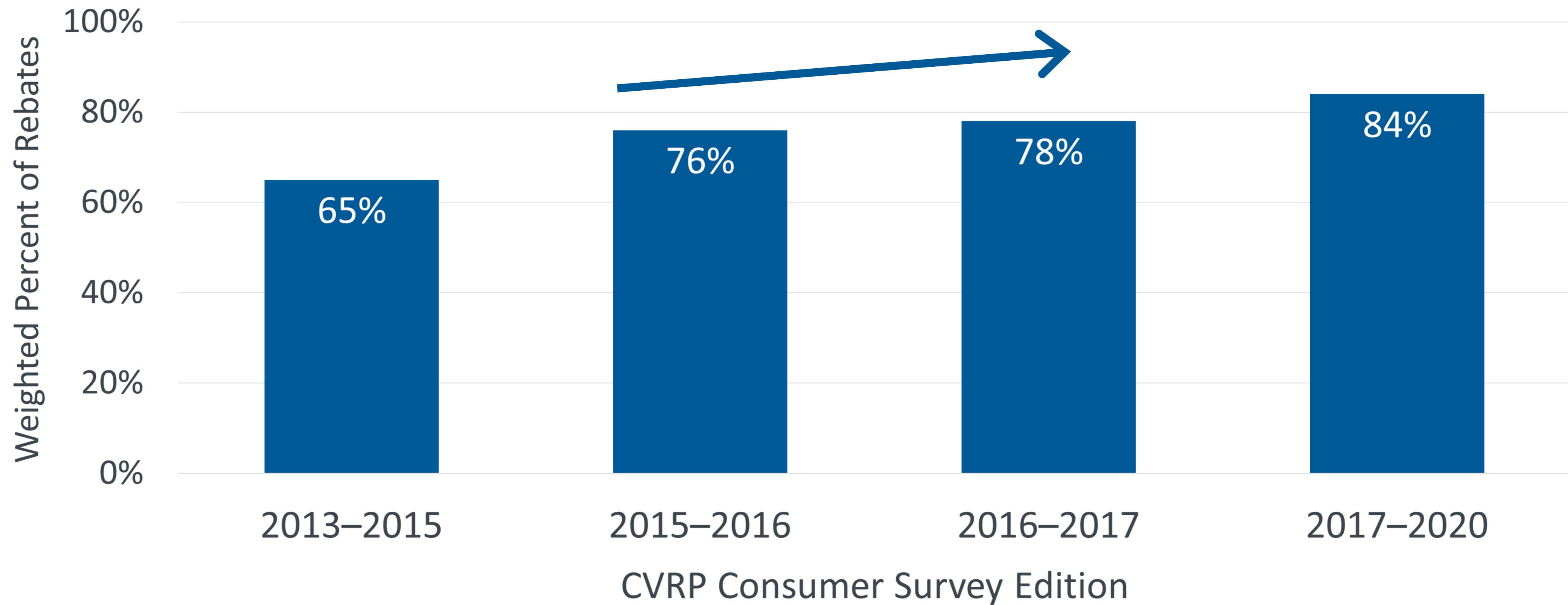
### Replaced a vehicle with their rebated *plug-in EV*



CVRP Consumer Survey, 2017–2020 Edition.  
*n*-value is filtered and question-specific.

# Vehicle Replacement is Increasing

Replaced a vehicle with their rebated *plug-in EV*

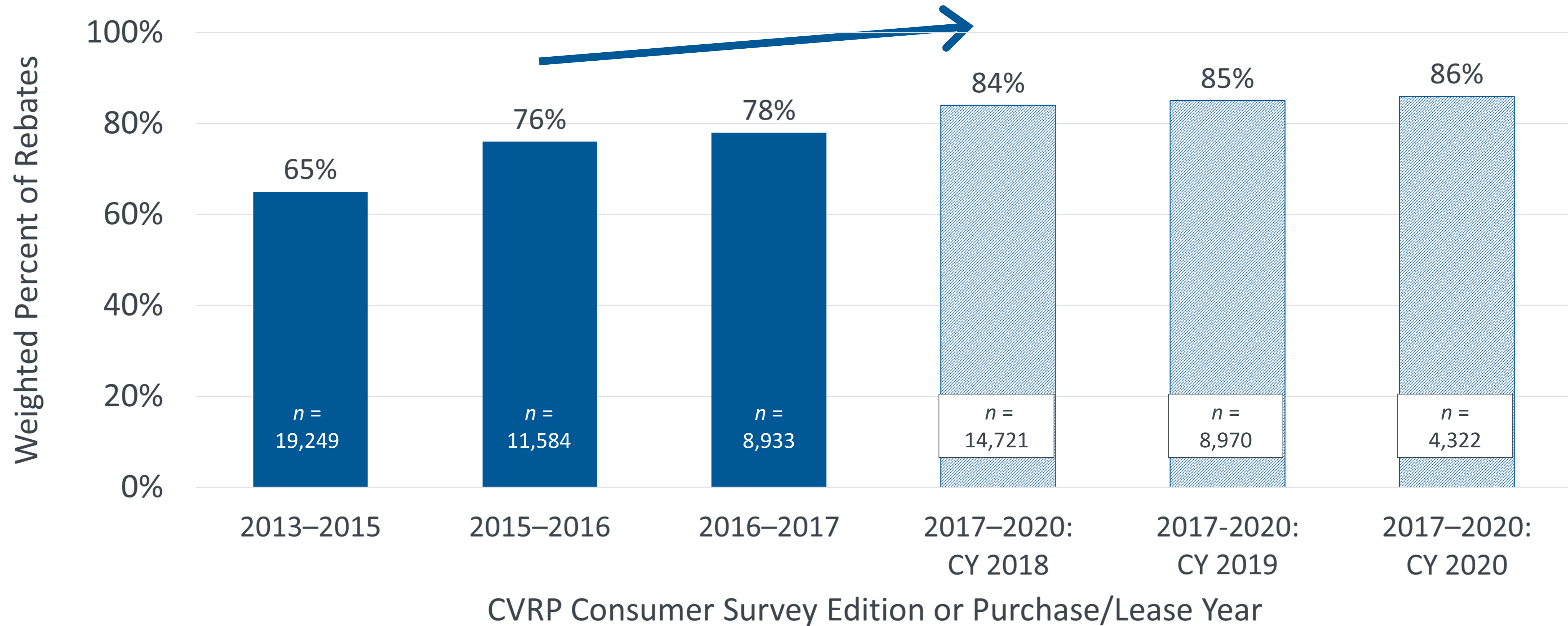


Overall datasets: 72,552 total survey respondents weighted to represent 376,800 rebate recipients.  
2013-15 Edition:  $n = 19,249$ . 2015-16 Edition:  $n = 11,584$ . 2016-17 Edition:  $n = 8,933$ . 2017-20 Edition: weighted  $n = 32,446$ .  $n$ -values are filtered and question-specific.

# Vehicle Replacement is Increasing

(recent-year breakdown)

Replaced a vehicle with their rebated *plug-in EV*

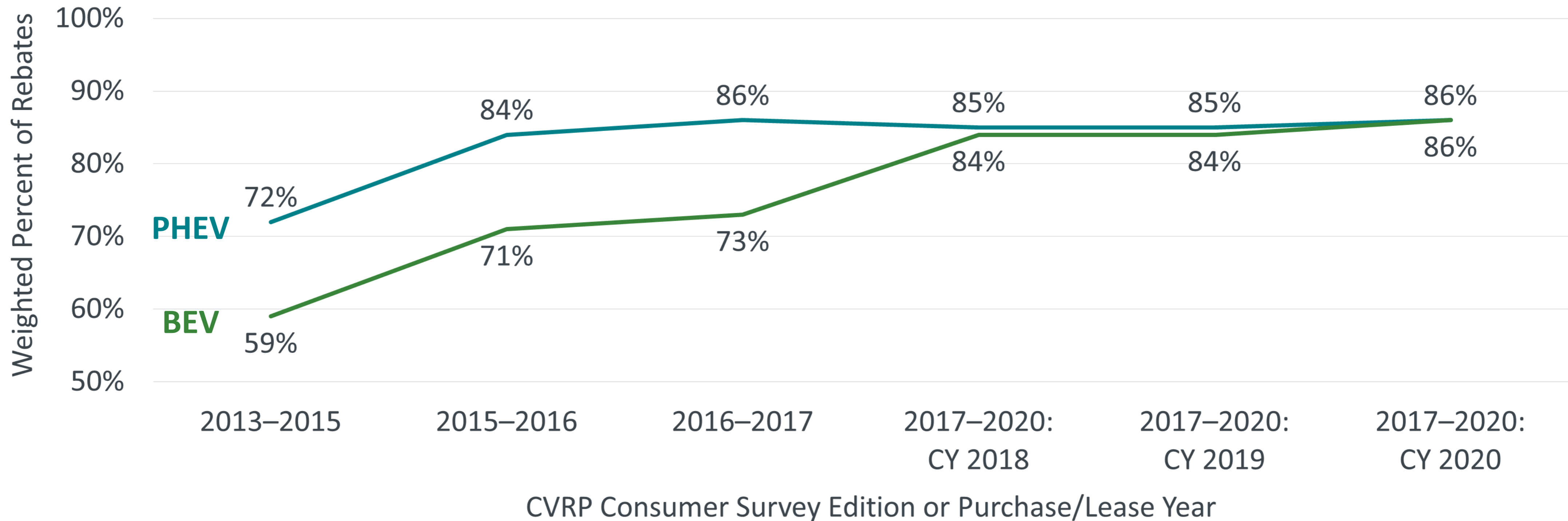


Overall datasets: 72,552 total survey respondents weighted to represent 376,800 rebate recipients.  
*n*-values are filtered and question-specific. CY 2020 weights specific to 2020 purchases/leases.



# Vehicle Replacement Has Long Been High for PHEVs, BEVs Gradually Caught Up

Replaced a vehicle with their rebated *plug-in EV*



CVRP Consumer Survey, 2013–2015 Edition: *n* = 19,249. 2015–2016 Edition: *n* = 11,584. 2016–2017 Edition: *n* = 8,933. 2017–2020 Edition: CY 2018 *n* = 14,721; CY 2019 *n* = 8,970; CY 2020 *n* = 4,322.

*n*-values are filtered and question-specific. CY 2020 weights specific to 2020 purchases/leases.





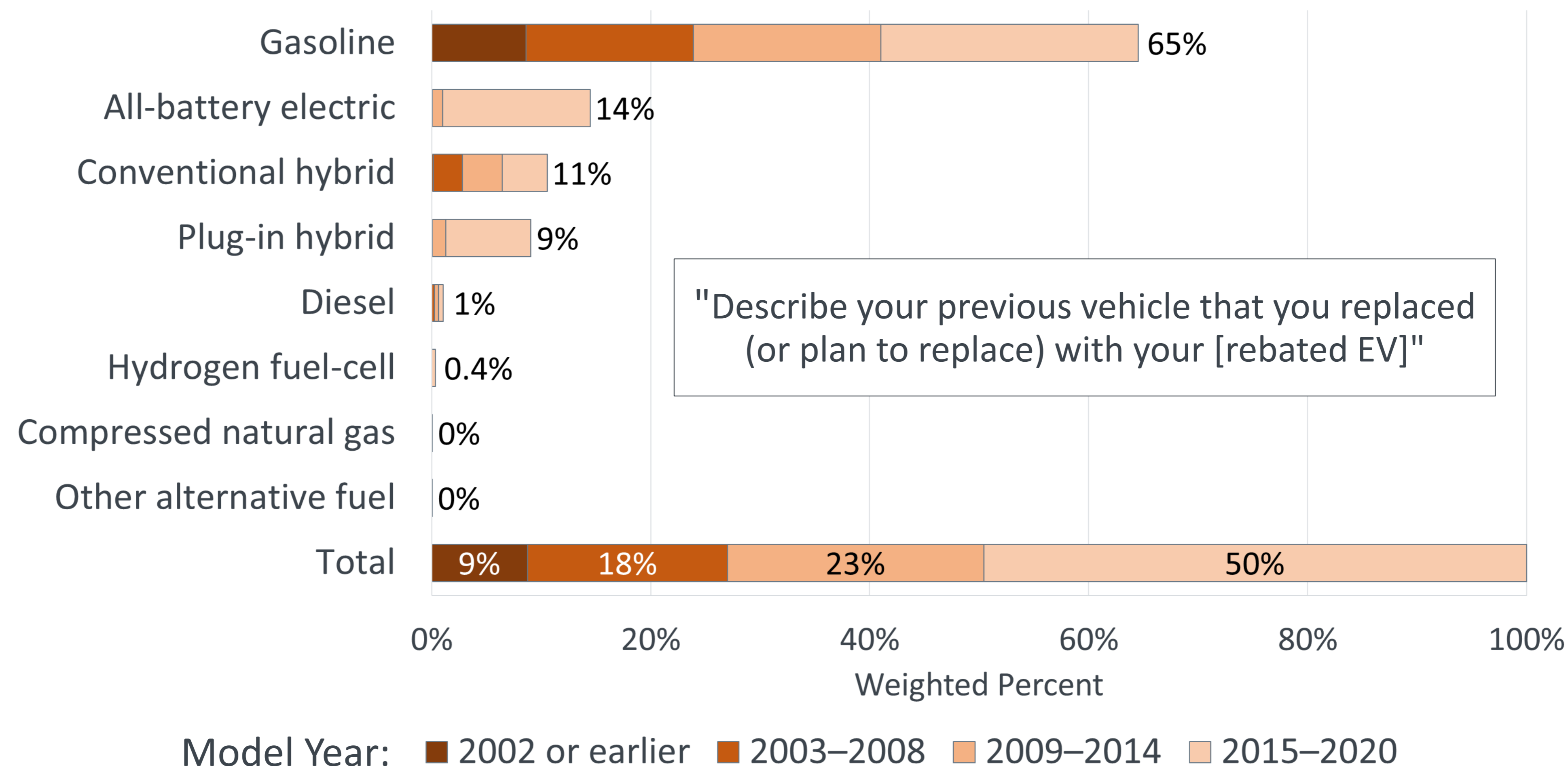
# Vehicle Age & Types Replaced

(during the onset of COVID-19)



# What Vehicles Have Rebates Helped Replace?

2020 Plug-in Electric Vehicle Purchases/Leases

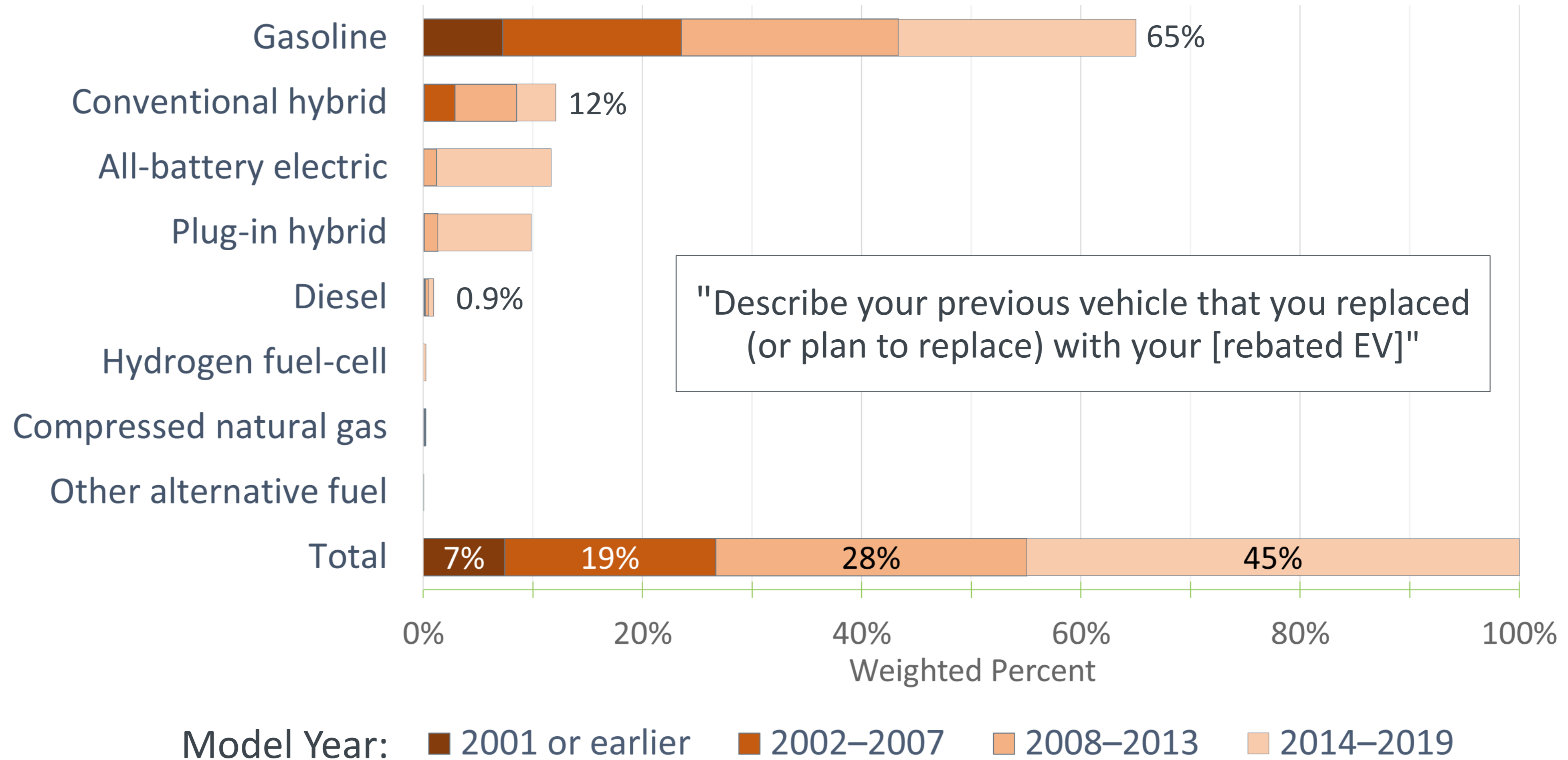


Follow-on replacement questions shown only to those that responded they replaced a vehicle with their rebated EV.  
CVRP Consumer Survey, 2017-2020 Edition. Filtered, question-specific, *n* = 3,146.



# What Vehicles Have Rebates Helped Replace?

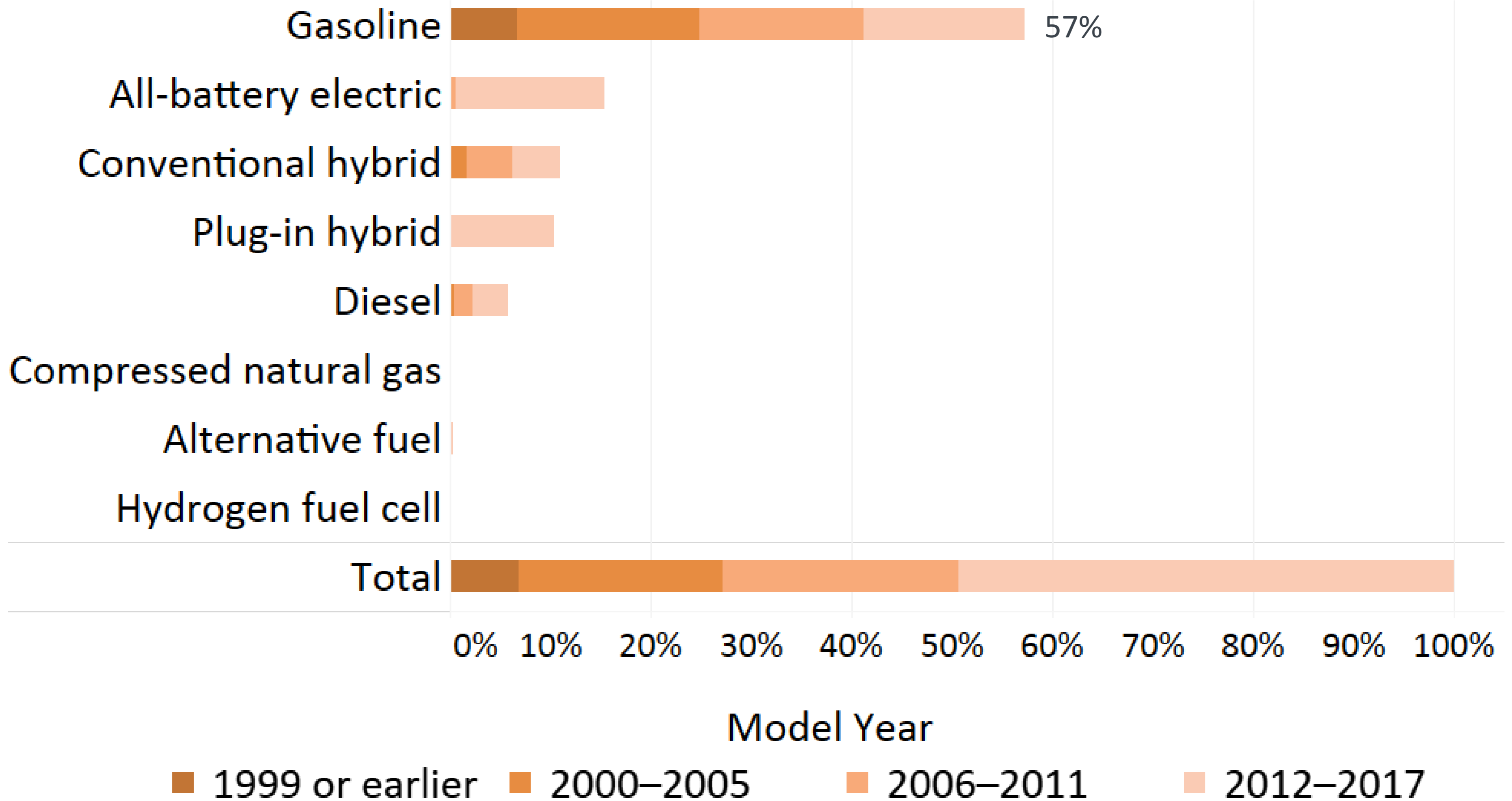
## 2019 Plug-in Electric Vehicle Purchases/Leases



Follow-on replacement questions shown only to those that responded they replaced a vehicle with their rebated EV.  
CVRP Consumer Survey: 2017–2019 edition. Filtered, question-specific, weighted n = 4,465.

# What Vehicles Have Rebates Helped Replace?

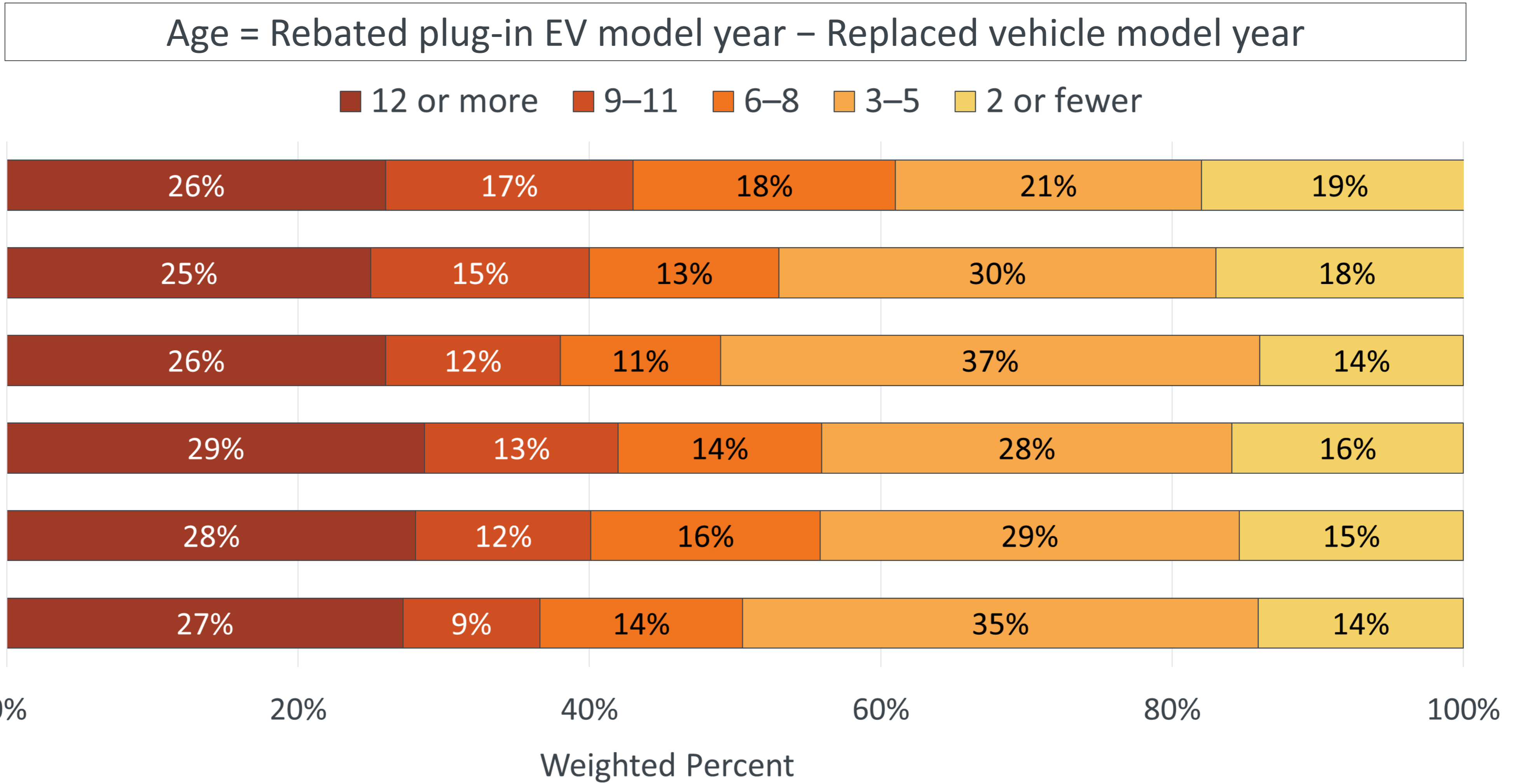
## Plug-in Electric Vehicle Purchases/Leases (2016–17 Survey Edition)





# Replaced Vehicle Age

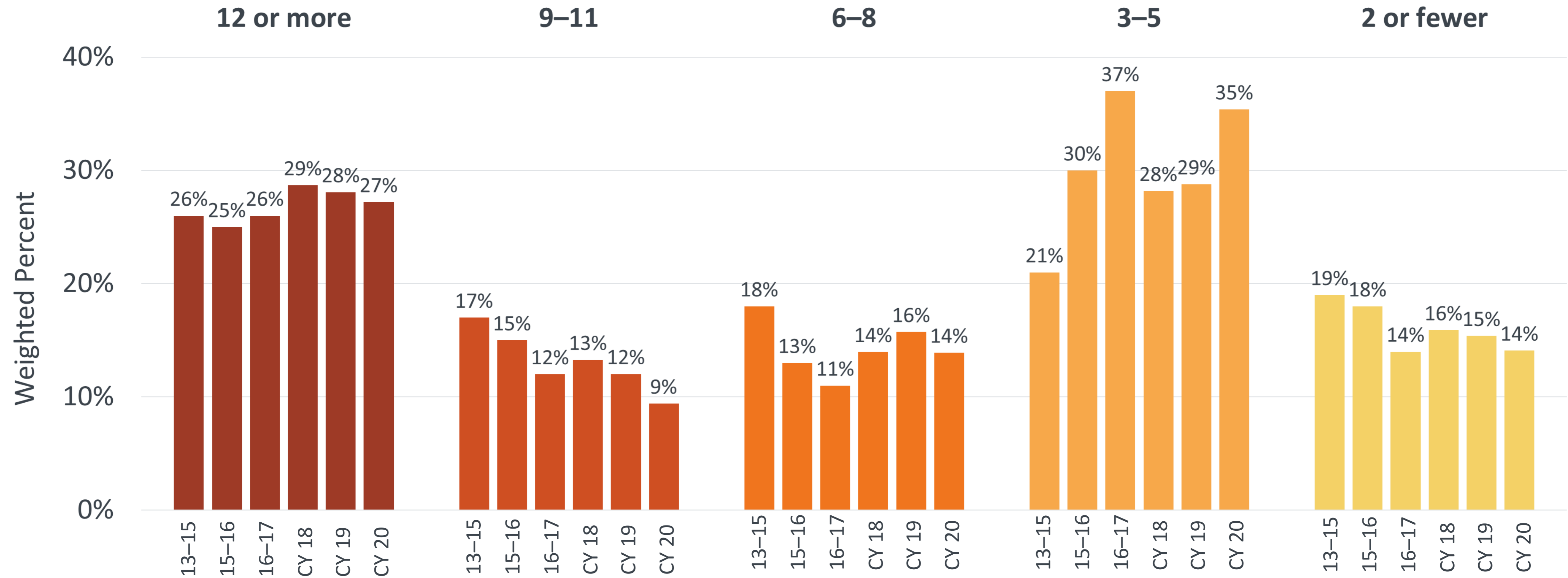
(stacked)



Follow-on replacement questions shown only to those that responded they replaced a vehicle with their rebated EV. CVRP Consumer Survey. 2013–2015 Edition: *n* = 12,273. 2015–2016 Edition: *n* = 8,651. 2016–2017 Edition: *n* = 6,968. 2017–2020 Edition: CY 2018 *n* = 10,964; CY 2019 *n* = 6,507; CY 2020 *n* = 3,149. *n*-values are filtered and question-specific. CY 2020 weights specific to 2020 purchases/leases.

# Replaced Vehicle Age

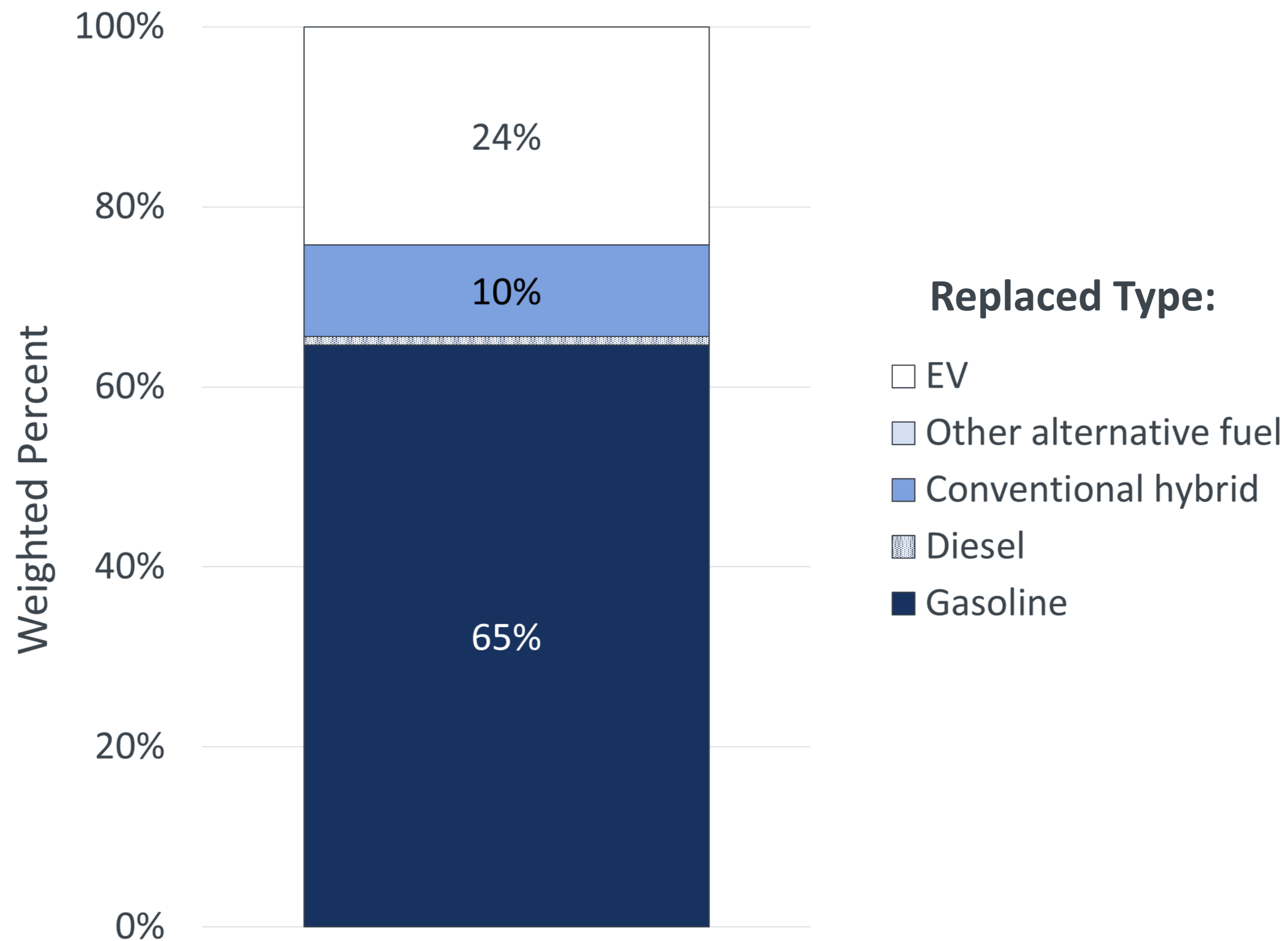
Age = Rebated plug-in EV model year – Replaced vehicle model year



Follow-on replacement questions shown only to those that responded they replaced a vehicle with their rebated EV. CVRP Consumer Survey, 2013–2015 Edition:  $n = 12,273$ . 2015–2016 Edition:  $n = 8,651$ . 2016–2017 Edition:  $n = 6,968$ . 2017–2020 Edition: CY 2018  $n = 10,964$ ; CY 2019  $n = 6,507$ ; CY 2020  $n = 3,149$ .  $n$ -values are filtered and question-specific. CY 2020 weights specific to 2020 purchases/leases.

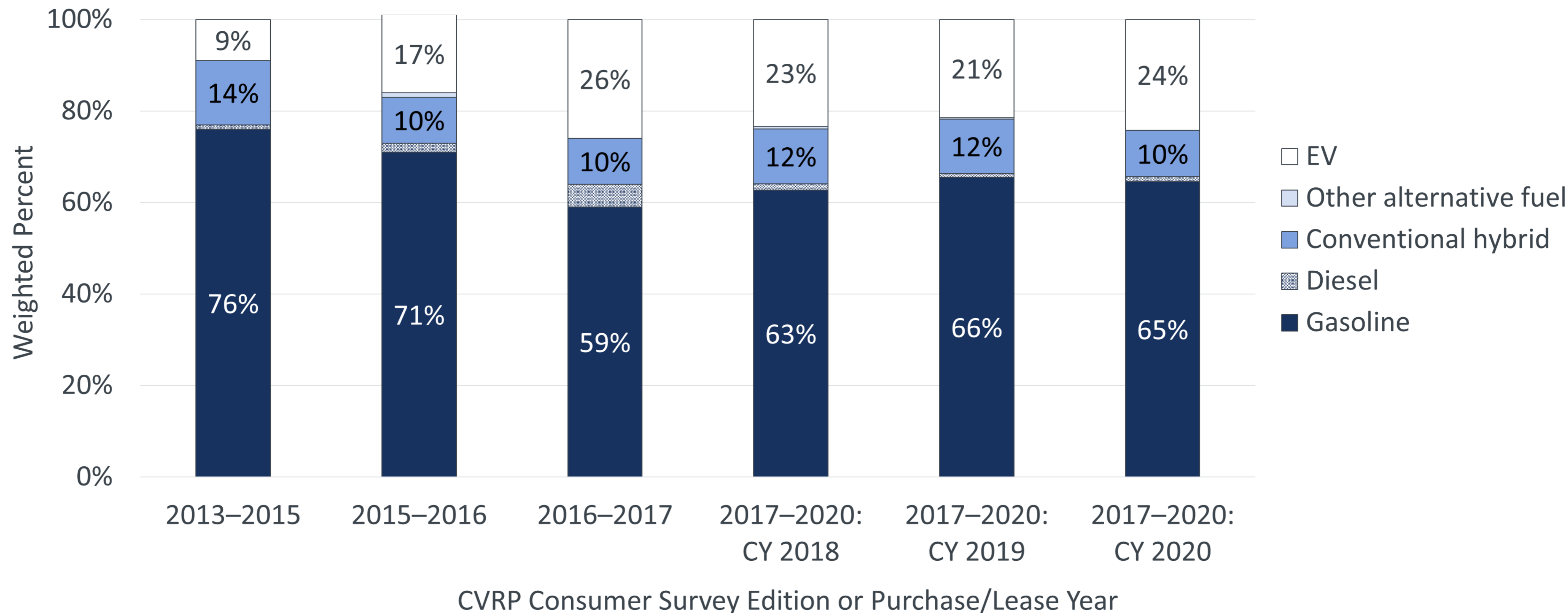


# Vehicles Replaced by 2020 Plug-in EV Purchases/Leases



Follow-on replacement questions shown only to those that responded they replaced a vehicle with their rebated EV.  
CVRP Consumer Survey, 2017–2020 Edition. Filtered, question-specific  $n = 3,725$ .

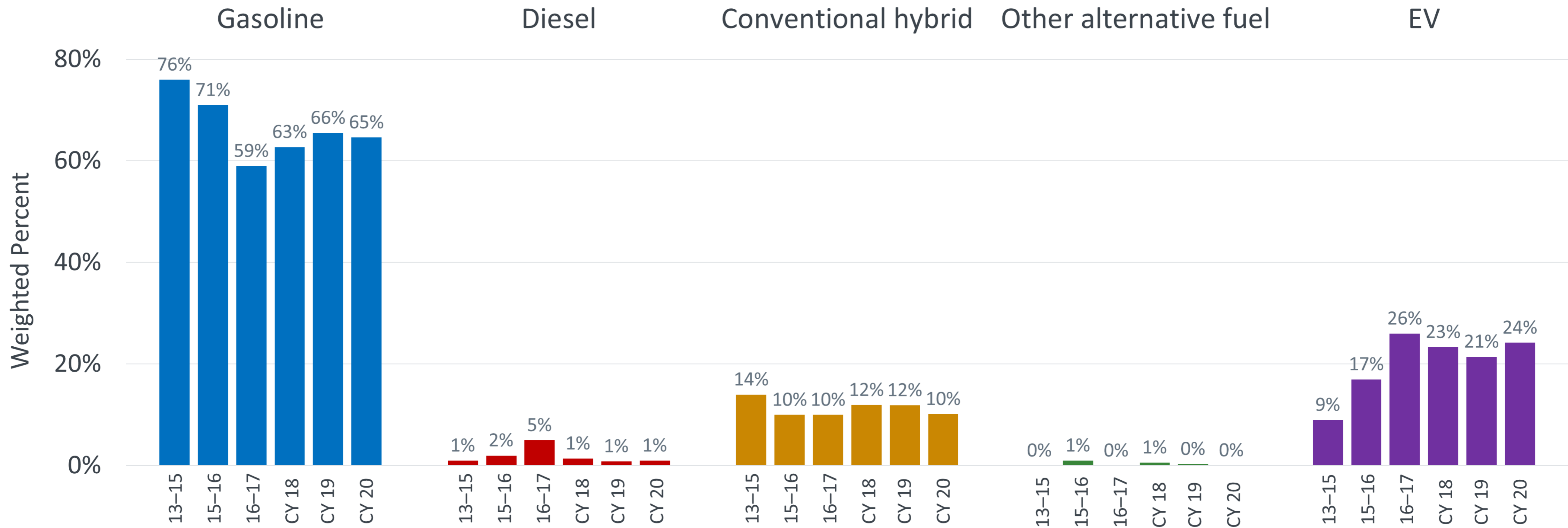
# What Vehicle Types Have Plug-in EV Rebates Helped Replace? (stacked)



Follow-on replacement questions shown only to those that responded they replaced a vehicle with their rebated EV. CVRP Consumer Survey, 2013–2015 Edition:  $n = 12,350$ . 2015–2016 Edition:  $n = 8,620$ . 2016–2017 Edition:  $n = 6,958$ . 2017–2020 Edition: CY 2018  $n = 12,321$ ; CY 2019  $n = 7,616$ ; CY 2020  $n = 3,725$ .  $n$ -values are filtered and question-specific. CY 2020 weights specific to 2020 purchases/leases.

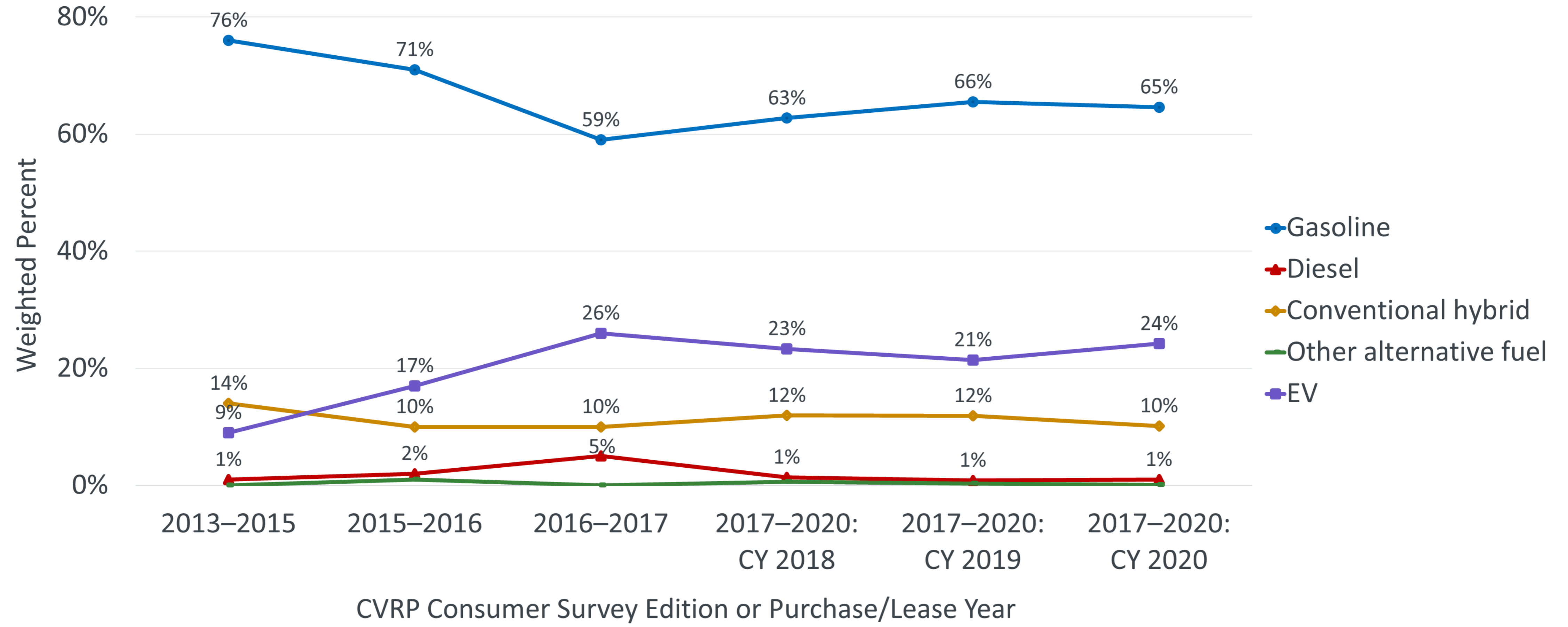


# What Vehicle Types Have Plug-in EV Rebates Helped Replace?



Follow-on replacement questions shown only to those that responded they replaced a vehicle with their rebated EV. CVRP Consumer Survey, 2013–2015 Edition: *n* = 12,350. 2015–2016 Edition: *n* = 8,620. 2016–2017 Edition: *n* = 6,958. 2017–2020 Edition: CY 2018 *n* = 12,321; CY 2019 *n* = 7,616; CY 2020 *n* = 3,725. *n*-values are filtered and question-specific. CY 2020 weights specific to 2020 purchases/leases.

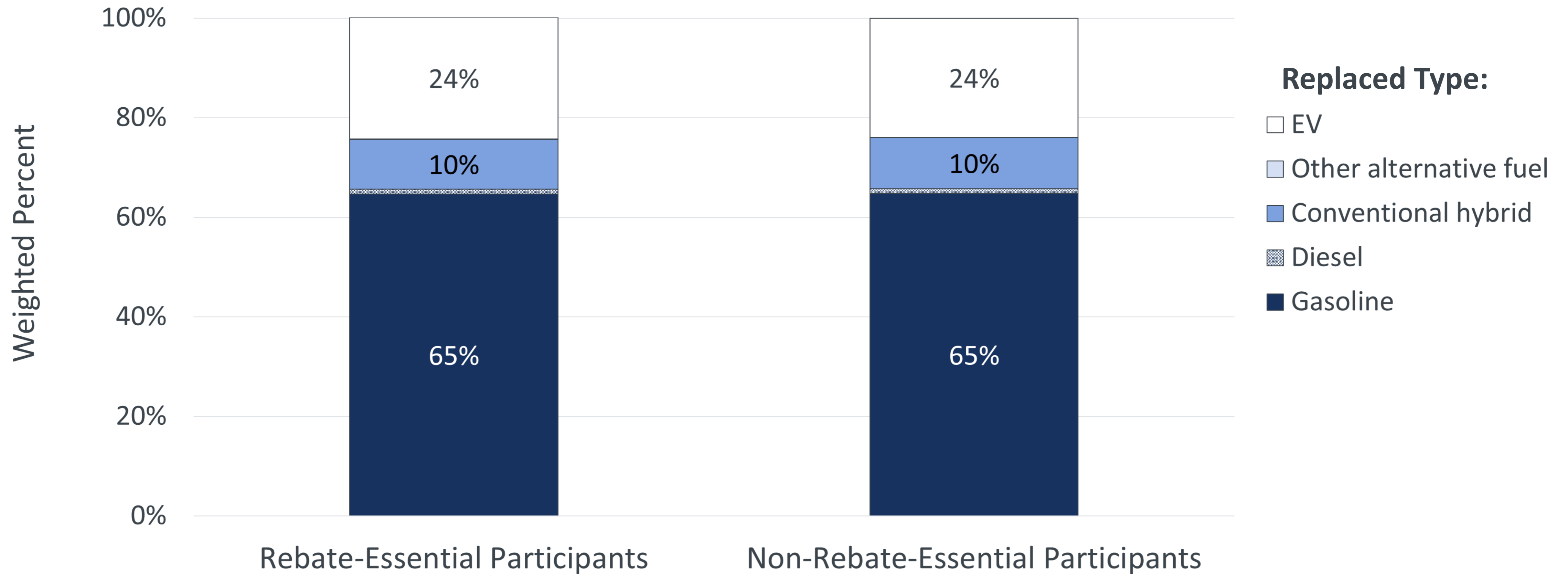
# What Vehicle Types Have Plug-in EV Rebates Helped Replace? (line)



Follow-on replacement questions shown only to those that responded they replaced a vehicle with their rebated EV. CVRP Consumer Survey, 2013–2015 Edition: *n* = 12,350. 2015–2016 Edition: *n* = 8,620. 2016–2017 Edition: *n* = 6,958. 2017–2020 Edition: CY 2018 *n* = 12,321; CY 2019 *n* = 7,616; CY 2020 *n* = 3,725. *n*-values are filtered and question-specific. CY 2020 weights specific to 2020 purchases/leases.



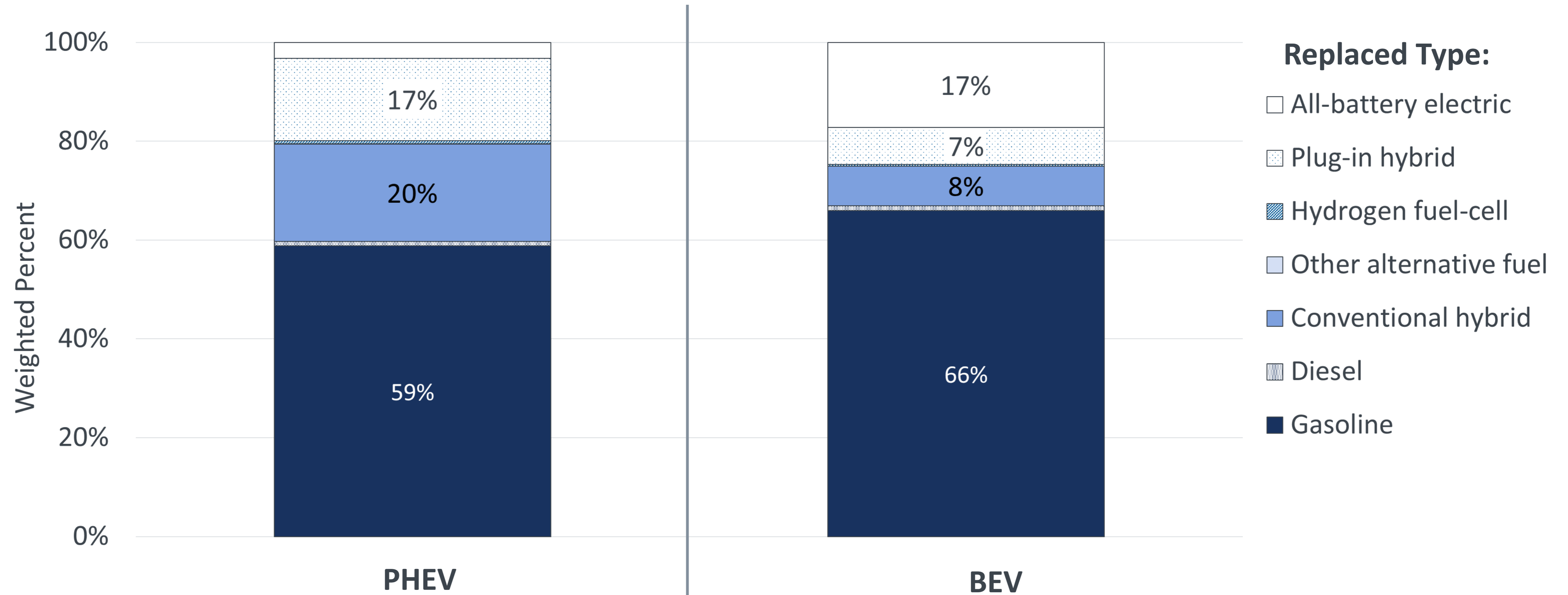
# What Vehicle Types Have “Essential” Rebates for Plug-in EVs Helped Replace? 2020 Purchases/Leases



Follow-on replacement questions shown only to those that responded they replaced a vehicle with their rebated EV.  
CVRP Consumer Survey, 2017–2020 Edition. Filtered, question-specific  $n = 3,704$ .

# Replaced-Vehicle Technology Types by Rebated-Vehicle Technology Type

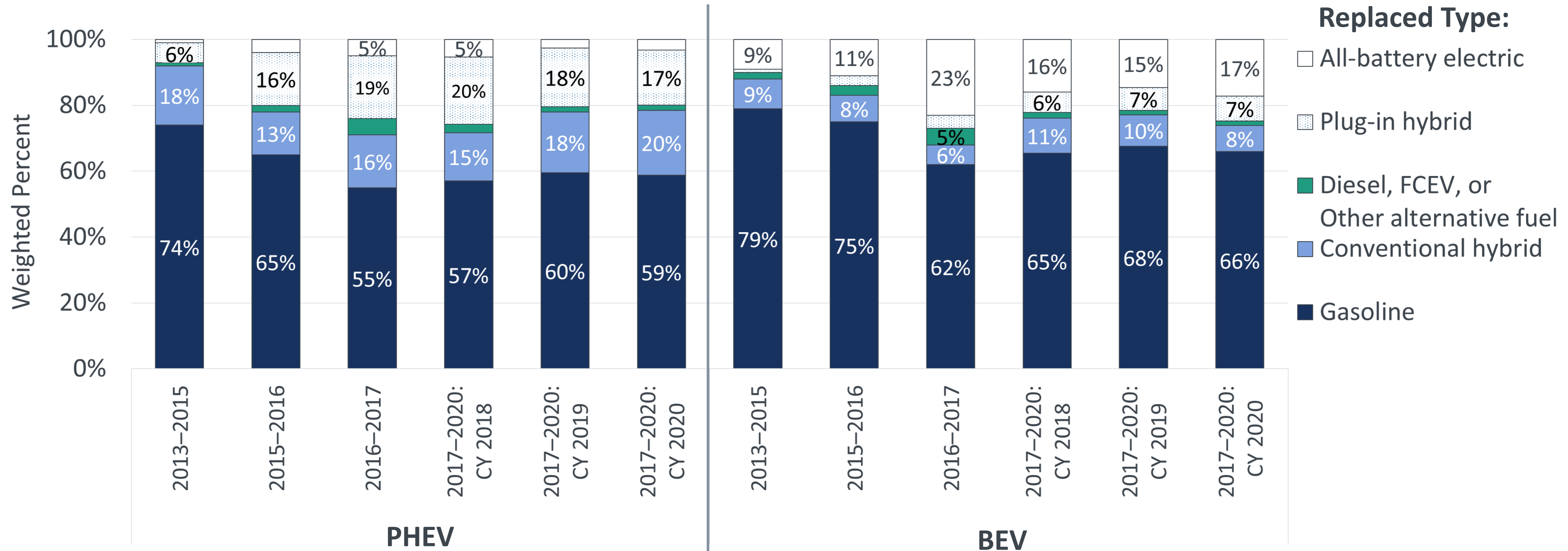
## 2020 Purchases/Leases



Follow-on replacement questions shown only to those that responded they replaced a vehicle with their rebated EV.  
 CVRP Consumer Survey, 2017–2020 Edition. Filtered, question-specific *n* = 3,725.

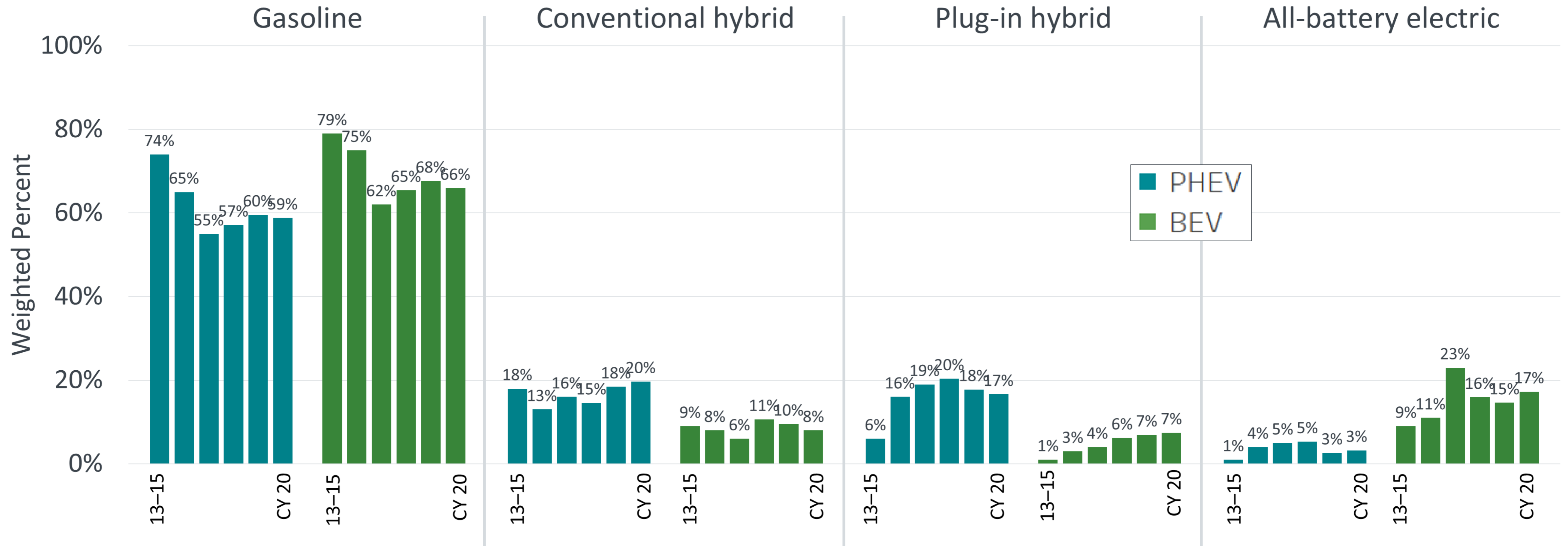


# Replaced-Vehicle Technology Types by Rebated-Vehicle Technology Type Over Time



Follow-on replacement questions shown only to those that responded they replaced a vehicle with their rebated EV. CVRP Consumer Survey, 2013–2015 Edition: *n* = 12,350. 2015–2016 Edition: *n* = 8,620. 2016–2017 Edition: *n* = 6,958. 2017–2020 Edition: CY 2018 *n* = 12,321; CY 2019 *n* = 7,616; CY 2020 *n* = 3,725. *n*-values are filtered and question-specific. CY 2020 weights specific to 2020 purchases/leases.

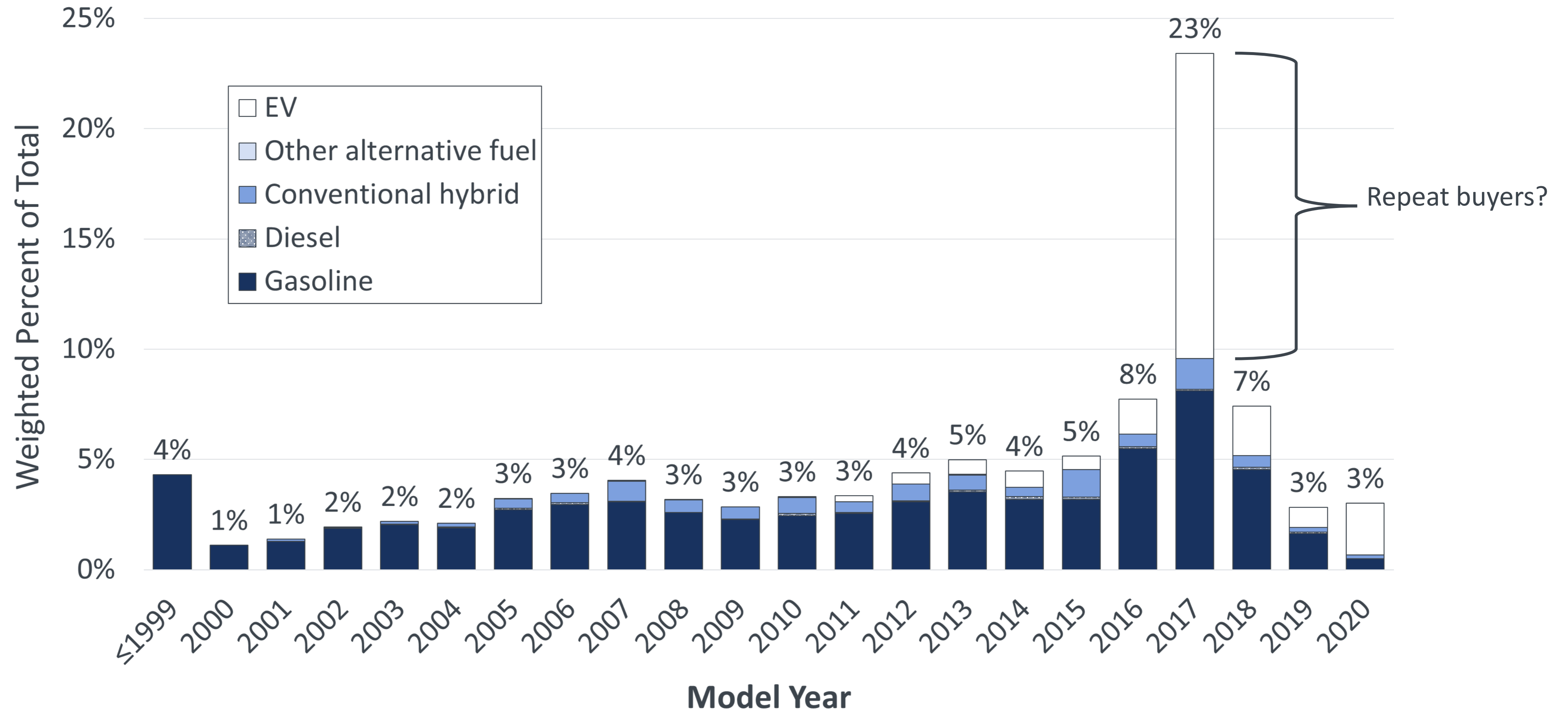
# Top 4 Replaced-Vehicle Technology Types by Rebated-Vehicle Technology Type



Follow-on replacement questions shown only to those that responded they replaced a vehicle with their rebated EV. CVRP Consumer Survey, 2013–2015 Edition:  $n = 12,350$ . 2015–2016 Edition:  $n = 8,620$ . 2016–2017 Edition:  $n = 6,958$ . 2017–2020 Edition: CY 2018  $n = 12,321$ ; CY 2019  $n = 7,616$ ; CY 2020  $n = 3,725$ .  $n$ -values are filtered and question-specific. CY 2020 weights specific to 2020 purchases/leases.



# Model-Year Distribution of Vehicles Replaced by 2020 Plug-in EV Purchases/Leases



CVRP Consumer Survey, 2017–2020 Edition. Filtered, question-specific *n* = 3,146.



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

# Summary & Select Findings



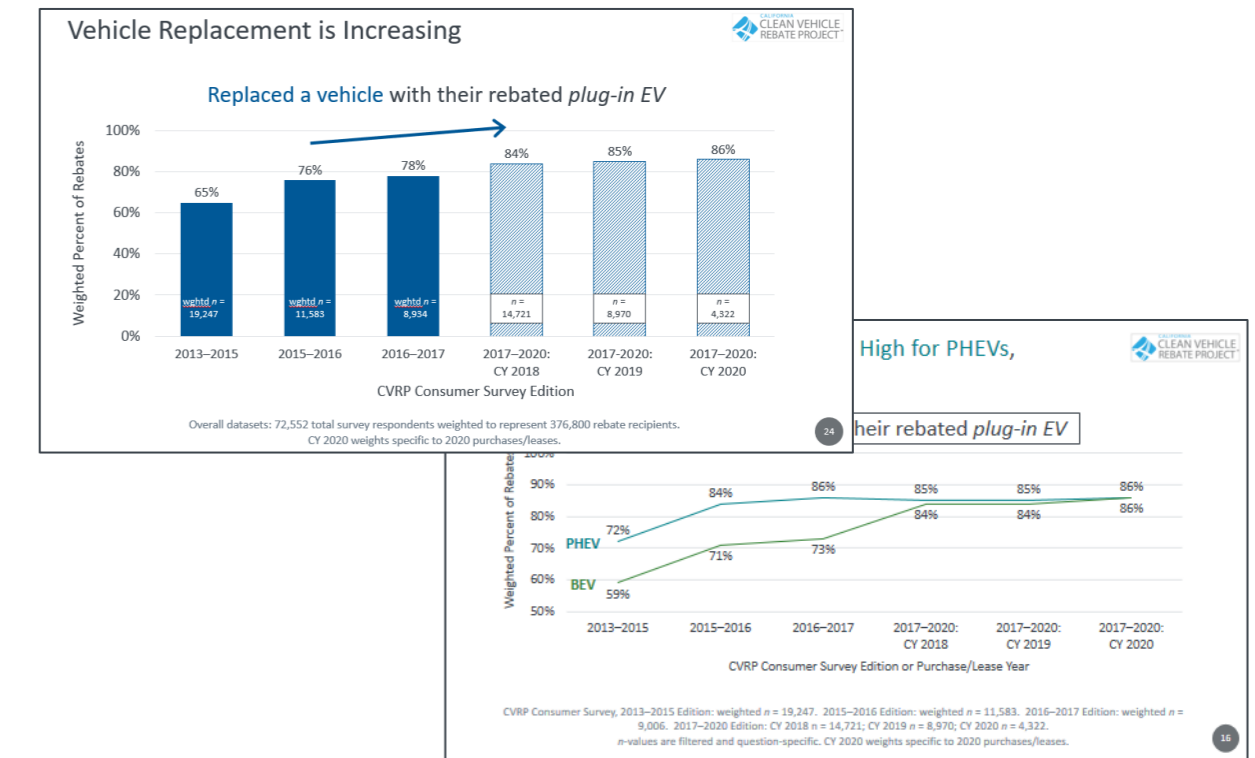
# Summary & Select Findings: Vehicle Replacement (at the onset of COVID-19)

## Context

- Program design and COVID-19 shaped impacts in 2020

## Replacement Rates

- Replacement rates continue increasing — up to 86% in 2020.
  - PHEVs produced strong replacement rates early, BEVs gradually caught up

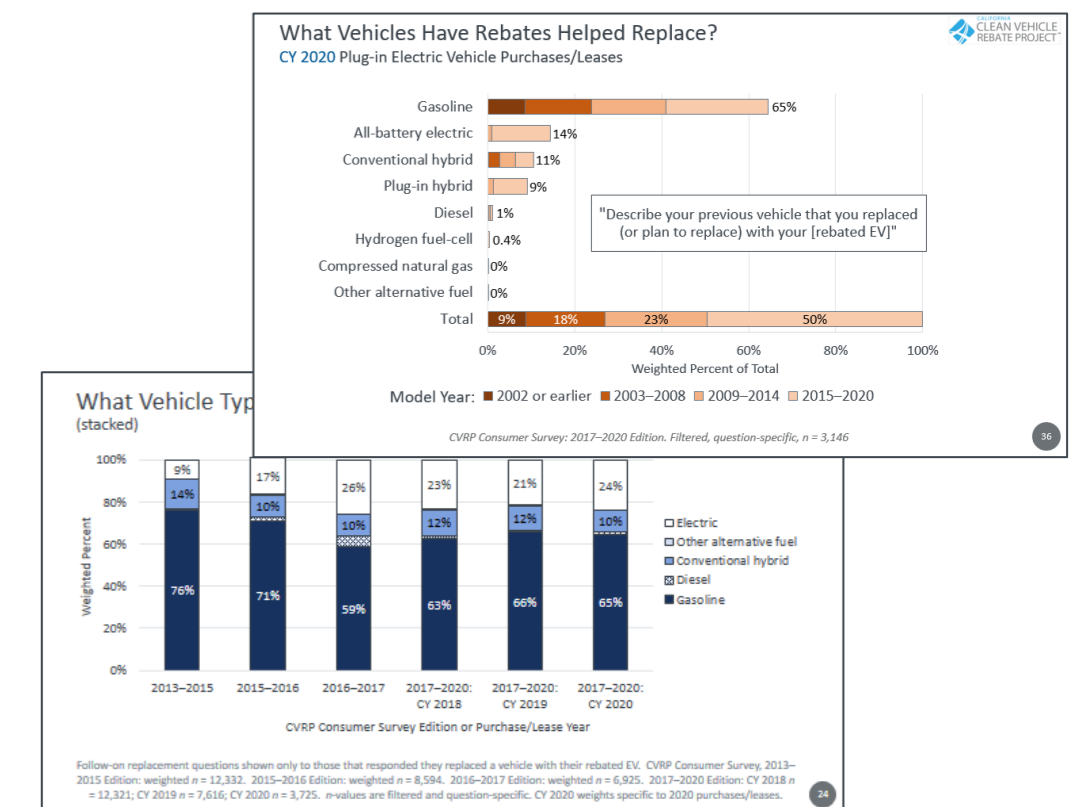


## Replaced Age

- 1/2 were 6+ years old
  - > 1/4<sup>th</sup> were 12+ years old

## Replaced Types

- > 3/4<sup>ths</sup> of replaced vehicles were **gasoline-fueled** (incl. conventional hybrid)
  - ~2/3<sup>rds</sup> were non-hybrid gasoline
- PHEVs replaced more gasoline vehicles overall (incl. hybrids) and PHEVs
- BEVs replaced more non-hybrid gasoline vehicles and BEVs



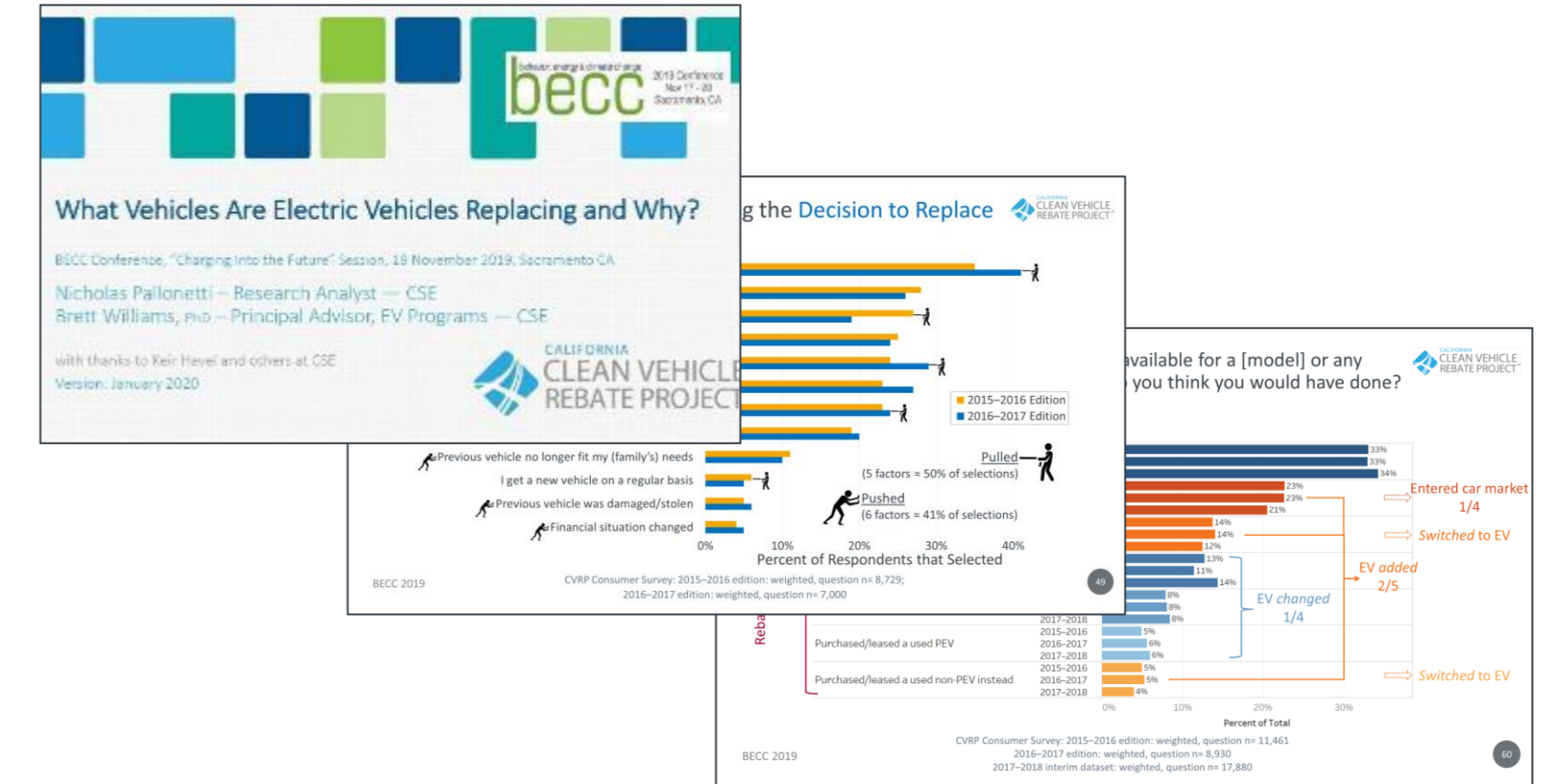
Bottom line: Most rebated EVs replaced older, more polluting vehicles



# Related Research: Replacement Behavior & Impacts

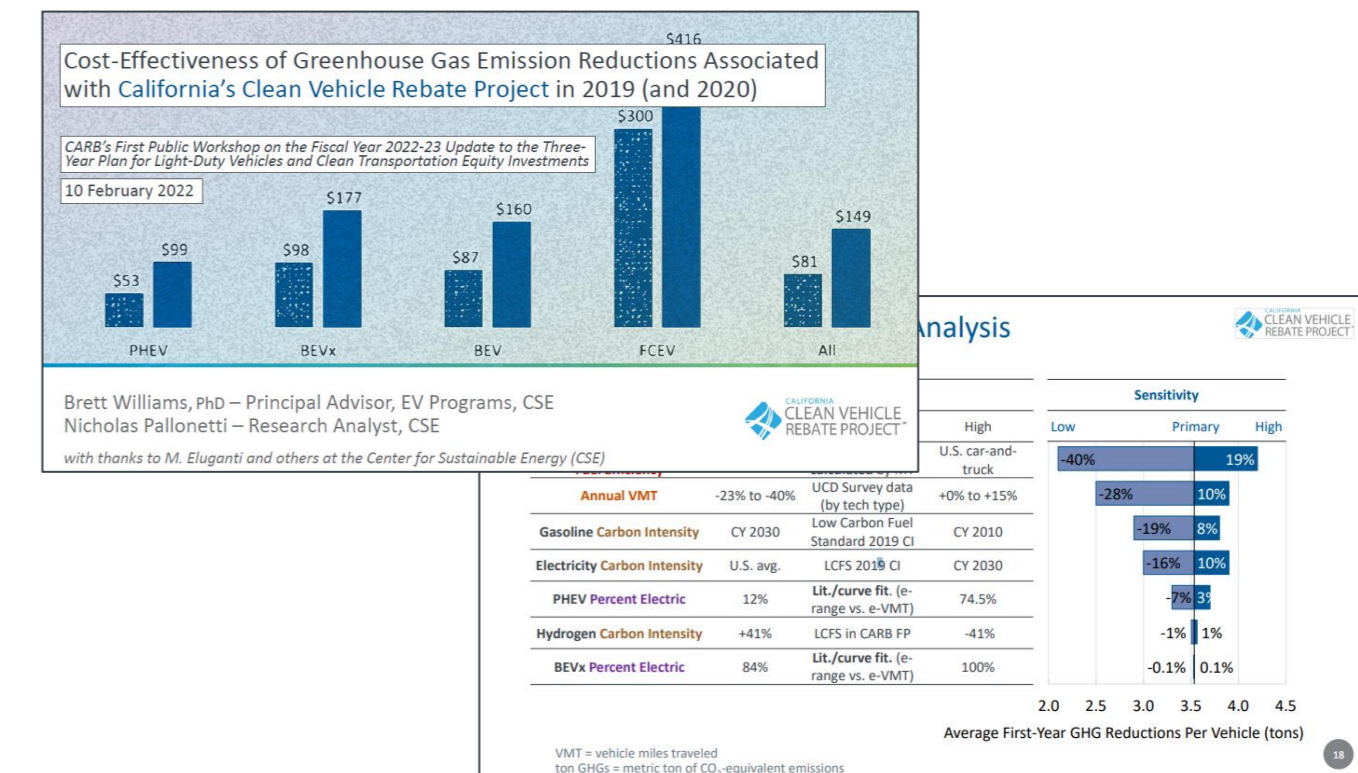
## What Vehicles Are Electric Vehicles Replacing and Why? (BECC 2019)

- Replacement motivations and what might have happened without the rebate



## Cost-Effectiveness of Greenhouse Gas Emission Reductions Associated with California's Clean Vehicle Rebate Project in 2019 (and 2020) (CARB workshop 2022)

- When compared to buying a new gasoline vehicle, rebated EVs may be saving 30–33 tons of GHG emissions per vehicle at a cost of \$99–\$160/ton of *Rebate Essential* GHG reductions





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 warm, golden light and lens flare effects. In the background, a public charging station with several orange charging cables is visible, along with a bicycle parked nearby. The overall atmosphere is clean and modern, representing sustainable urban transportation.

# Additional Details & Resources



# Funding Availability Has Been Regularly Disrupted

(as of Sept. 2021)



## Table 4: CVRP Waitlists

Waitlist Year	Start Date	End Date	Length in Days
2011*	Jun. 20	Sept. 30	102
2013*	May 1	Jun. 30	60
2014	Mar. 28	Jul. 22	116
2016	Jun. 11	Sept. 28	109
2017**	Jun. 30	Nov. 20	143
2019**	Jun. 5	Sept. 23	110
2021	Apr. 23	Sept. 15	145

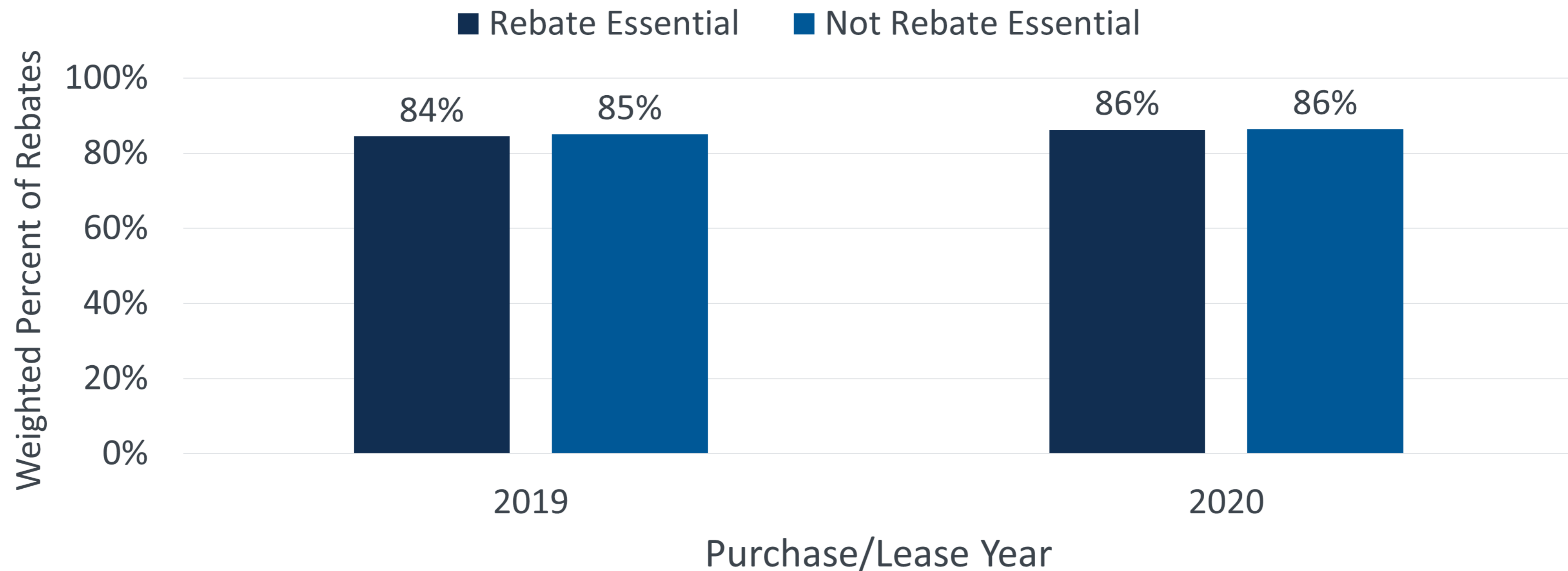
\* *Dates approximate.*

\*\* *For standard applications only; no waitlist for income-qualified increased rebates.*



# Vehicle Replacement is Consistent Across Measures of Rebate Influence

## Replaced a vehicle with their rebated *plug-in EV*



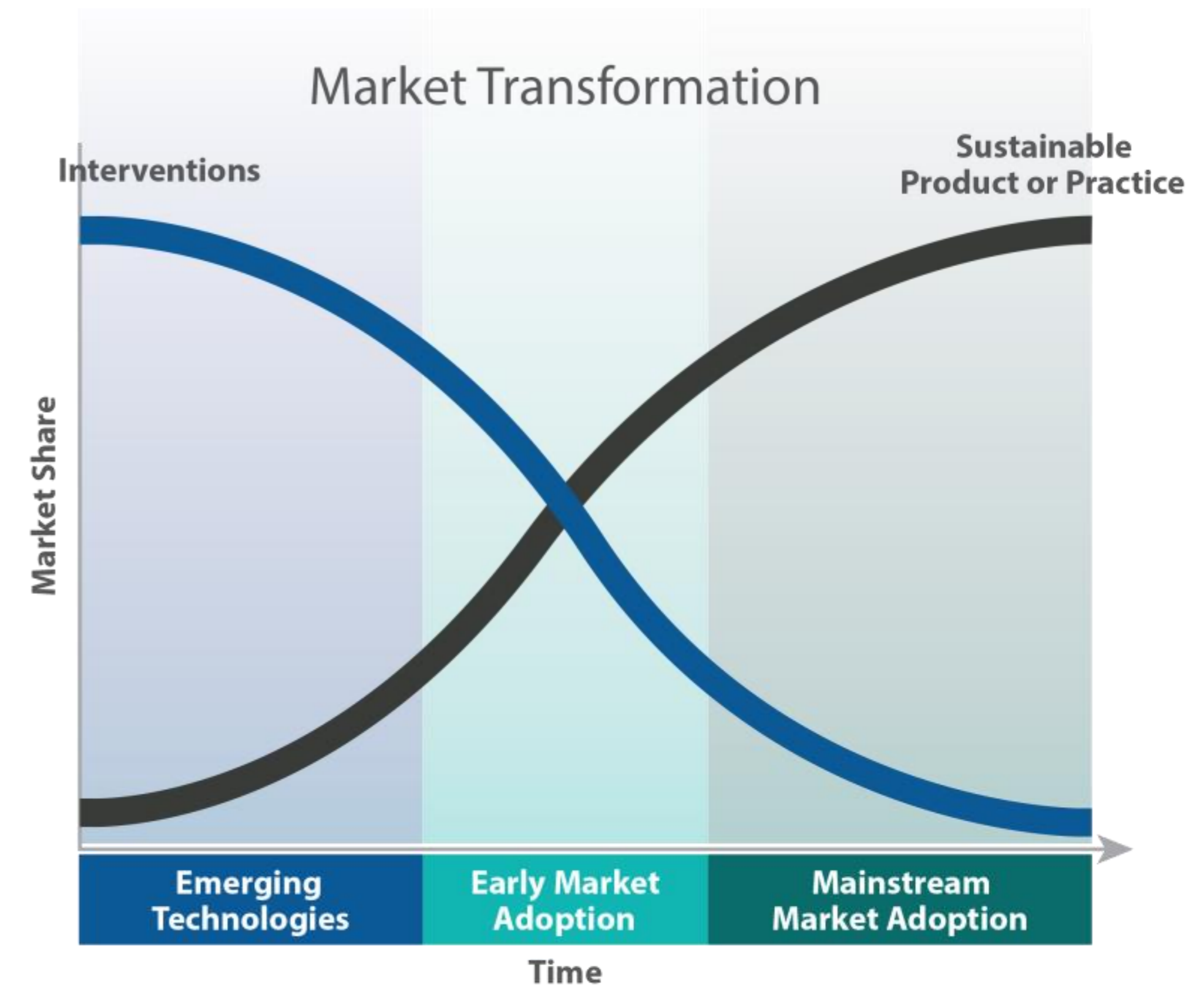
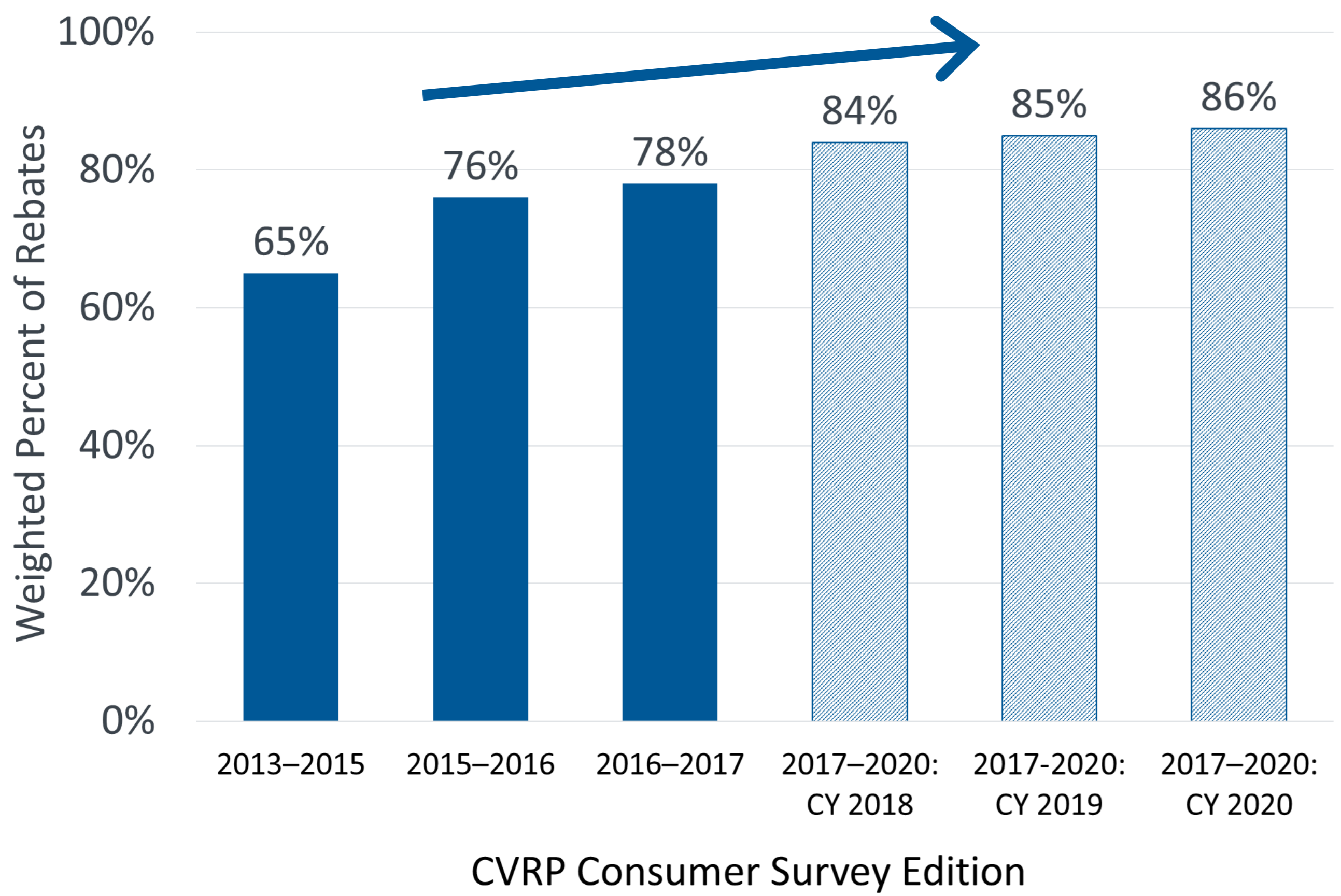
CVRP Consumer Survey, 2017–2020 Edition. 2019  $n = 8,909$ . 2020  $n = 4,295$ .  
 $n$ -values are filtered and question-specific. 2020 weights specific to 2020 purchases/leases.

# Incentive impact is increasing: Is it too soon to phase them out?

Replaced a vehicle with their *plug-in EV*

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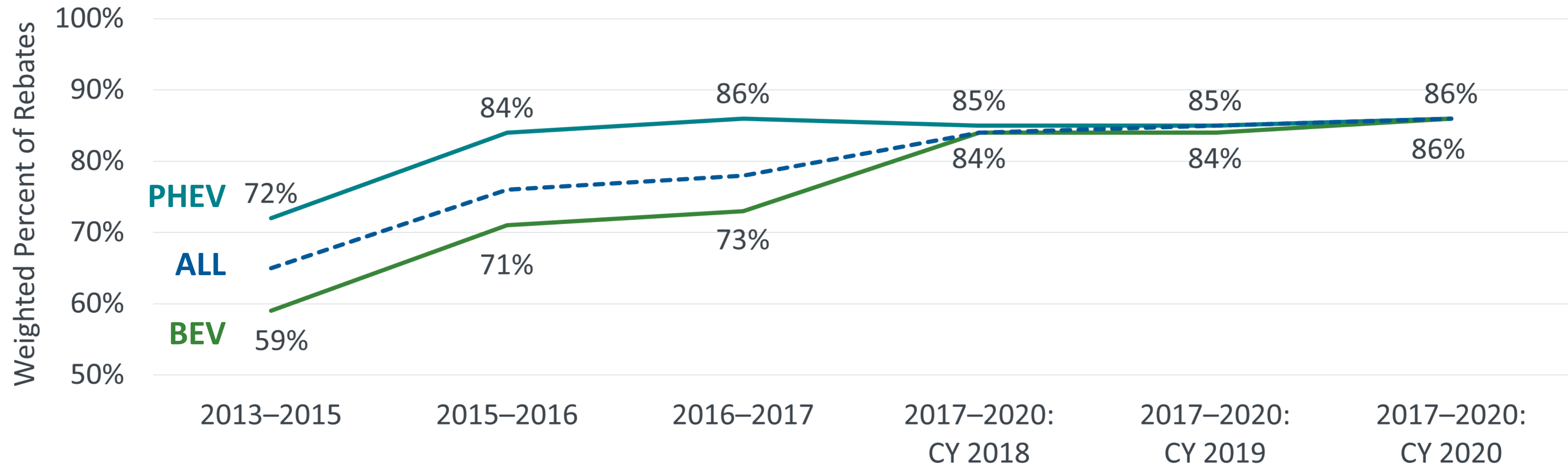
Common paradigm



Overall datasets: 72,552 total survey respondents weighted to represent 376,800 rebate recipients. CY 2020 weights specific to 2020 purchases/leases.

# Vehicle Replacement Has Long Been High for PHEVs, BEVs Gradually Caught Up

Replaced a vehicle with their rebated *plug-in EV*



CVRP Consumer Survey Edition or Purchase/Lease Year

CVRP Consumer Survey, 2013–2015 Edition:  $n = 19,249$

2015–2016 Edition:  $n = 11,584$

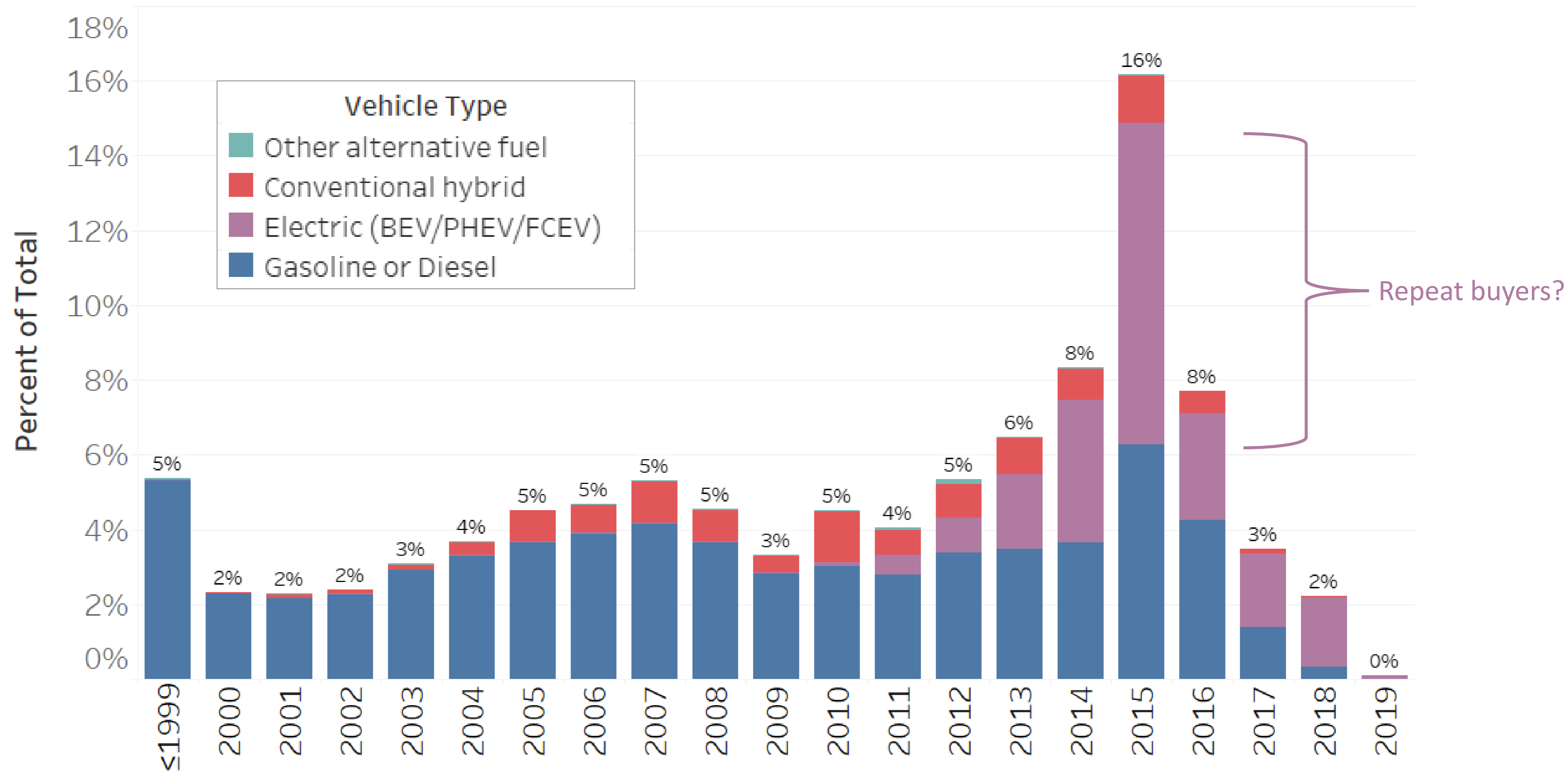
2016–2017 Edition:  $n = 8,933$

2017–2020 Edition: CY 2018  $n = 14,721$ ; CY 2019  $n = 8,970$ ; CY 2020  $n = 4,322$ .

$n$ -values are filtered and question-specific. CY 2020 weights specific to 2020 purchases/leases.







# Model-Year Distribution of Vehicles Replaced by 2017–18 Edition Survey Respondents



# Consumer Survey Data

(shows rebates to individuals only)

					<b>Total</b>
<b>Vehicle Purchase/Lease Dates</b>	Sep. 2012* – Dec. 2019	Jun. 2014 – Apr. 2020	May 2015 – Sep. 2018	Mar. 2017 – Dec. 2019	Sep. 2012* – Apr. 2020
<b>Survey Responses (total n)**</b>	66,902	6,616	1,565	5,474	80,557
<b>Program Population (N)***</b>	339,200	16,100	3,500	21,800	380,700

Includes fuel-cell EVs (CVRP only).

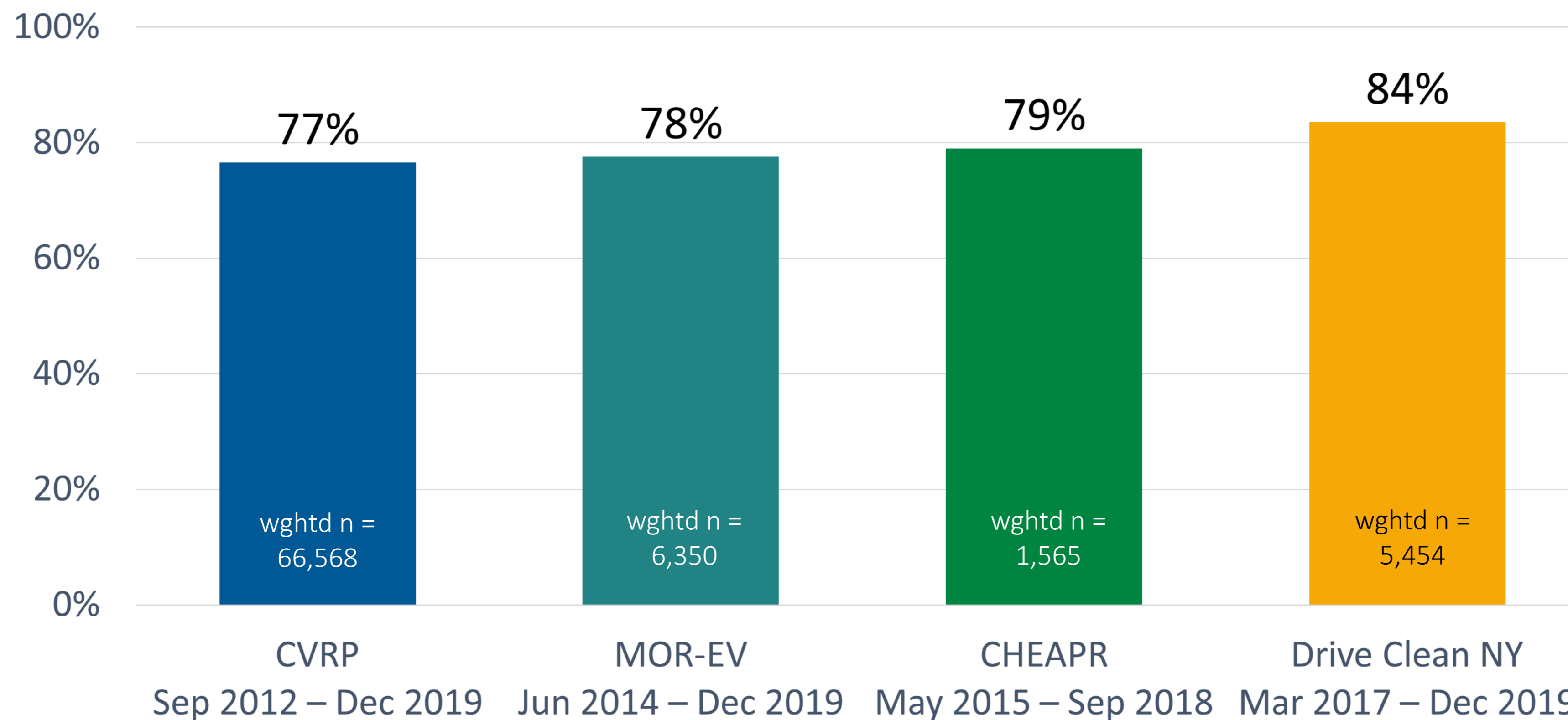
\*Two fuel-cell EVs rebated by CVRP with purchase/lease dates from Dec. 2010 – Sep. 2012 are included.

\*\* Subsequently weighted to represent the program population along the dimensions of vehicle category, model, buy vs. lease, and county.

\*\*\* Small numbers of rebated vehicles are not represented in the time frames due to application lags. Rounded to nearest 100.

# Across Four States, Do EVs Get Used?

Replaced a vehicle with their rebated *clean vehicle*



*Weighted n-values are filtered and question-specific.*

*Overall datasets: 80,557 total survey respondents weighted to represent 380,700 rebate recipients.*



# Select Publications (reverse chronological, as of 3/2022)



- N. Pallonetti and B.D.H. Williams (2022, Jan.), [“Evaluating the Cost-Effectiveness of Greenhouse Gas Emission Reductions Associated with Statewide Electric Vehicle Rebate Programs in California and Massachusetts in 2019,”](#) for *International Energy Program Evaluation Conference 2022*.
- Williams, B. D. H. (2022, Jan.), [Brief: PHEV Consumers Most Highly Influenced by the U.S. Federal Tax Credit.](#) Clean Vehicle Rebate Project
- B.D.H. Williams (2021, Oct.), [An Electric-Vehicle Consumer Segmentation Roadmap: Strategically Amplifying Participation in the New York Drive Clean Rebate Program,](#) NYSERDA Report 21-30.
- N. Pallonetti and B. D. H. Williams (2021, Jul.), [“Refining Estimates of Fuel-Cycle Greenhouse-Gas Emission Reductions Associated with California’s Clean Vehicle Rebate Project with Program Data and Other Case-Specific Inputs,”](#) *Energies*, vol. 14, no. 15.
- B. D. H. Williams and J. B. Anderson (2021, Mar.), [“Strategically Targeting Plug-In Electric Vehicle Rebates and Outreach Using ‘EV Convert’ Characteristics,”](#) *Energies*, vol. 14, no. 7, p. 1899.
- B.D.H. Williams, J.B. Anderson, A. Lastuka (2020, Sep.), [Characterizing Plug-in Hybrid Electric Vehicle Consumers Who Found the U.S. Federal Tax Credit Extremely Important in Enabling Their Purchase,](#) in: *33rd Electr. Veh. Symp.*, Electric Drive Transportation Association (EDTA), EVS33 and Zenodo, Portland OR.
- S. Hardman, P. Plötz, G. Tal, J. Axsen, E. Figenbaum, P. Jochem, S. Karlsson, N. Refa, F. Sprei, B.D. Williams, J. Whitehead, B. Witkamp (2019), [Exploring the Role of Plug-In Hybrid Electric Vehicles in Electrifying Passenger Transportation,](#) International EV Policy Council, UC Davis Plug-in Hybrid and Electric Vehicle Research Center.
- B.D. Williams, J. Orose, M. Jones, J.B. Anderson (2018, Oct.), [Summary of Disadvantaged Community Responses to the Electric Vehicle Consumer Survey, 2013–2015 Edition.](#) Clean Vehicle Rebate Project.
- B.D. Williams, J.B. Anderson (2018, Sep.), [Strategically Targeting Plug-in Electric Vehicle Rebates and Outreach Using Characteristics of “Rebate-Essential” Consumers in 2016–2017,](#) in: *31st Int. Electr. Veh. Symp.*, Society of Automotive Engineers of Japan, Inc., Kobe, Japan.
- C. Johnson, B.D. Williams, J.B. Anderson, N. Appenzeller (2017, Jun.), [Evaluating the Connecticut Dealer Incentive for Electric Vehicle Sales,](#) Center for Sustainable Energy (CSE).
- C. Johnson, B.D. Williams (2017, Jan.), [Characterizing Plug-In Hybrid Electric Vehicle Consumers Most Influenced by California’s Electric Vehicle Rebate,](#) *Transp. Res. Rec.* 2628, 23–31.

# Select Presentations & Videos (Reverse Chronological, as of 6/2022)



- [CVRP 2020 Data Brief: Incentive Influence](#)
- CARB Video: [“CVRP 2020 Data Brief: Consumer Characteristics,”](#) time 1:05:43–1:26:09. [Slides.](#)
- CARB Video: [“Cost-Effectiveness of Greenhouse Gas Emission Reductions Associated with California’s Clean Vehicle Rebate Project in 2019 \(and 2020\),”](#) time 2:01-2:31. [Slides.](#)
- [California Plug-in Hybrid EV Consumers Who Found the U.S. Federal Tax Credit Extremely Important in Enabling Their Purchase](#)
- [Data from Statewide Electric Vehicle Rebate Programs: Vehicles, Consumers, Impacts, and Effectiveness](#)
- [CVRP CY 2019 Data Brief: Vehicle Replacement & Incentive Influence](#)
- [CVRP Data Brief: MSRP Considerations](#)
- [EV Purchase Incentives: Program Design, Outputs, and Outcomes of Four Statewide Programs with a Focus on Massachusetts](#)
- [What Vehicles Are Electric Vehicles Replacing and Why?](#)
- [Electric Vehicle Incentives and Policies](#)
- [Proposed FY 2019–20 Funding Plan: Final CVRP Supporting Analysis](#)
- [CVRP: Data and Analysis Update](#)
- [Cost-Effectively Targeting EV Outreach and Incentives to “Rebate-Essential” Consumers](#)
- [Electric Vehicle Rebates: Exploring Indicators of Impact in Four States](#)
- [Targeting EV Consumer Segments & Incentivizing Dealers](#)
- Yale Webinar: [“Supporting EV Commercialization with Rebates: Statewide Programs, Vehicle & Consumer Data, and Findings,”](#) 58 minutes. [Slides.](#)
- [CVRP Income Cap Analysis: Informing Policy Discussions](#)



Recommended citation:

B.D.H. Williams and N. Pallonetti, Presentation: “CVRP 2020 Data Brief: Vehicle Replacement,” Clean Vehicle Rebate Project, administered by the Center for Sustainable Energy on behalf of the California Air Resources Board, June 2022.

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

