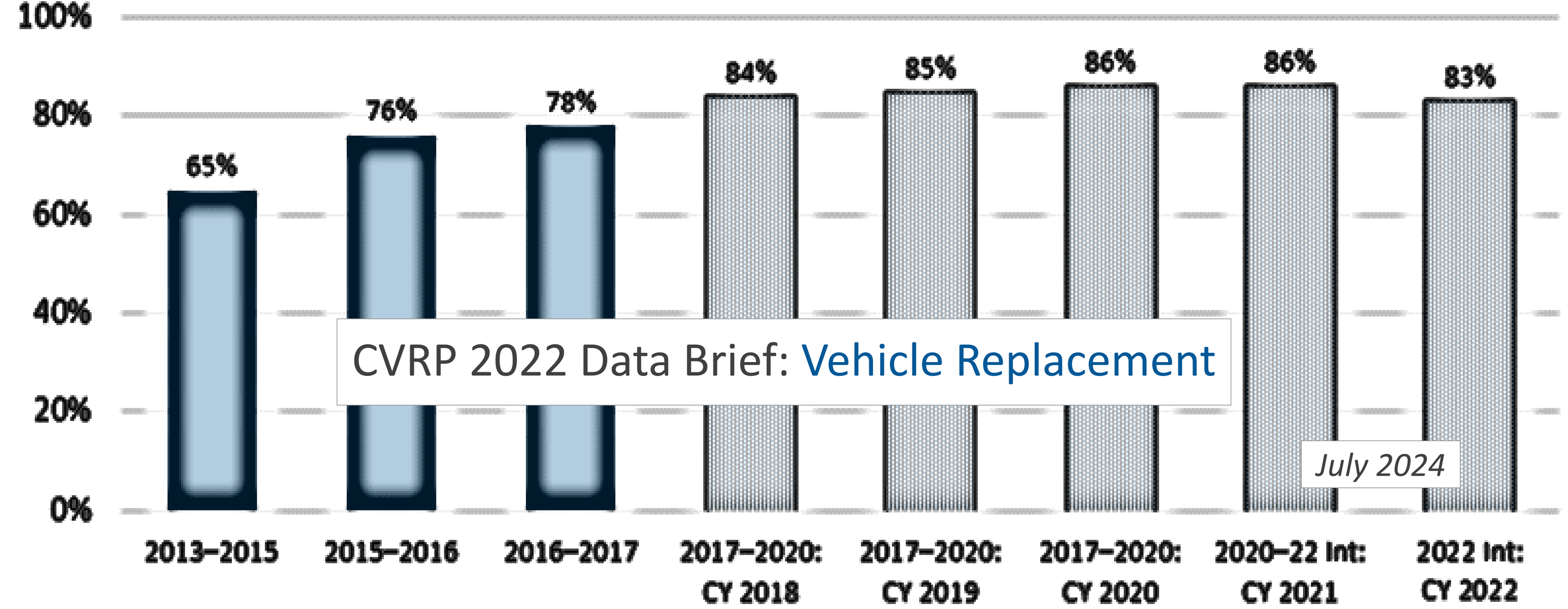

CVRP 2022 Data Brief: Vehicle Replacement

July 2024

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Nicholas Pallonetti – Research Analyst, CSE

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

CALIFORNIA CLEAN VEHICLE REBATE PROJECT℠

Outline: Vehicle Replacement (2022)

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

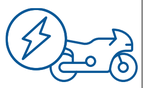
EVs = light-duty plug-in hybrid, battery, and fuel-cell electric vehicles (PHEVs, BEVx vehicles, BEVs, and FCEVs)

Context

Program Design, Market Dynamics, & Data

Base Rebate Amount for Most Individuals At Lowest Levels

CALIFORNIA CLEAN VEHICLE REBATE PROJECT™

	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.

** Income-qualified consumers eligible for an additional $1,500.*

*** Income-qualified consumers eligible for an additional $2,000.*

**** Income-qualified consumers eligible for an additional $2,500.*

Program Design Shapes Outcomes

Color coding:
2022 highlights
Also in effect during 2022

CALIFORNIA CLEAN VEHICLE REBATE PROJECT™

For personal rebates:

as of Mar. 2010
- Incentive stacking permitted
- 36-month ownership requirement
- Rebates per year limit = 20

as of Dec. 2013
- Rebates per year limit = 2

as of May 2014
- 18-month application window

as of Dec. 2014 / Jan. 2015
- 30-month ownership requirement (retroactive)
- Total rebate limit = 2

as of Mar. 2016
- $250k–$500k income cap (PEVs)
- +$1,500 for income-qualified households (≤ 300% FPL), excluding ZEMs

as of Nov. 2016
- $150k–$300k income cap (PEVs)
- ≥ 20 UDDS electric miles
- +$2,000 for income-qualified households (≤ 300% FPL), excl. ZEMs

as of Jan. 2018
- $150k–$300k income cap on stacking HOV decal (only binding on FCEVs)
- Rebate Now San Diego County preapproval pilot with point-of-sale option

as of Jan. 2019
- Stacking with CVAP grant not permitted (retroactive)

as of Dec. 2019
- Total rebates limit = 1 §
- Base MSRP ≤ $60k (PEVs)
- 3-month application window ‡
- ≥ 35 UDDS electric miles
- +$2,500 † for income-qualified households (≤ 300% FPL), excl. ZEMs

as of Apr. 2020
- Stacking with CVAP grant permitted

as of Jan. 2021
- +$2,500 for income-qualified households, ≤ 400% FPL, excl. ZEMs

as of Apr. 2021
- ≥ 30 U.S. EPA electric miles (45 UDDS)
- Rebate Now preapproval option limited to income-qualified households, expanded to include SJ Valley

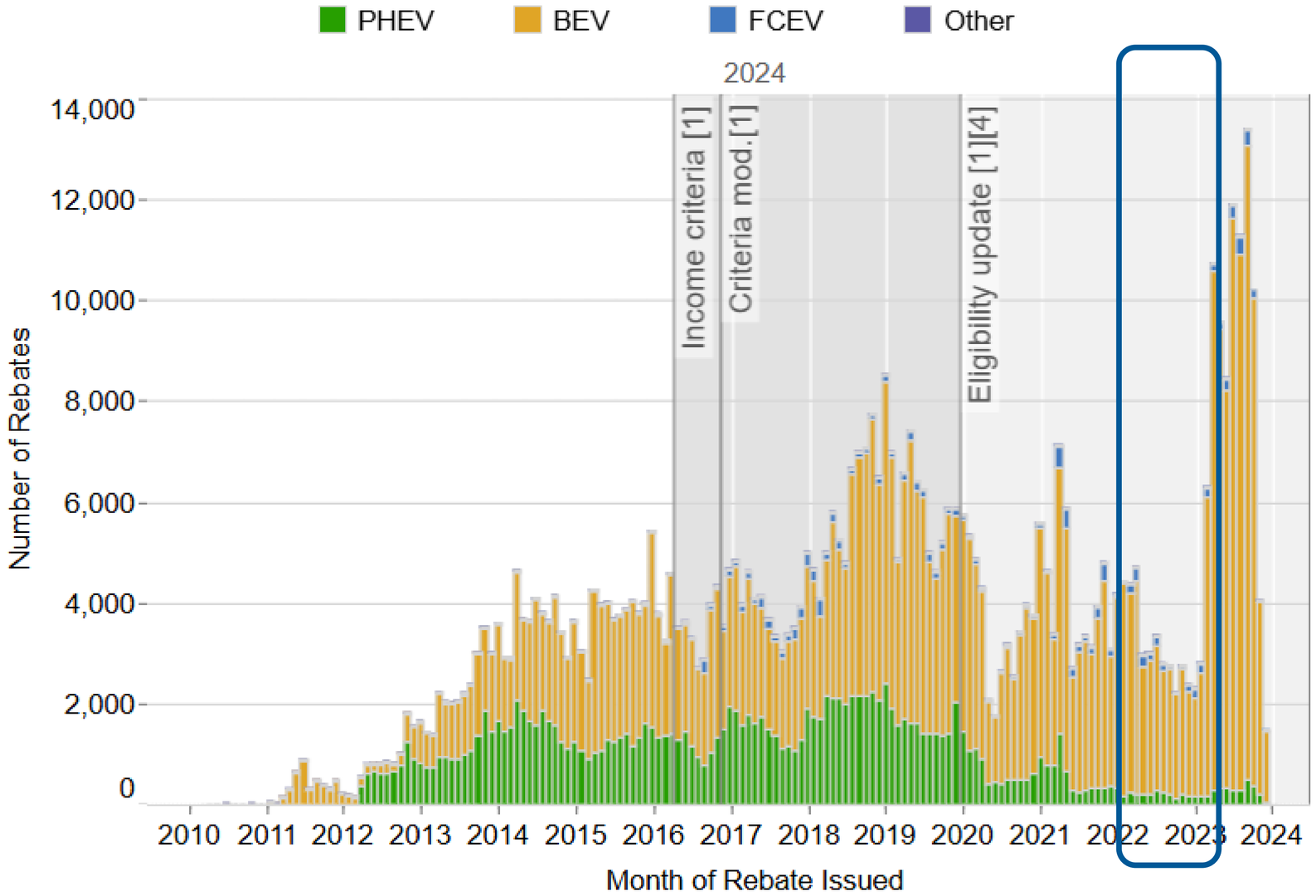
as of Feb. 2022
- Base MSRP: ≤ $60k for Large Vehicles*, ≤ $45k for Cars*
- $135k–$200k income cap (PEVs)
- $135k–$200k income cap on stacking HOV decal (only binding on FCEVs)

as of Jul. 2022
- $150k–$300k income cap on stacking HOV decal (only binding on FCEVs)

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.

*§ A second rebate can be approved for a FCEV if the first rebate was for a PEV. ‡ COVID exemptions on application window effectively delayed implementation until 4/15/2021. † Change due to $500 decrease in standard rebate amounts (previous slide). * Large Vehicles include minivans, pickups, and SUVs; Cars include all other light-duty vehicle classes (e.g., hatchbacks, sedans, wagons, and two-seaters).*

2022 Saw a Decline in Applications When Tesla Model 3 & Y Prices Rose Above the MSRP Cap



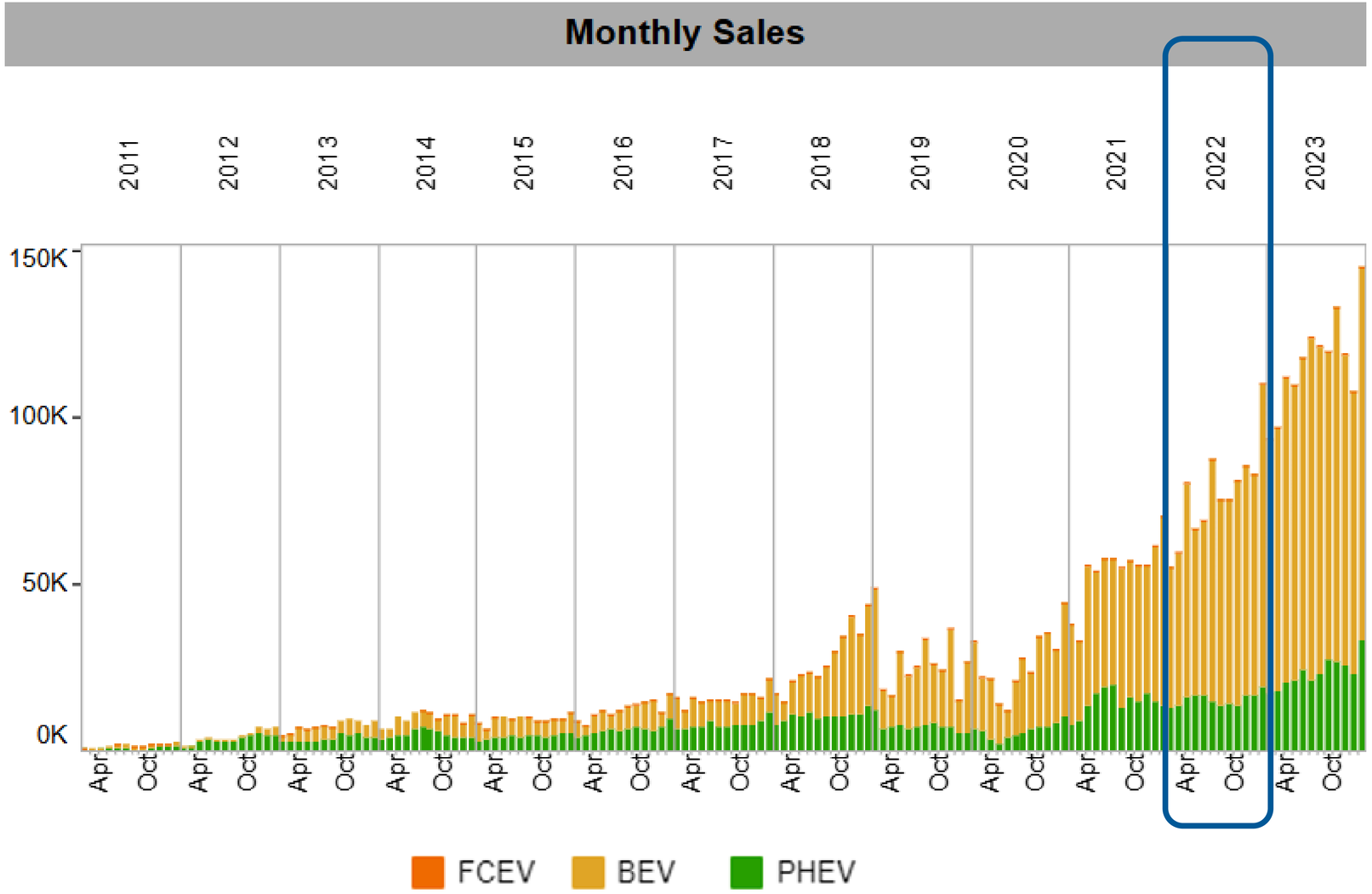
Rebate applications for calendar year 2022 purchases/leases for individuals spanned 1/1/2022 – 3/30/2023.

6% applied in 2023.

Adapted from https://cleanvehiclerebate.org/eng/rebate-statistics (6/24/24), including changing colors and stacking order for ease of comparison across similar slides.

However, Total EV Sales in California Continued to Grow

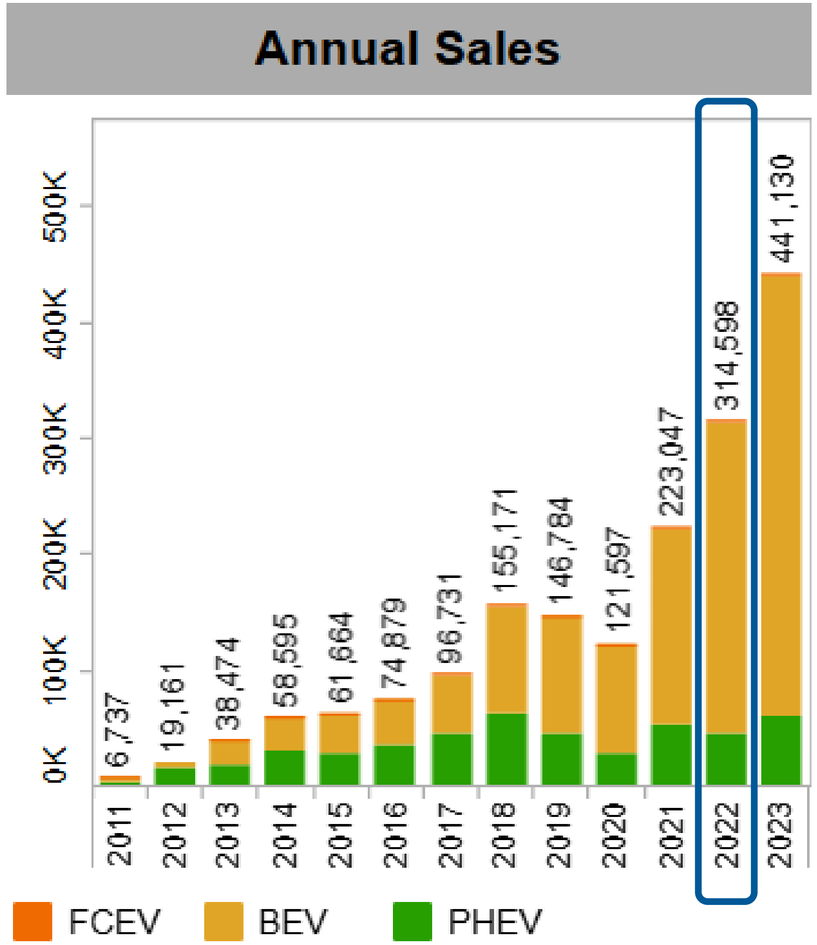
2011–2023



~11% of registered EVs purchased in 2022 received rebates.

Image from https://www.autosinnovate.org/EVDashboard (*6/24/24*)

More Broadly, Electric Vehicle Sales in California Increased 2011–2018, Decreased in 2019 and During the Pandemic, and Rebounded in 2021 and Beyond



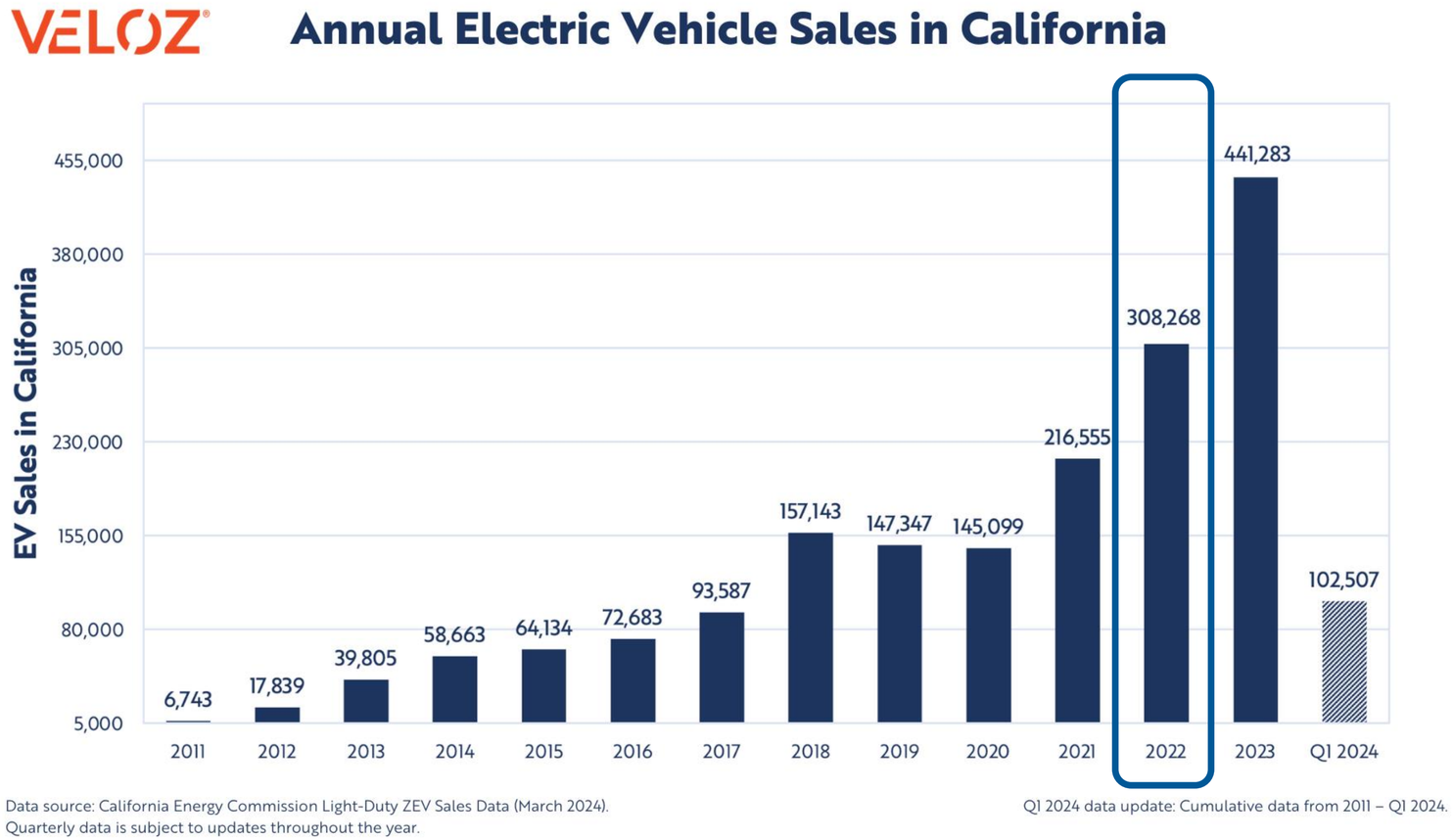


Image 1 from https://www.autosinnovate.org/EVDashboard (6/24/24).

Image 2 from https://www.veloz.org/wp-content/uploads/2024/05/Q1-2024_Annual-EV-Sales-in-CA-1.png

CVRP Consumer Survey Editions

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

	2013–2015 Edition	2015–2016 Edition	2016–2017 Edition	2017–2020 Edition	2020–2023 Edition (in progress) Interim Datasets	Total
Vehicle Purchase/ Lease Dates	Sep. 2012 – May 2015	April 2015 – May 2016	May 2016 – May 2017	June 2017 – Nov. 2020	Dec. 2020 – Dec. 2022	Sep. 2012 – Dec. 2022
Survey Responses (total *n*)**	19,460	11,611	8,957	32,524	15,482	88,034
Program Population (*N*)***	91,081	45,685	46,839	193,167	86,451	463,223

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

*** Subsequently weighted to represent the program population, see "CVRP Consumer Survey: Weighting Detail" slide for further detail.*

**** Small numbers of rebated vehicles are not represented in the time frames due to application lags. Numbers may not be exactly comparable due to evolving weighting practices.*

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	2020–2023 Edition (in progress) Interim Datasets	Interim 2021 purchases/ leases subset	Interim 2022 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	Dec. 2020 – Dec. 2022	Jan. 2021– Dec. 2021	Jan. 2022 – Dec. 2022	Sep. 2012 – Dec. 2022
Survey Responses (total *n*)	19,460***	11,611***	8,957***	32,524***	14,757	8,991	4,331***	15,482	7,694***	6,674***	86,920
Program Population (*N*)****	91,081	45,685	46,839	193,167	78,591 (filtered subset of weighted Edition)	61,277 (filtered subset of weighted Edition)	26,463	86,451	45,261	33,685	455,718

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

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

**** Subsequently weighted to represent the program population, see "CVRP Consumer Survey: Weighting Detail" slide for further detail.*

***** Small numbers of vehicles are not represented in the time frames due to application lags. Numbers may not be exactly comparable due to evolving weighting practices.*

CVRP Consumer Survey: Weighting Detail

- Each survey edition is individually weighted to represent the program population along the dimensions of vehicle category, vehicle model, buy vs. lease, and county.
  - Year of purchase/lease was also included in weighting for the 2017–20 Edition & 2020–22 Interim Dataset.
    - Weighting for the 2021 subset & 2022 Interim Dataset also included rebate type (Standard Rebate vs. Increased Rebate).
- The 2020 and 2021 purchase/lease subsets were also independently weighted
  - This produced only minor differences compared to the filtered approach used for the 2018 & 2019 subsets.
- Summary of weights, 2022 Interim Dataset:

Min	Median	Mean	Max
0.17	0.986	1	5.51

Multi-State Consumer Survey Data

(latest available year, shows rebates to individuals for plug-in EVs* only)

Center for Sustainable Energy™

	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	Jan. 2022 – Dec. 2022	Oct. 2021 – Dec. 2022	Jul. 2022 – Jun. 2023	Jan. 2022 – Dec. 2022	Oct. 2021 – Jun. 2023
Survey Responses (total *n*)**	6,674	1,309	958	5,472	14,761
Program Population (*N*)***	33,685	4,551	2,308	27,187	67,731

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

*** Subsequently weighted to represent the program population.*

**** Small numbers of rebated vehicles are not represented in the time frames due to application lags. Numbers may not be exactly comparable due to evolving weighting practices.*

Vehicle Replacement

Vehicle Replacement: Select Resources

Presentations & Video

- ❖ CVRP 2021 Data Brief: Vehicle Replacement (2024, Apr.). CVRP posting.
- ❖ NY Drive Clean Rebates: Vehicle Replacement & Rebate Influence thru 2022 (2024, Mar.).
- ❖ NY Drive Clean Rebates: Select Impacts Through 2021. Paper. CSE posting. (2023, Jun. 12).
- Data from Statewide Electric Vehicle Rebate Programs: Vehicles, Consumers, Impacts, and Effectiveness (2021, Jul.)
- EV Purchase Incentives: Program Design, Outputs, and Outcomes of Four Statewide Programs with a Focus on Massachusetts (2020, Dec.)
- Infographic: What Vehicles Are Electric Vehicles Replacing and Why? (2020, Jan.)
- ❖ What Vehicles Are Electric Vehicles Replacing and Why? (2019, Nov.)
- Electric Vehicle Incentives and Policies (2019, Nov.)
- CVRP: Data and Analysis Update (2018, Dec.)
- Electric Vehicle Rebates: Exploring Indicators of Impact in Four States (2018, Jun.)
- Yale Webinar: "Supporting EV Commercialization with Rebates: Statewide Programs, Vehicle & Consumer Data, and Findings," 58 minutes. Slides. (2017, Apr.)

Publications

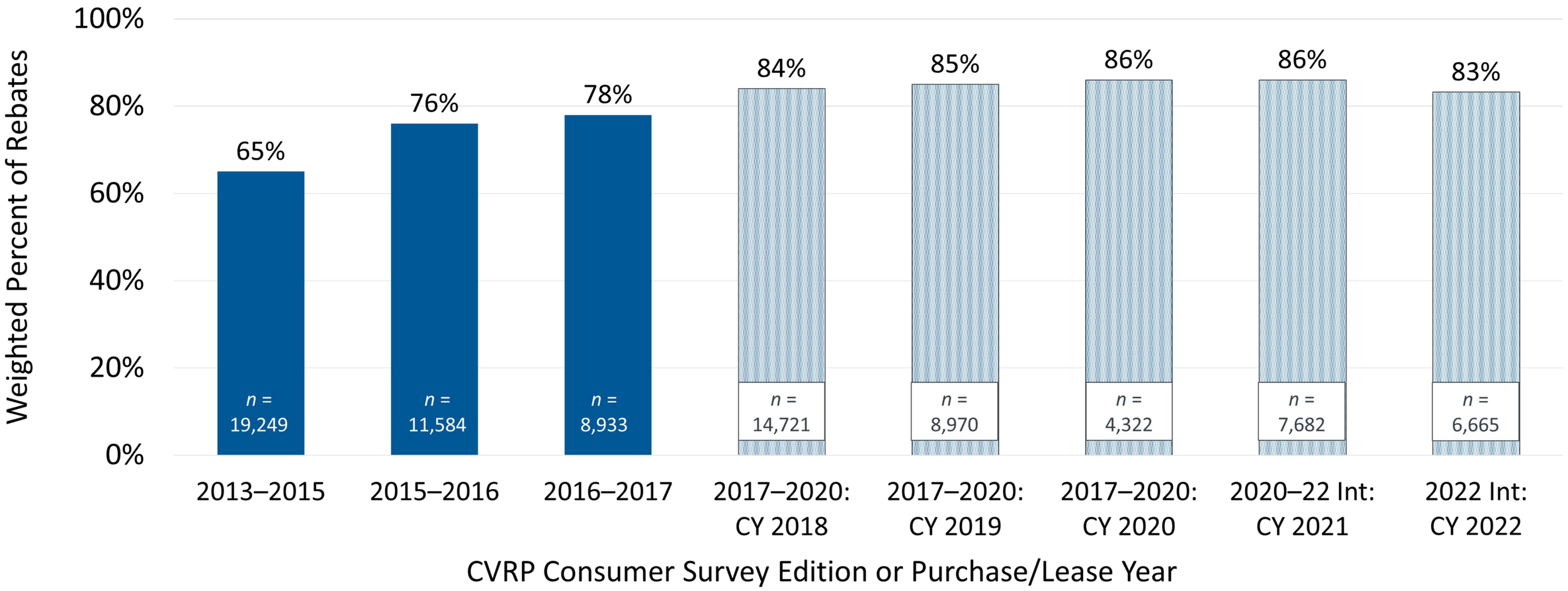
- ❖ N. Pallonetti and B.D.H. Williams (2023, Mar.), Vehicle Replacement: Findings from California's Clean Vehicle Rebate Project, *36th International Electric Vehicle Symposium* (EVS36), EDTA, Sacramento CA, USA. Paper. CSE posting. Precursor slides.
- ❖ B.D.H. Williams and N. Pallonetti (2023, Mar.), New York State's Drive Clean Rebate for Electric Vehicles: Measures of Impact, *36th International Electric Vehicle Symposium (EVS36)*, EDTA, Sacramento CA, USA. Paper. Slides. CSE posting.
- 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, *Program Reports*, Clean Vehicle Rebate Project, San Diego CA.
- C. Johnson, B.D. Williams, C. Hsu, J.B. Anderson (2017, Jun.), Summary Documentation of the Electric Vehicle Consumer Survey, 2013–2015 Edition, *Program Reports,* Clean Vehicle Rebate Project, San Diego CA.

Reverse chronological as of 4/2024; key resources marked with a diamond bullet. Additional related items.

Vehicle Replacement Rates

Vehicle Replacement Increased, Then Has Held Relatively Steady

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



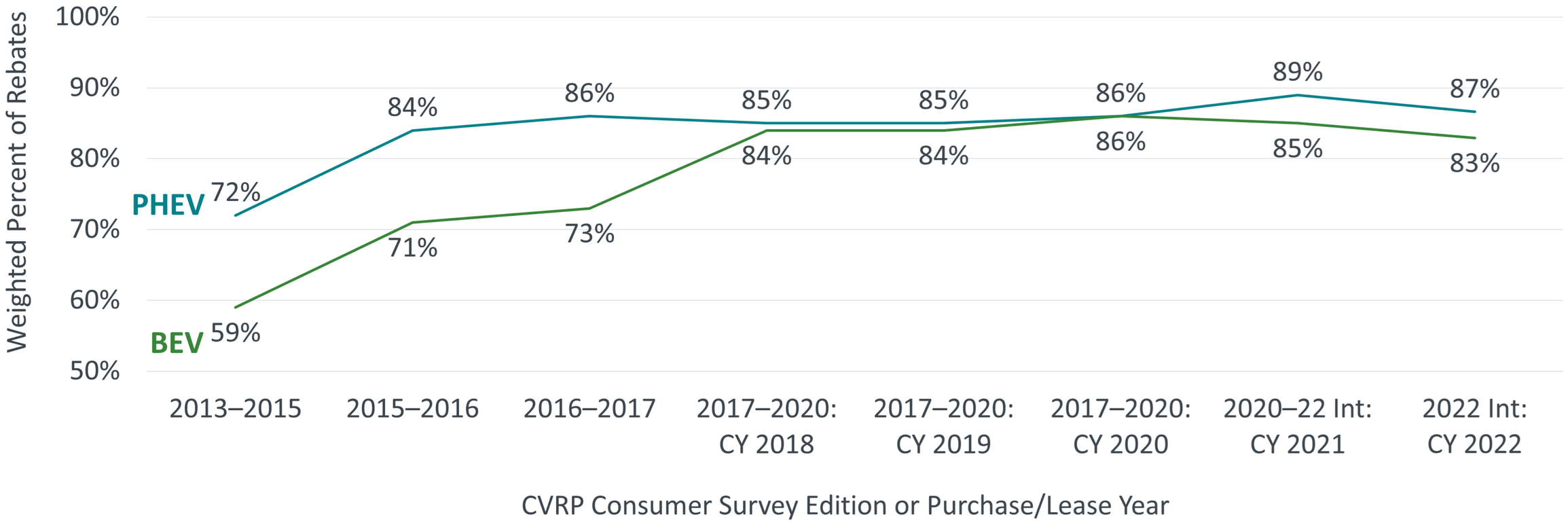
n-values are filtered and question-specific.

CY = calendar year.

Vehicle Replacement Has Long Been High for PHEVs, BEVs Gradually Caught Up, But Recently Lag

CALIFORNIA CLEAN VEHICLE REBATE PROJECT™

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



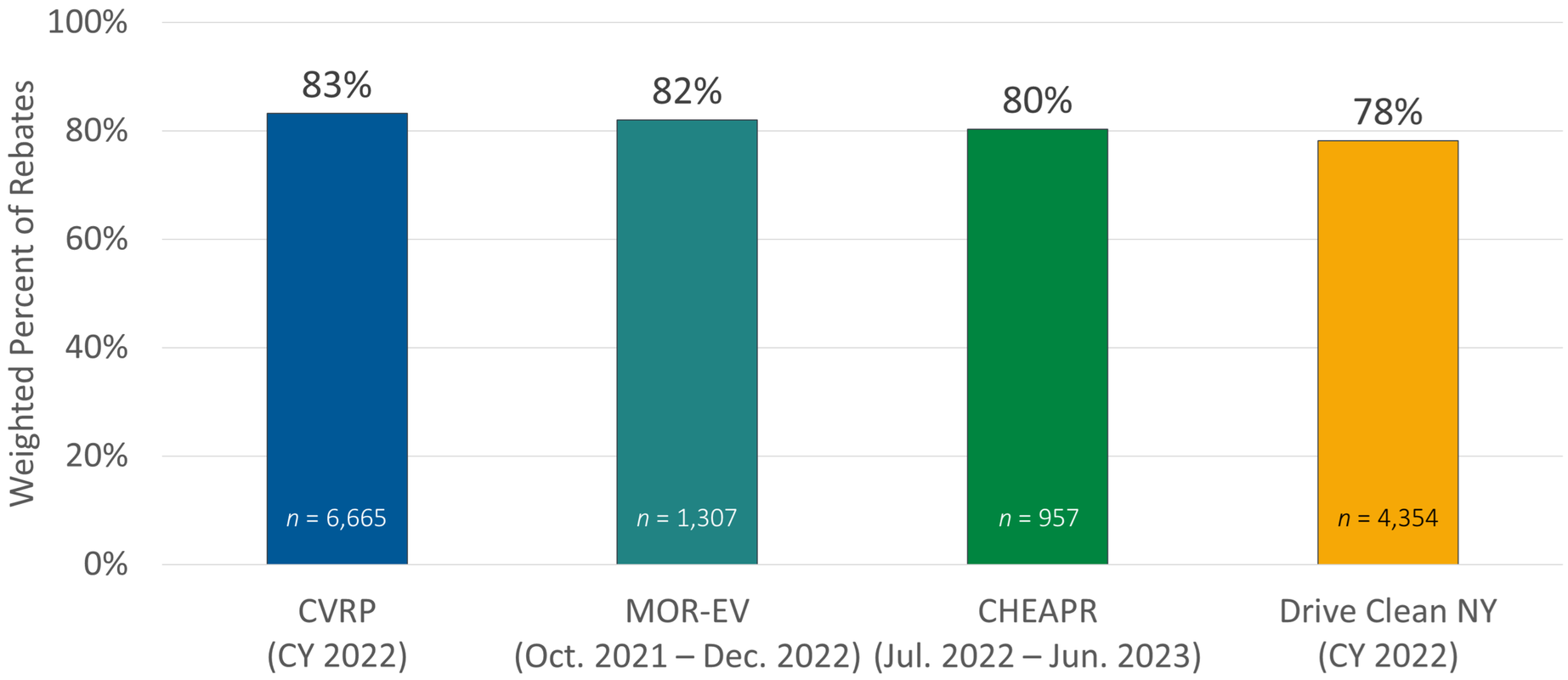
CVRP Consumer Survey, 2013–2015 Edition: n = 19,249. 2015–2016 Edition: n = 11,584. 2016–2017 Edition: n = 8,933. 2017–2020 Edition: CY 2018 n = 14,721; CY 2019 n = 8,970; CY 2020 n = 4,322. 2020–2022 Interim Dataset: CY 2021 n = 7,682. 2022 Interim Dataset: CY 2022 n = 6,665. n-values are filtered and question-specific.

Across Four States, EVs Are Replacing Older, More Polluting Vehicles

circa 2022

Center for Sustainable Energy™

Replaced a vehicle with their rebated *clean vehicle*



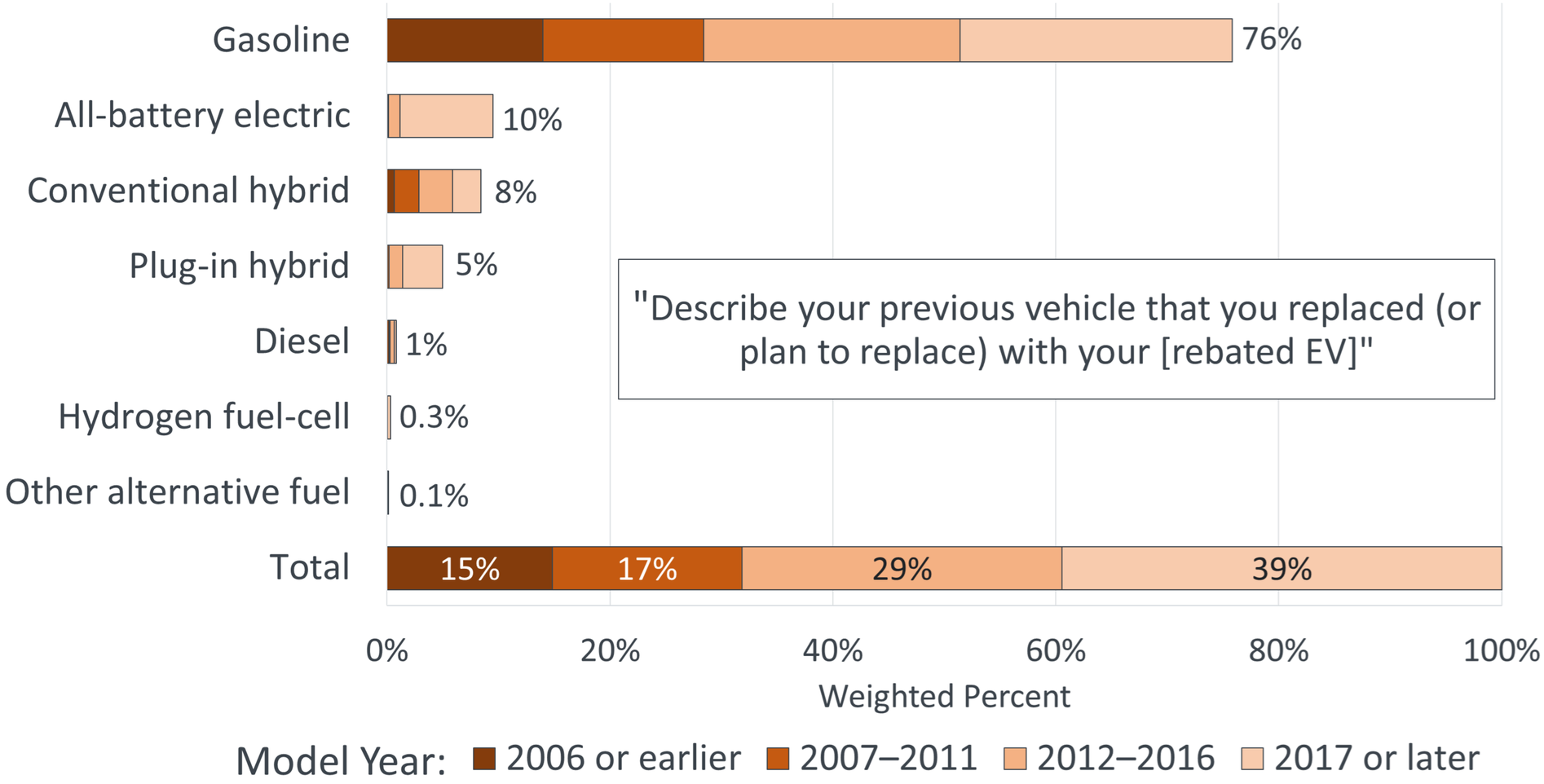
n-values are question-specific.

Overall datasets: 14,761 total survey respondents weighted to represent 67,731 rebate recipients.

Vehicle Age & Types Replaced

What Vehicles Have Rebates Helped Replace?

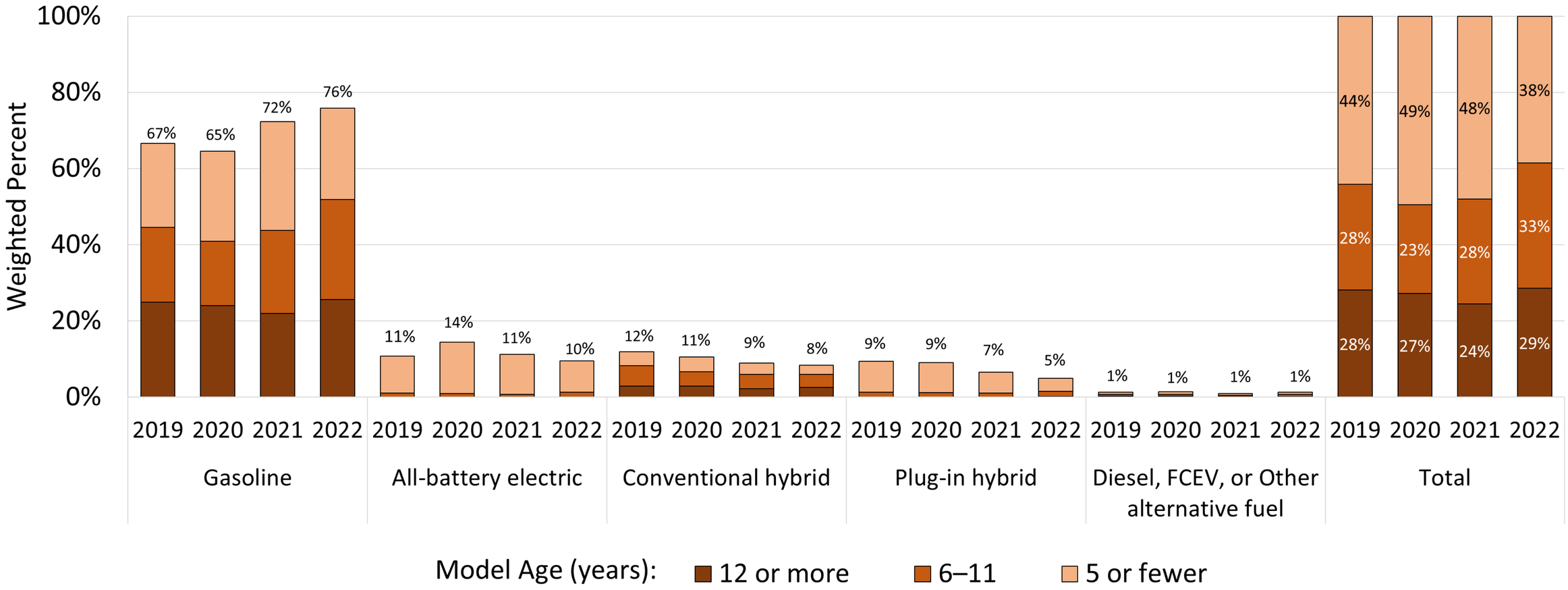
2022 Plug-in Electric Vehicle Purchases/Leases



Questions shown only to those that responded they replaced a vehicle with their rebated EV.
CVRP Consumer Survey 2022 Interim Dataset. Filtered, question-specific, n = 5,474.

What Vehicles Have Rebates Helped Replace?

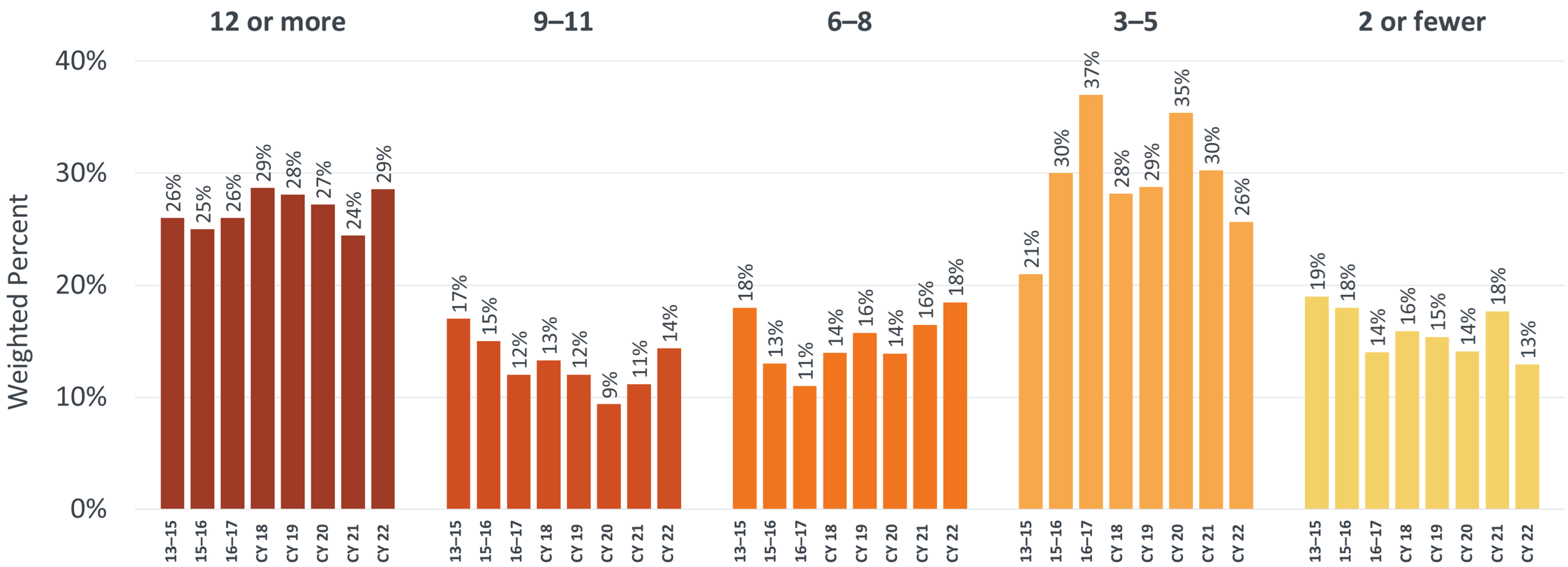
2019–2022 Plug-in Electric Vehicle Purchases/Leases



Questions shown only to those that responded they replaced a vehicle with their rebated EV.
CVRP Consumer Survey, 2017–2020 Edition: CY 2019 n = 6,498; CY 2020 n = 3,146. 2020–2022 Interim Dataset: CY 2021 n = 6,493.
2022 Interim Dataset: CY 2022 n = 5,474. n-values are filtered and question-specific.

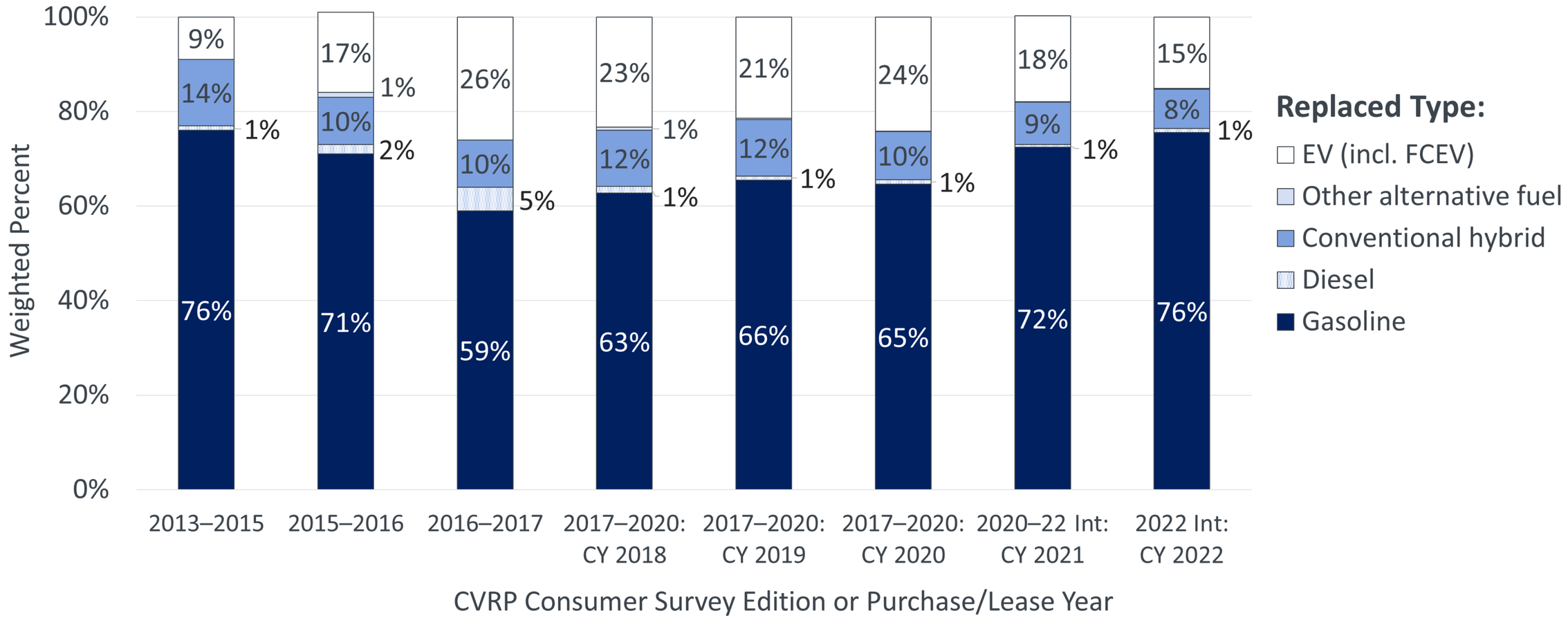
Replaced Vehicle Age: Share of Older Vehicles Increased in 2022

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



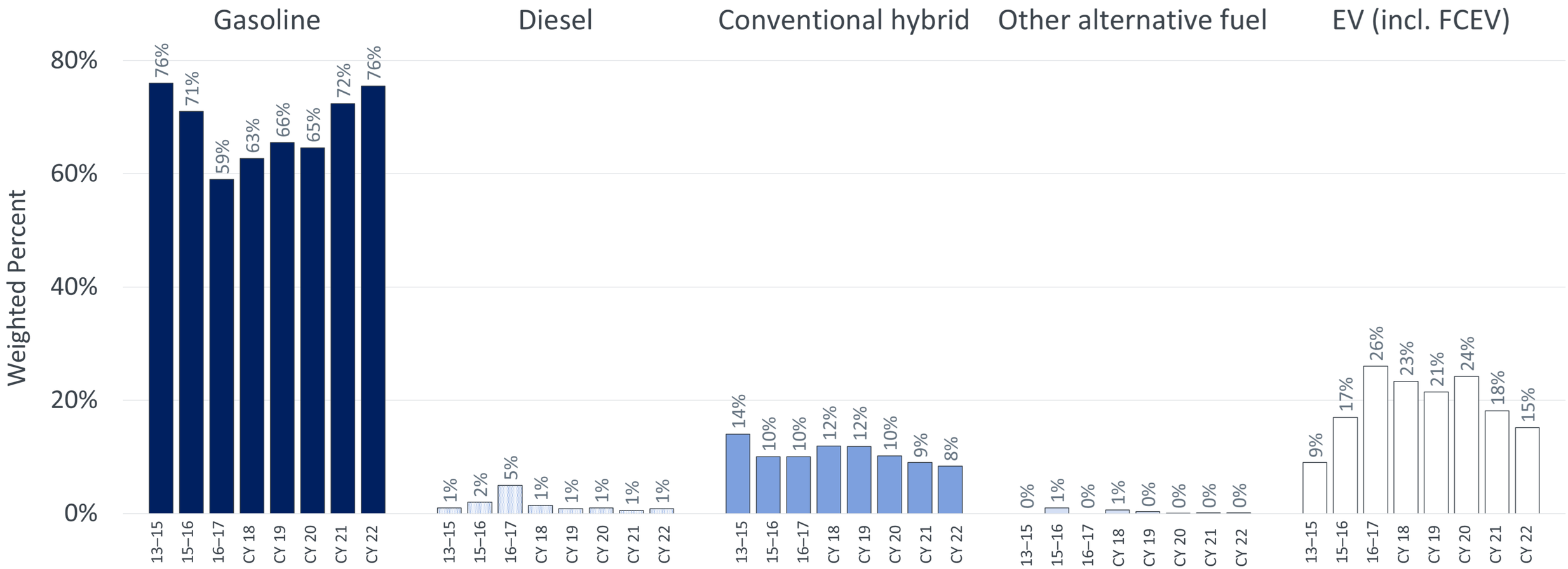
Question shown only to those that responded they replaced a vehicle with their rebated EV. CVRP Consumer Survey, 2013–2015 Edition: n = 12,273. 2015–2016 Edition: n = 8,651. 2016–2017 Edition: n = 6,968. 2017–2020 Edition: CY 2018 n = 10,964; CY 2019 n = 6,507; CY 2020 n = 3,149. 2020–2022 Interim Dataset: CY 2021 n = 6,494. 2022 Interim Dataset: CY 2022 n = 5,484.
n-values are filtered and question-specific.

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



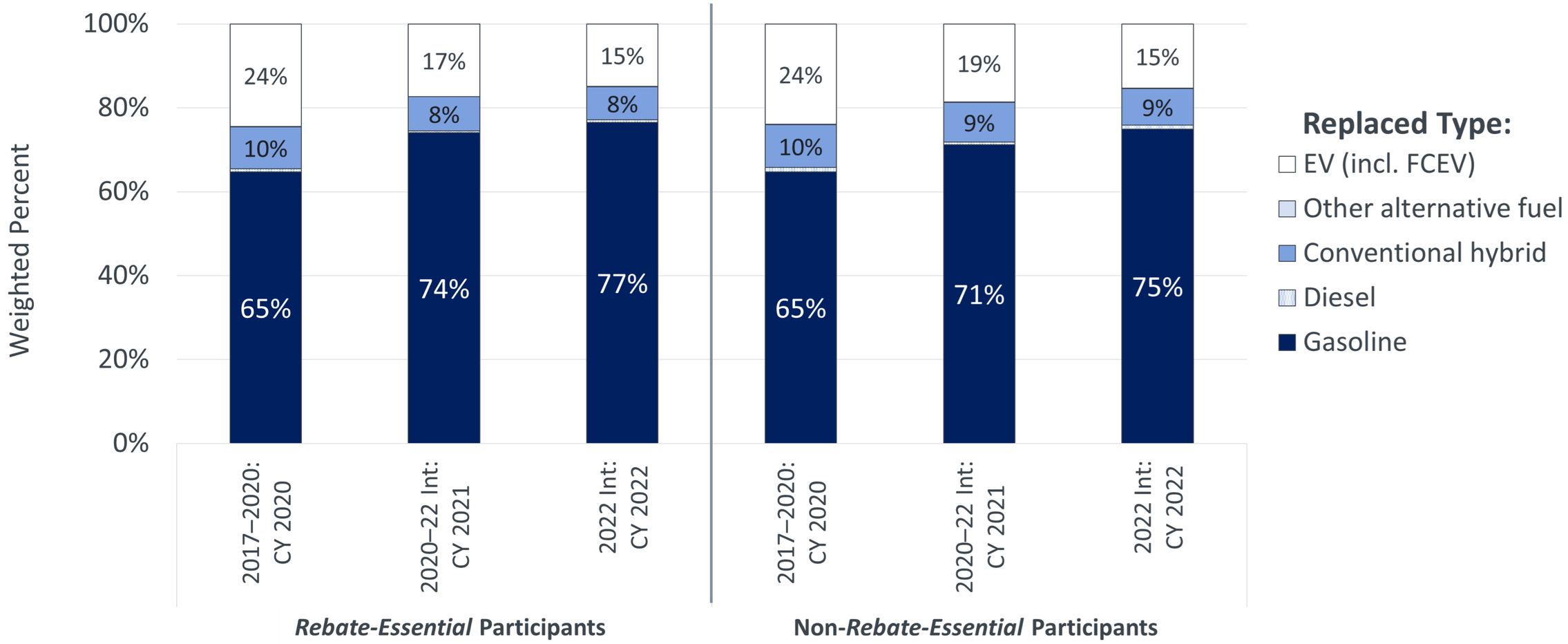
Question shown only to those that responded they replaced a vehicle with their rebated EV. CVRP Consumer Survey, 2013–2015 Edition: n = 12,350. 2015–2016 Edition: n = 8,620. 2016–2017 Edition: n = 6,958. 2017–2020 Edition: CY 2018 n = 12,321; CY 2019 n = 7,616; CY 2020 n = 3,725. 2020–2022 Interim Dataset: CY 2021 n = 6,513. 2022 Interim Dataset: CY 2022 n = 5,498.
n-values are filtered and question-specific.

What Vehicle Types Have Plug-in EV Rebates Helped Replace Over Time?
(unstacked)



Question 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. 2020–2022 Interim Dataset: CY 2021 n = 6,513. 2022 Interim Dataset: CY 2022 n = 5,498.
n-values are filtered and question-specific.

"Rebate-Essential" and "non-*Rebate-Essential*" Consumers Replace Similar Vehicle Types

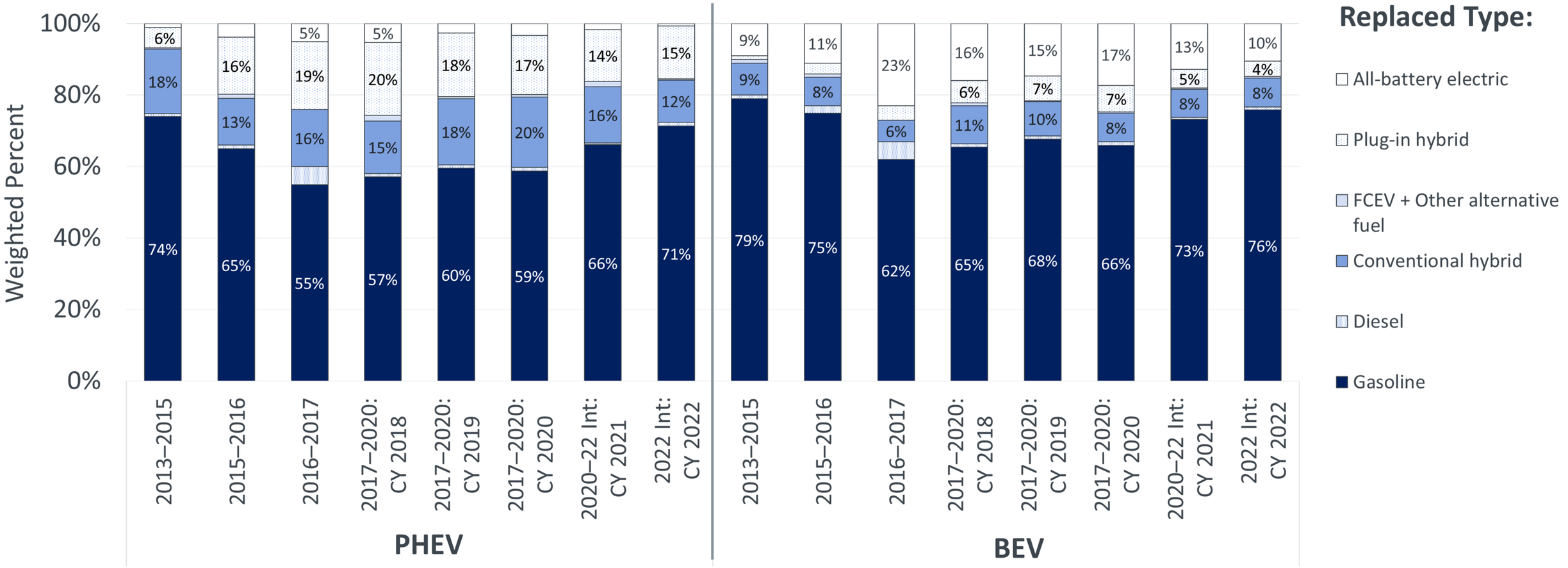


For more on *Rebate Essentiality* metrics and their definition, see the EVS36 paper *Rebate Influence on Electric Vehicle Adoption in California.*

Replacement question shown only to those that responded they replaced a vehicle with their rebated EV. CVRP Consumer Survey, 2017–2020 Edition n = 3,704; 2020–2022 Interim Dataset n = 6,485; 2022 Interim Dataset n = 5,483. n-values are filtered and question-specific.

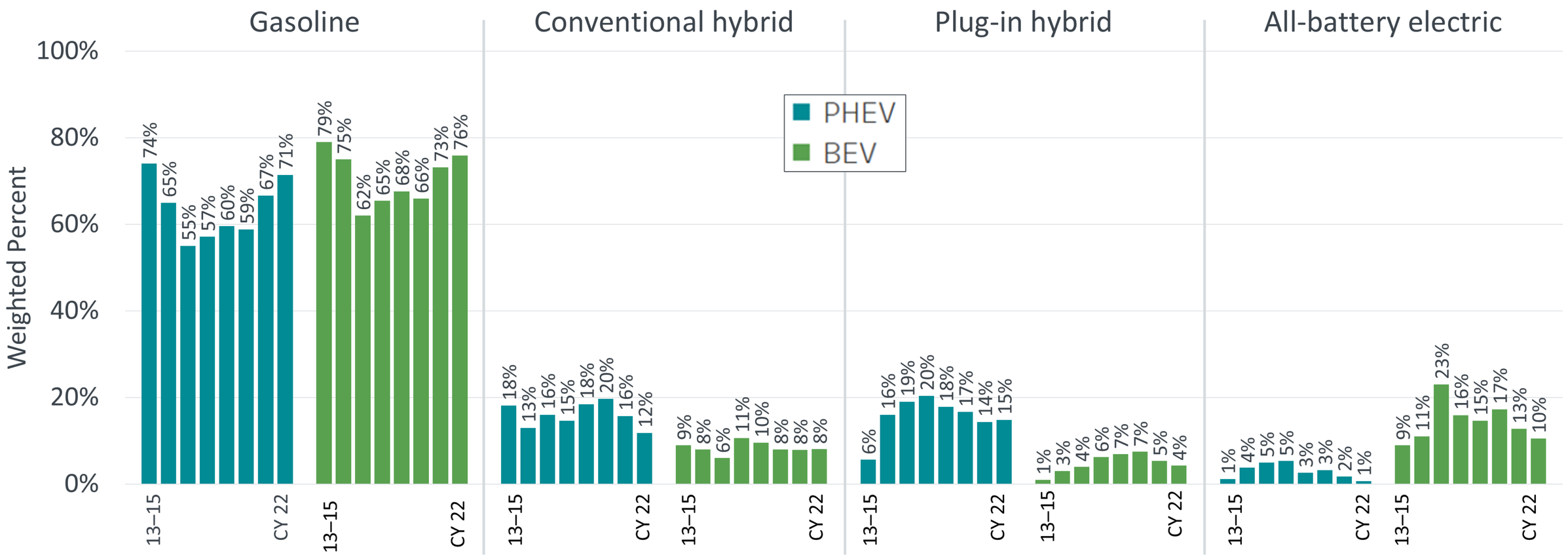
Replaced-Vehicle Technology Types by Rebated-Vehicle Technology Type

Over Time



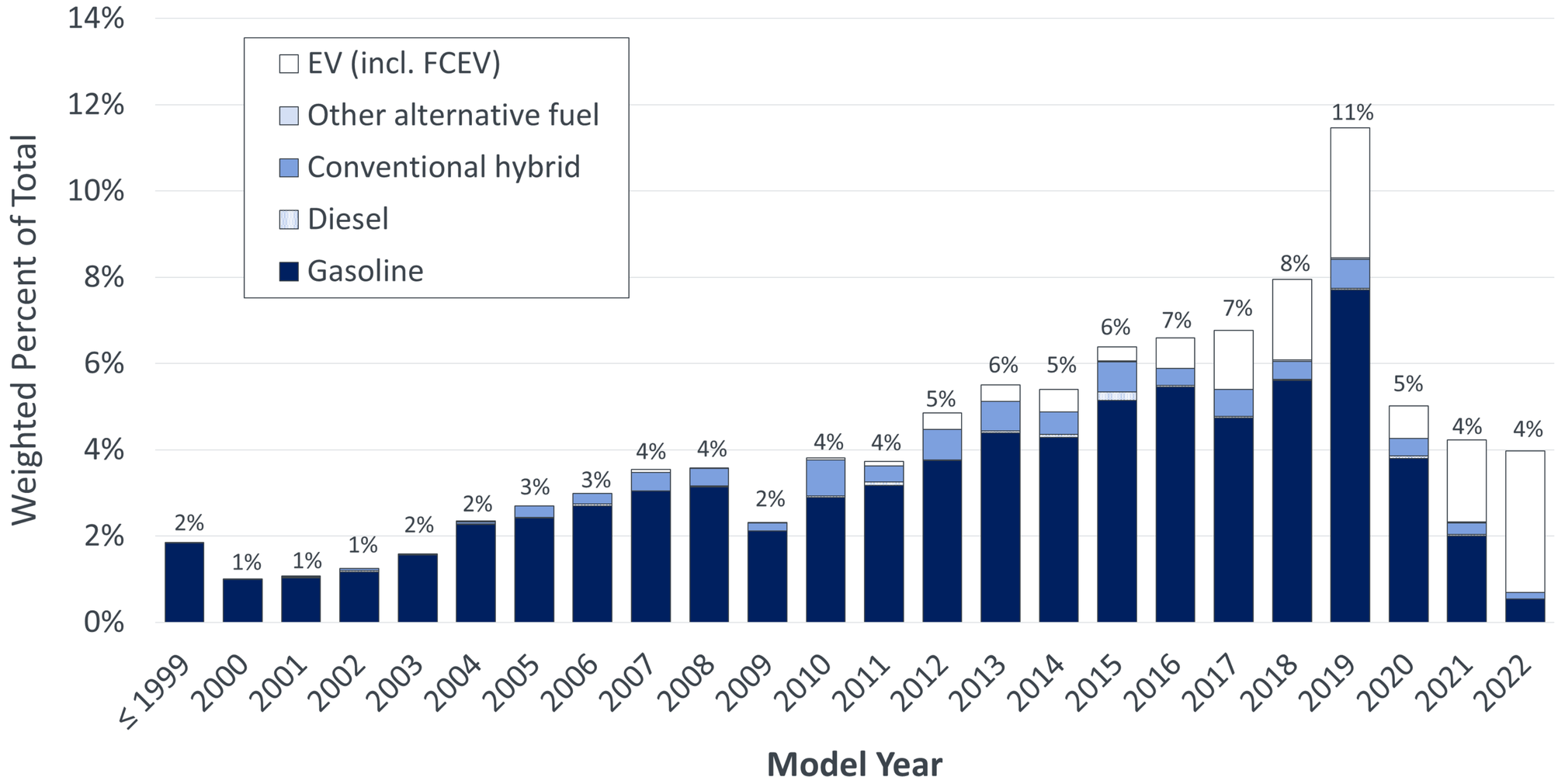
Question shown only to those that responded they replaced a vehicle with their rebated EV. CVRP Consumer Survey, 2013–2015 Edition: n = 12,350. 2015–2016 Edition: n = 8,620. 2016–2017 Edition: n = 6,958. 2017–2020 Edition: CY 2018 n = 12,321; CY 2019 n = 7,616; CY 2020 n = 3,725; 2020–2022 Interim Dataset n = 6,513; 2022 Interim Dataset n = 5,498. n-values are filtered and question-specific.

Top 4 Replaced-Vehicle Technology Types by Rebated-Vehicle Technology Type (unstacked)



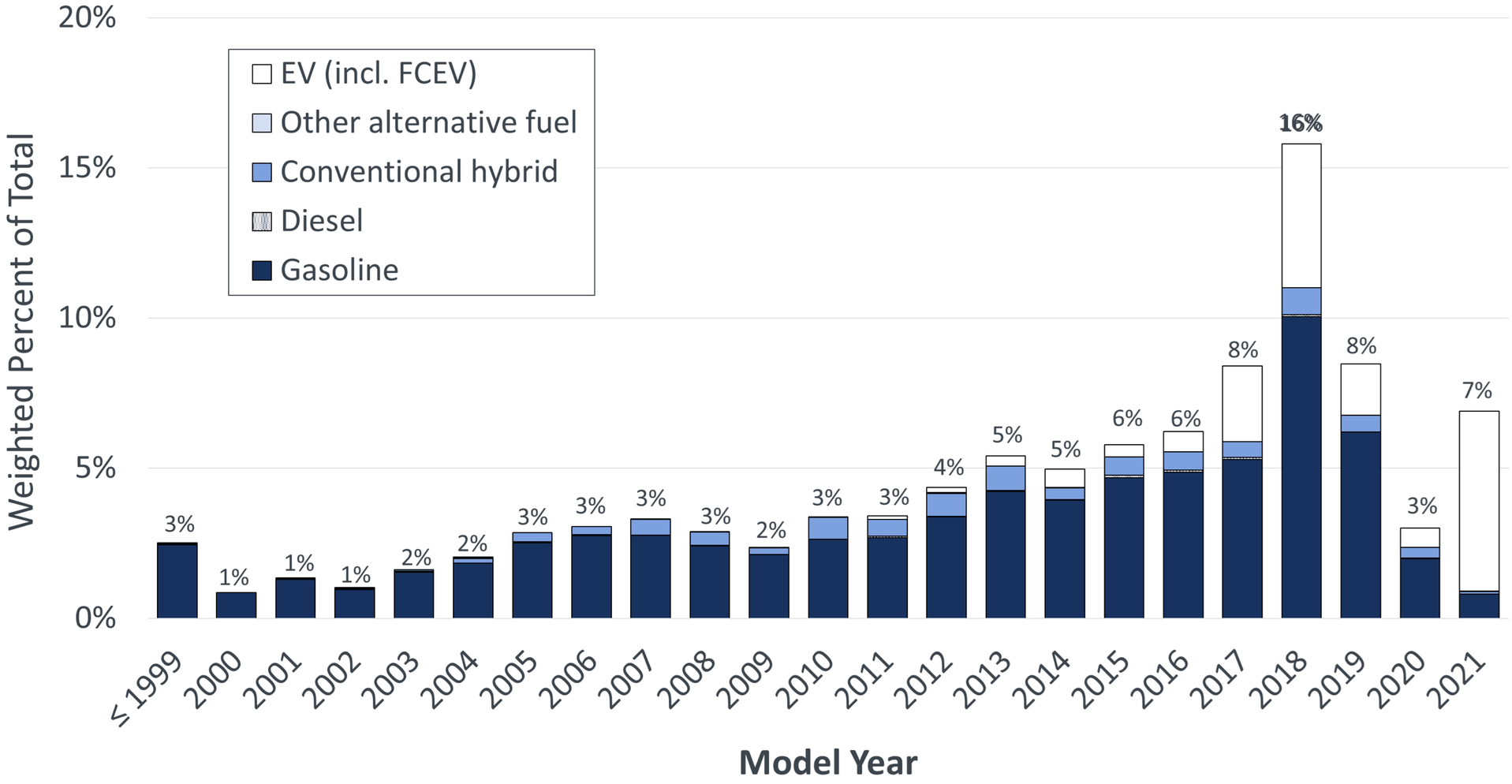
Question shown only to those that responded they replaced a vehicle with their rebated EV. CVRP Consumer Survey, 2013–2015 Edition: n = 12,350. 2015–2016 Edition: n = 8,620. 2016–2017 Edition: n = 6,958. 2017–2020 Edition: CY 2018 n = 12,321; CY 2019 n = 7,616; CY 2020 n = 3,725; 2020–2022 Interim Dataset n = 6,513; 2022 Interim Dataset n = 5,498. n-values are filtered and question-specific.

Model-Year Distribution of Vehicles Replaced by 2022 Plug-in EV Purchases/Leases



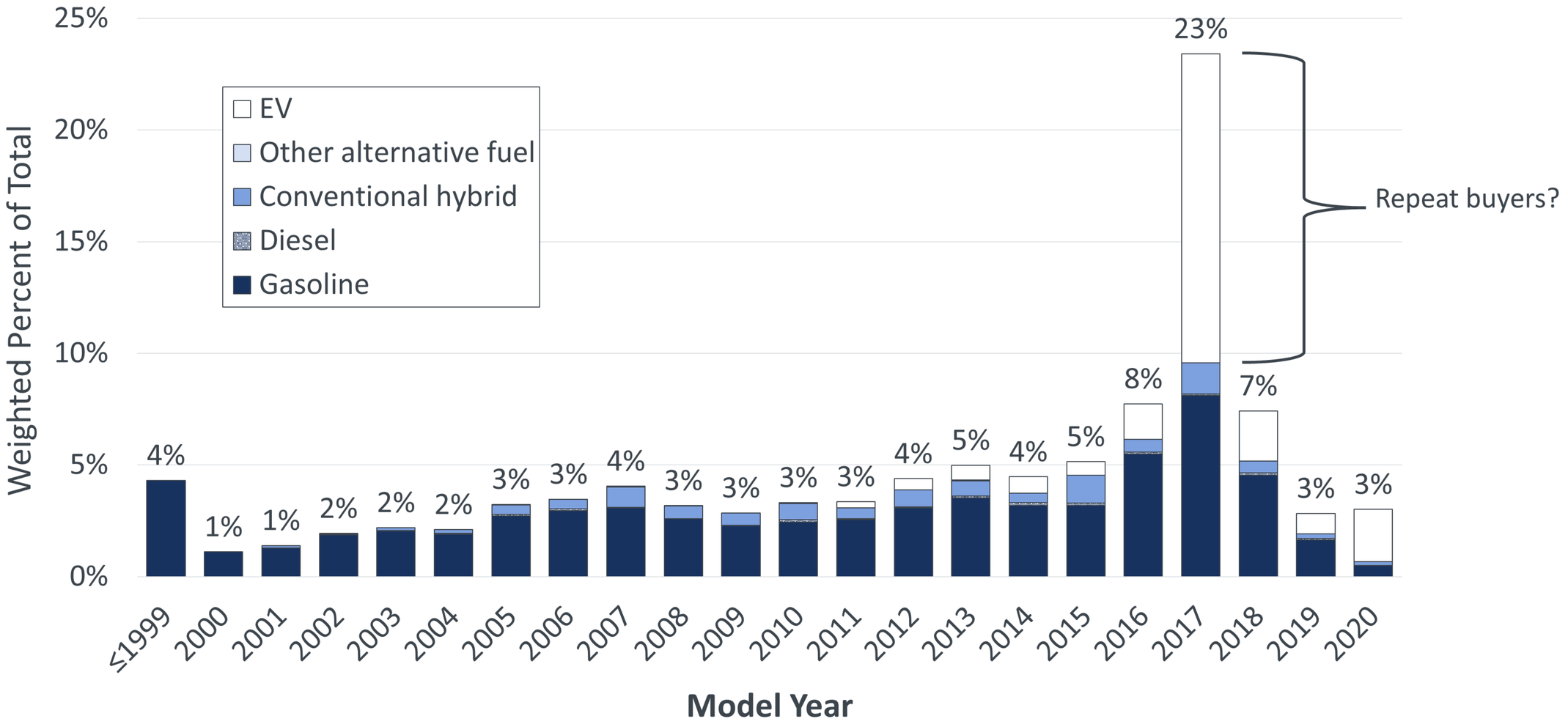
CVRP Consumer Survey, 2022 Interim Dataset. Filtered, question-specific n = 5,474

Model-Year Distribution of Vehicles Replaced by 2021 Plug-in EV Purchases/Leases



CVRP Consumer Survey, 2020–2022 Interim Dataset. Filtered, question-specific n = 6,493

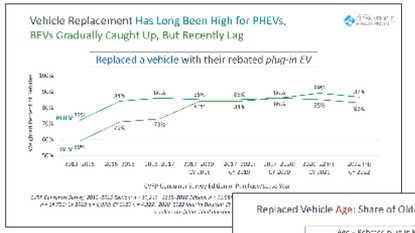
Model-Year Distribution of Vehicles Replaced by 2020 Plug-in EV Purchases/Leases

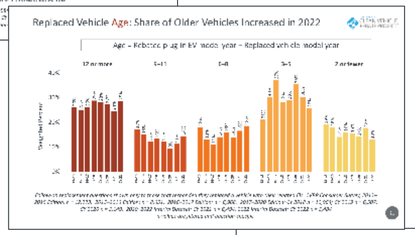


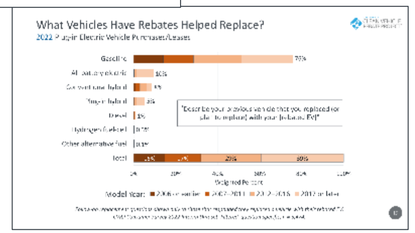
CVRP Consumer Survey, 2017–2020 Edition. Filtered, question-specific n = 3,146.

Summary & Select Findings

Summary & Select Findings: 2022 Vehicle Replacement







Context

- Program design and COVID-19 fallout shaped impacts.

Replacement Rates

- 83% overall and 87% for PHEVs
  - PHEVs produced strong replacement rates early, BEVs are mostly caught up.

Replaced Age

- **3/5^{ths}** were **6+ years old**.
  - **29%** were **12+ years old** (up from 24% in 2021 – were folks holding on during COVID?).

Replaced Types

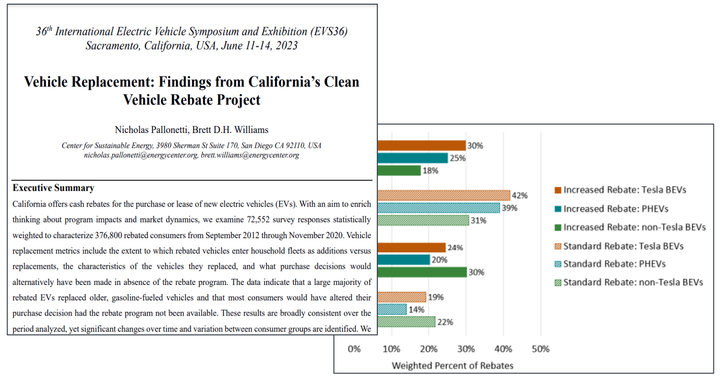
- **5/6^{ths}** of replaced vehicles were **gasoline-fueled** (incl. conventional hybrids).
  - Non-hybrid gasoline replacement *increased* to a high of 76%, not seen since the 2013–15 survey data.
  - Only 15% of replaced vehicles were EVs, the lowest since the 2013–15 survey data.
- **PHEVs more frequently replaced hybrids and plug-in hybrids** than BEVs did.
- **BEVs more frequently replaced gasoline vehicles and BEVs** than PHEVs did.

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

Related Insights: Replacement Behavior & Impacts

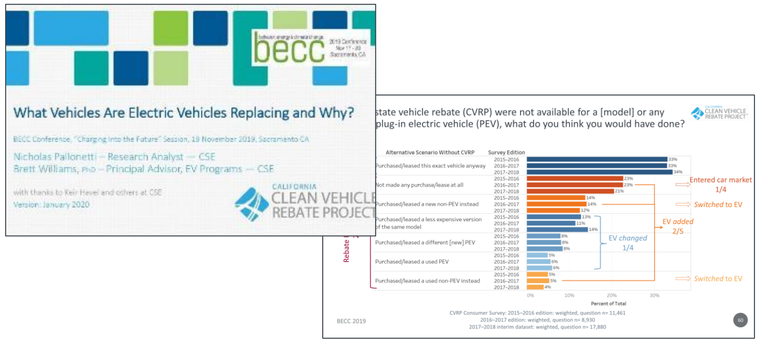
Vehicle Replacement: Findings from California's Clean Vehicle Rebate Project (EVS36)

- Replacement motivations and what might have happened without the rebate



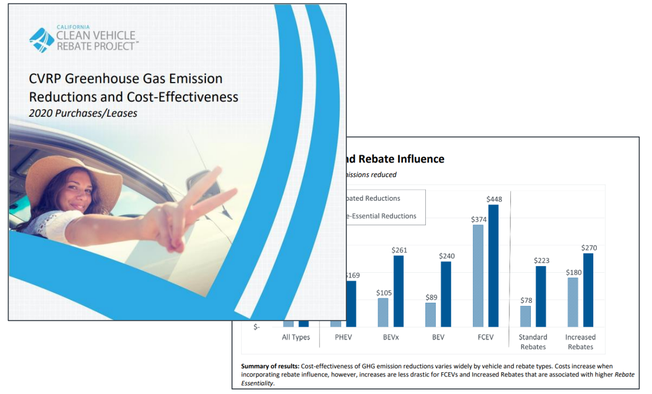
What Vehicles Are Electric Vehicles Replacing and Why? (BECC 2019)

- Replacement motivations and what might have happened without the rebate



CVRP Greenhouse Gas Emission Reductions and Cost-Effectiveness: 2021 Purchases/Leases

- When compared to buying a new gasoline vehicle, rebated plug-in EVs may be saving 17–24 tons of GHG emissions over 100k miles per vehicle at a cost of $246–$301/ton of *Rebate Essential* GHG reductions



Additional Details & Resources

Funding Availability Has Been Regularly Disrupted
(as of Dec. 2022)

CALIFORNIA CLEAN VEHICLE REBATE PROJECT™

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

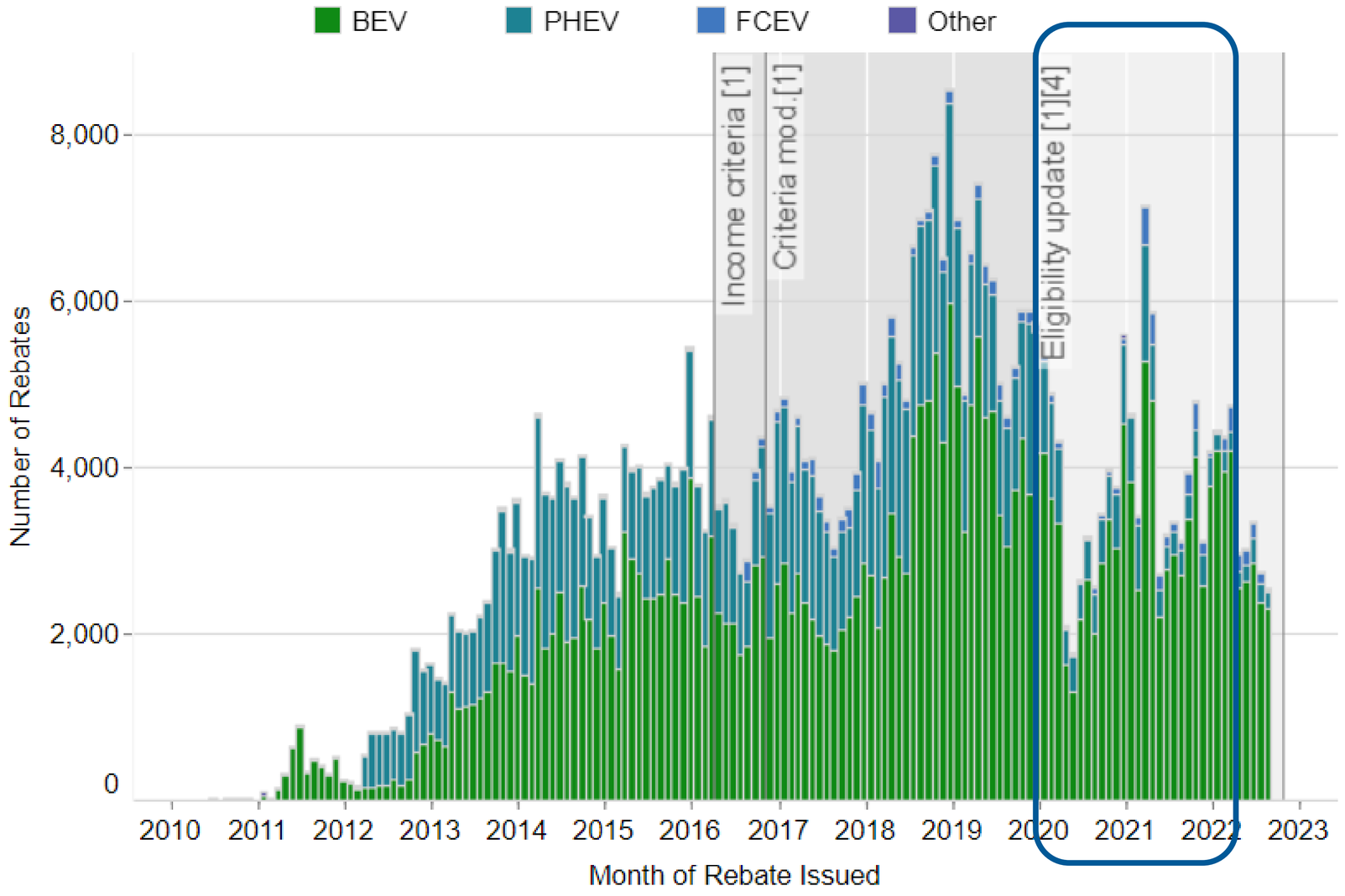
** Dates approximate.*

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

***Note**: Tesla MSRP exceeded cap, became ineligible 3/15/2022.*

Table adapted from https://cleanvehiclerebate.org/sites/default/files/attachments/Disruptions_Fact_Sheet_9_2021.pdf

2020–21 Results/Trends Should be Interpreted with Caution (COVID) Applications Saw Dramatic Decline But Some Recovery



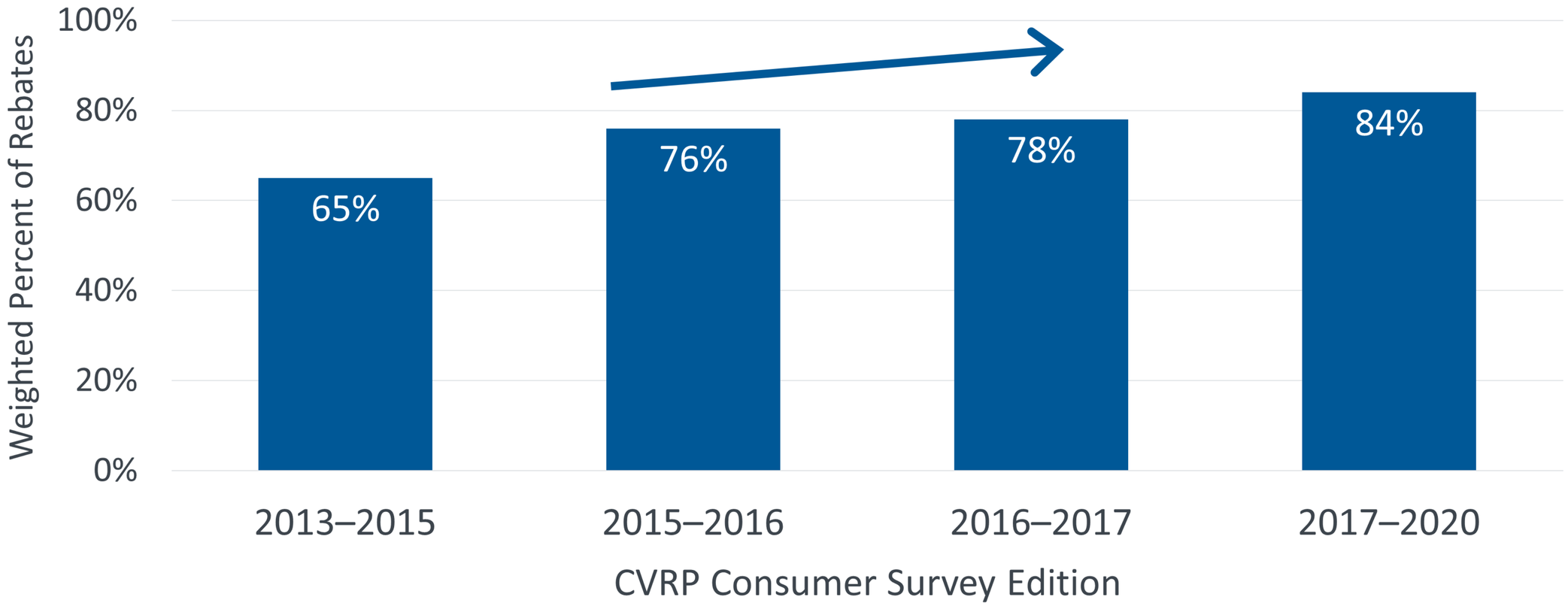
Rebate applications for calendar year 2021 purchases/leases for individuals spanned 1/1/2021 – 7/1/2022*.

9% applied in 2022.

** Special waivers permitted ~20 applications beyond the 3-month application window. 1/5/23 image from https://cleanvehiclerebate.org/eng/rebate-statistics*

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.

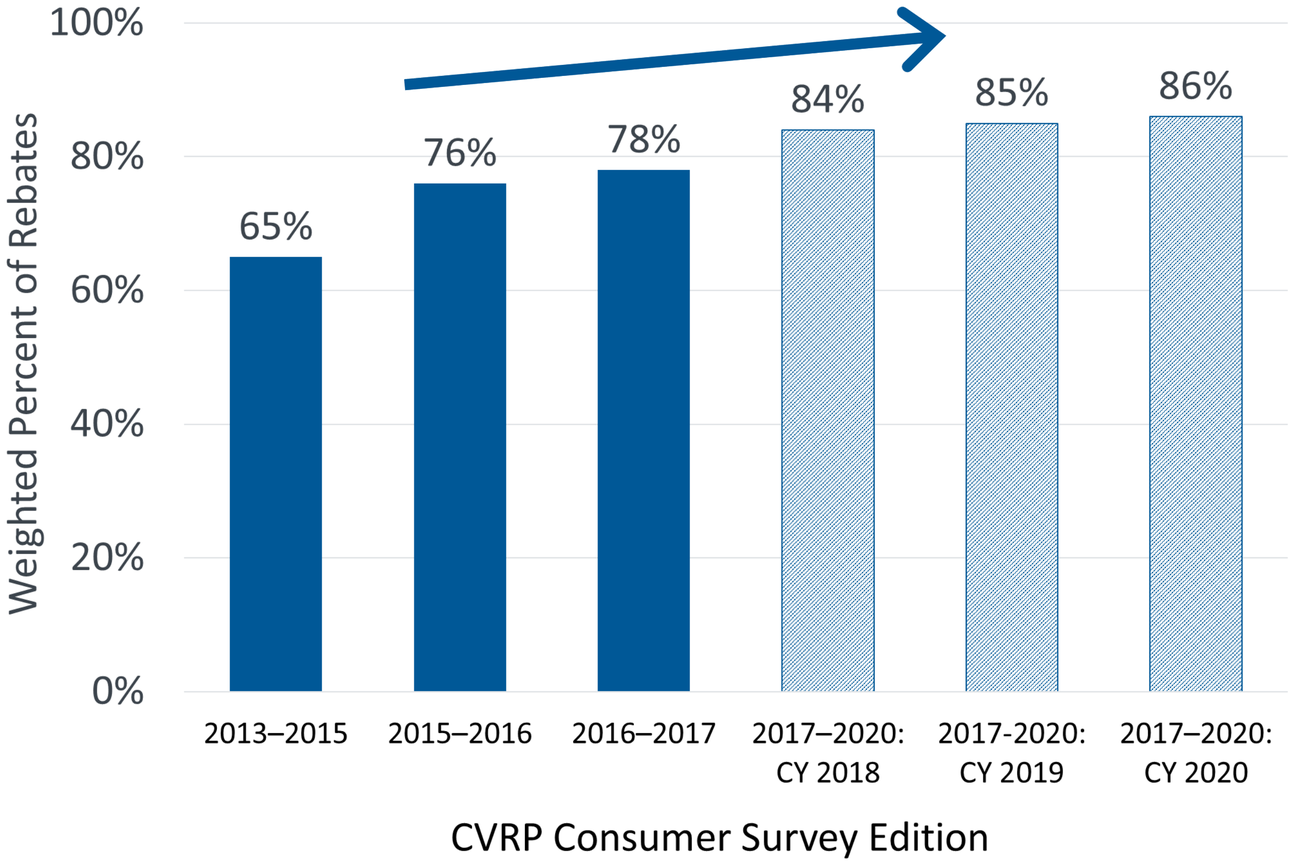
Incentive impact is generally increasing: Too soon to phase them out?

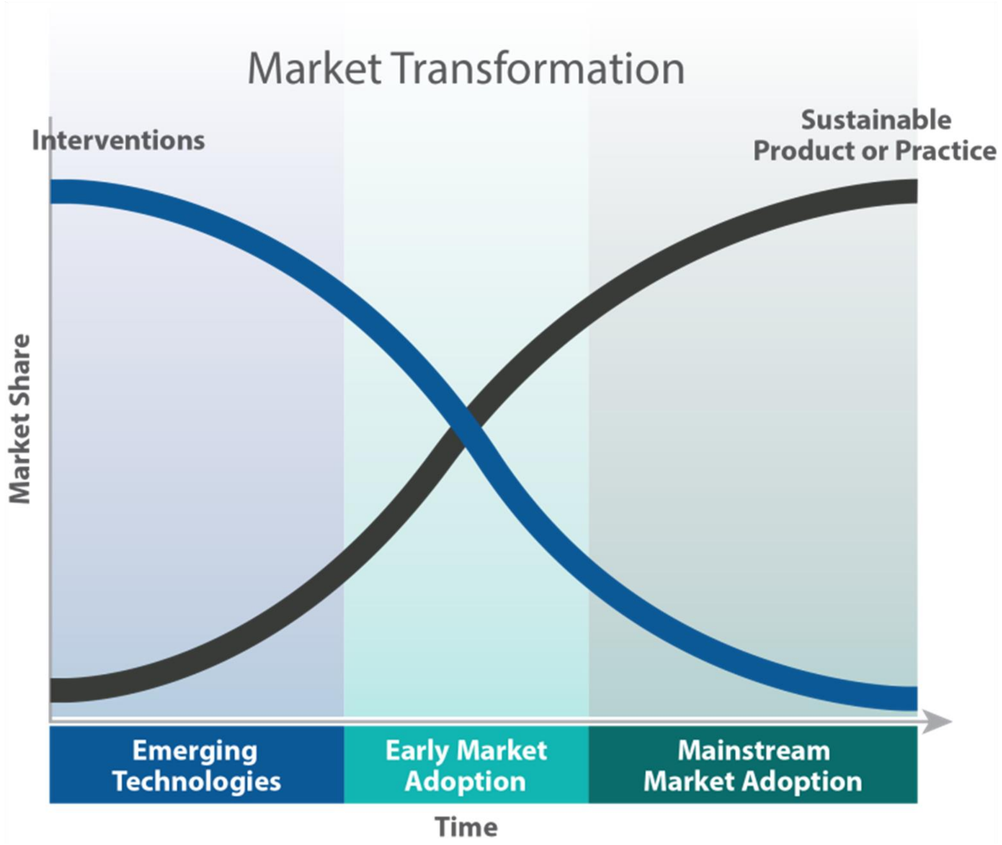
CALIFORNIA CLEAN VEHICLE REBATE PROJECT™

Replaced a vehicle with their *plug-in EV*

≠

Common paradigm

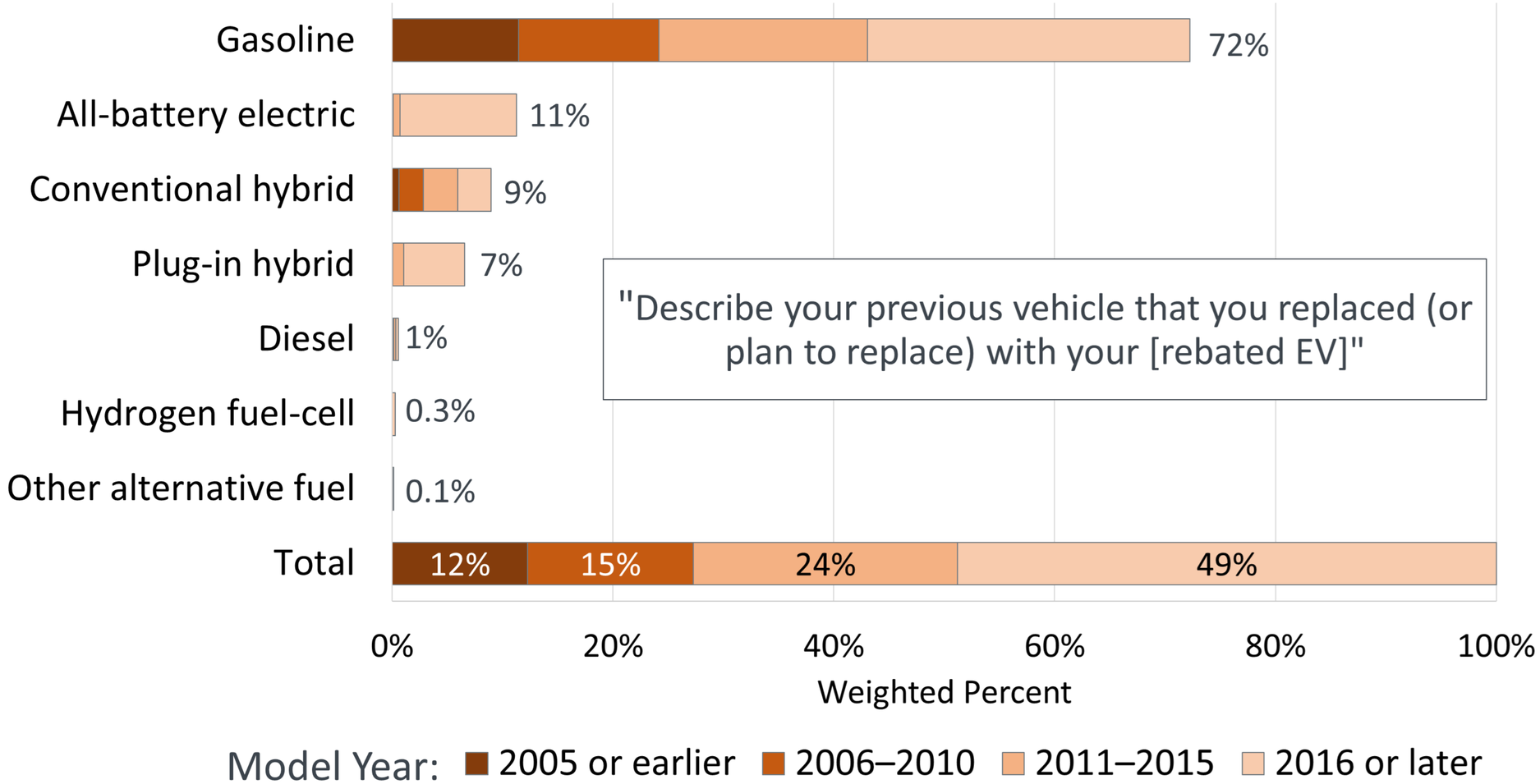




Overall datasets: 72,552 total survey respondents weighted to represent 376,800 rebate recipients. CY 2020 weights specific to 2020 purchases/leases.

What Vehicles Have Rebates Helped Replace?

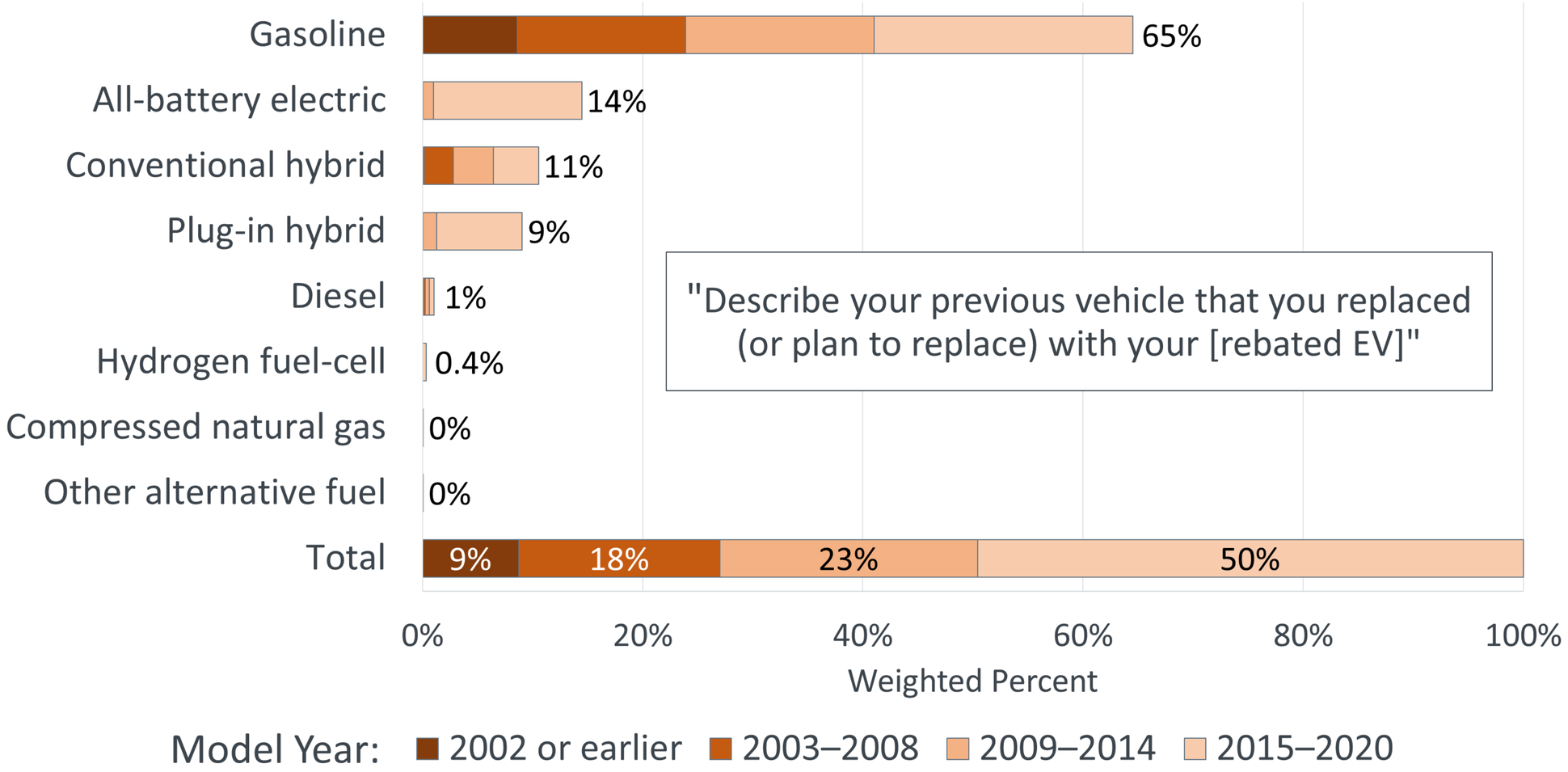
2021 Plug-in Electric Vehicle Purchases/Leases



Questions shown only to those that responded they replaced a vehicle with their rebated EV.
CVRP Consumer Survey 2020–2022 Interim Dataset. Filtered, question-specific, n = 6,493.

What Vehicles Have Rebates Helped Replace?

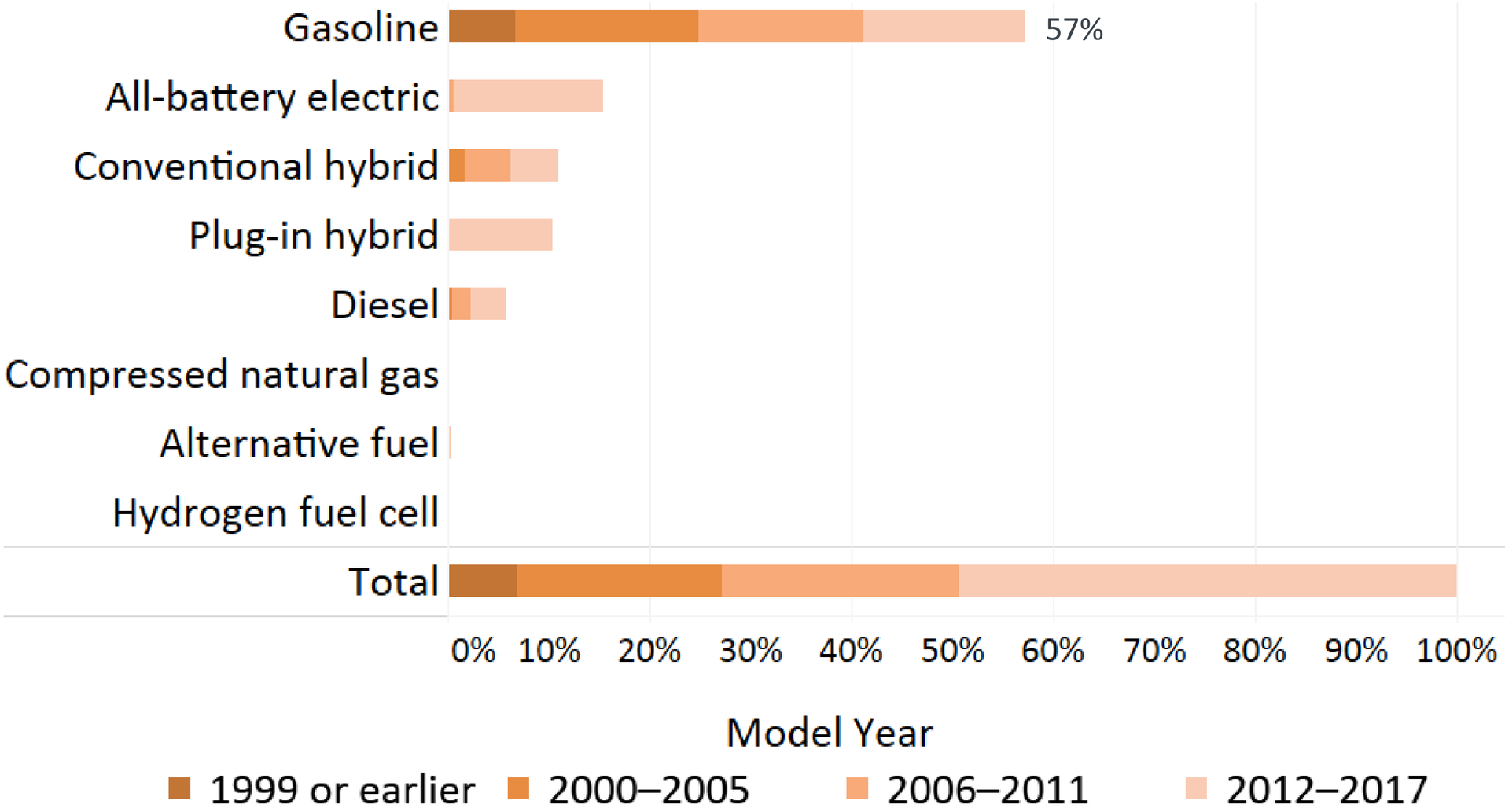
2020 Plug-in Electric Vehicle Purchases/Leases



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?

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

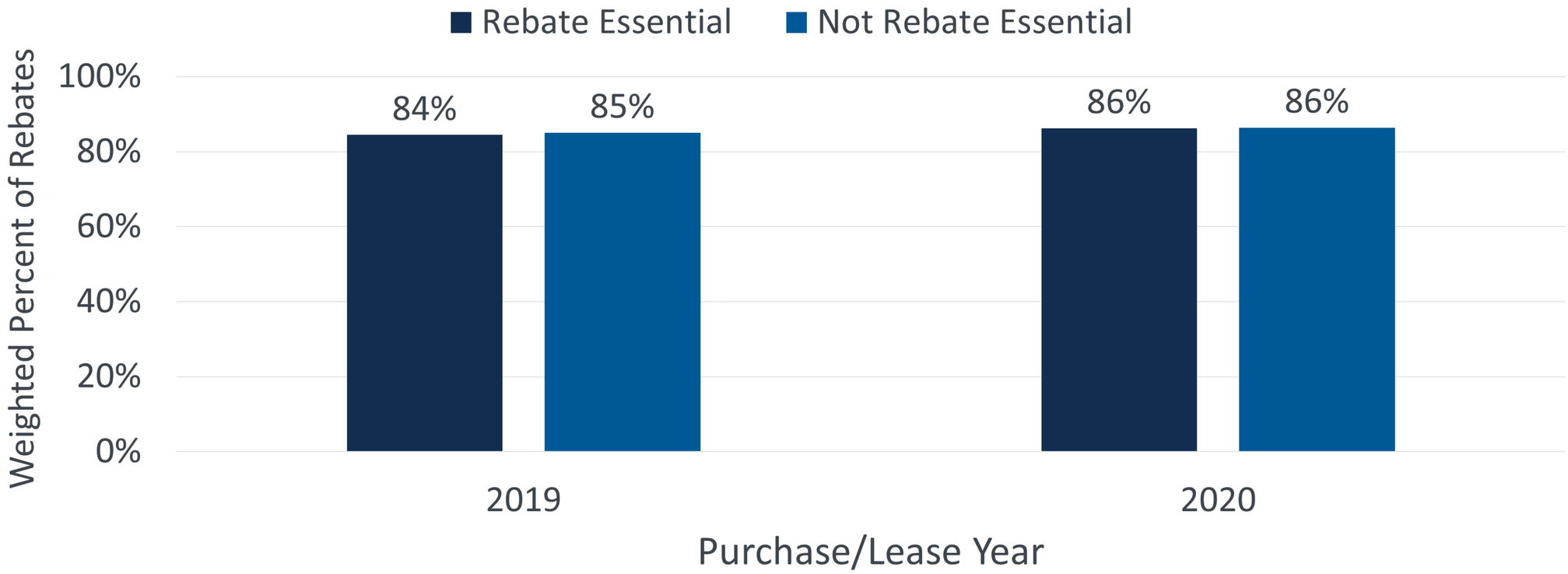


Questions shown only to those that responded they replaced a vehicle with their rebated EV.

*CVRP Consumer Survey. **2016–2017** edition, **trimmed to start November 2016**, weighted n=4,695*

Vehicle Replacement is Consistent Across Measures of Rebate Influence

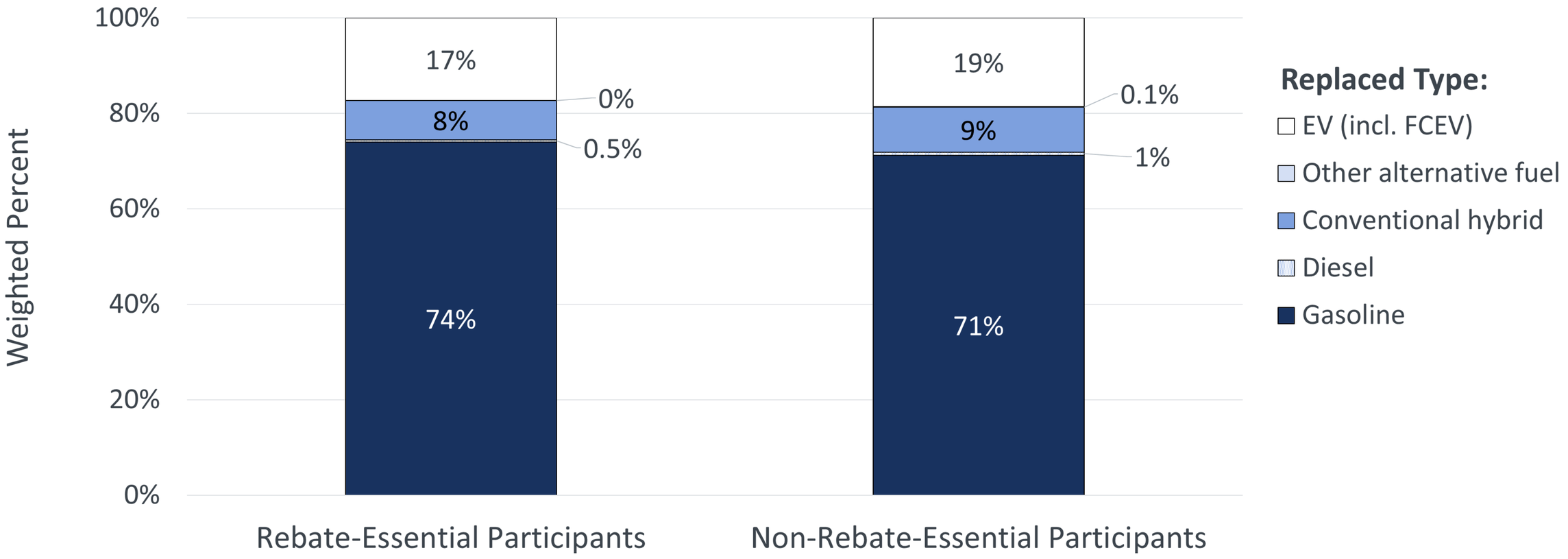
Replaced a vehicle with their rebated *plug-in EV*



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.

"Essential" and *"non-Essential"* Rebates Replace Similar Vehicle Types

2021 Purchases/Leases



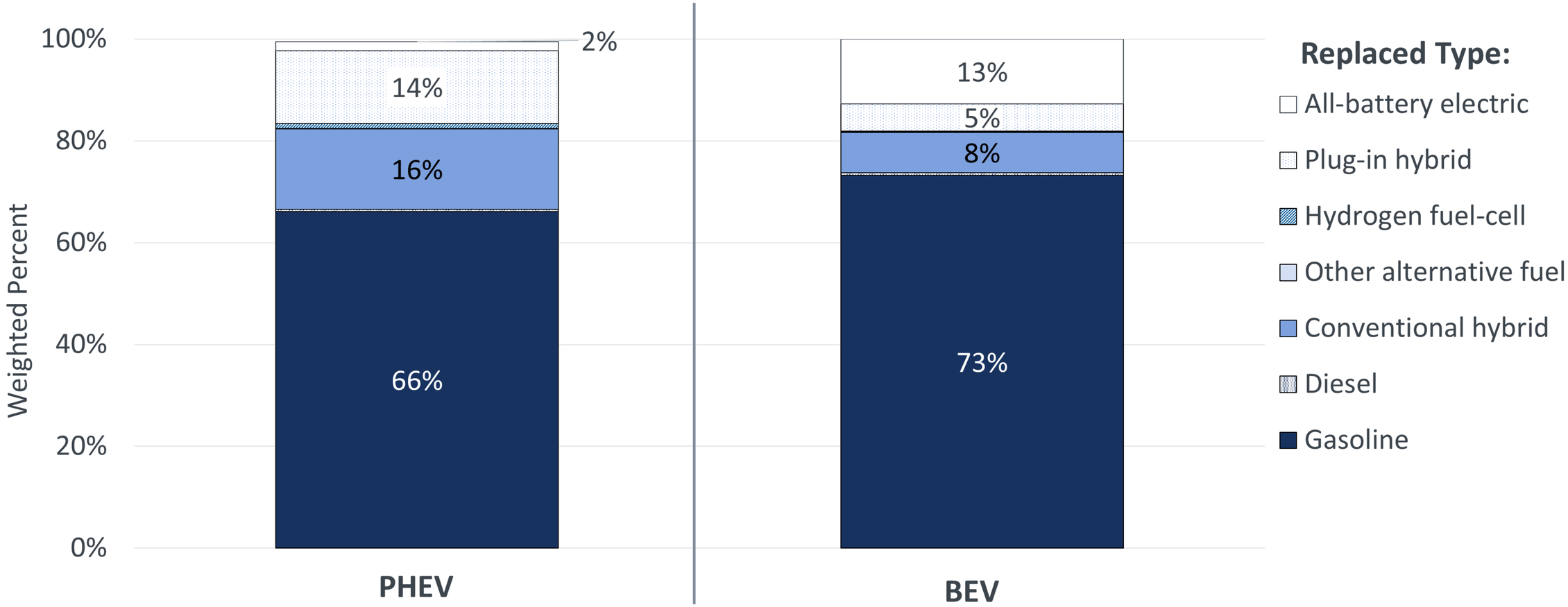
For more on *Rebate Essentiality* metrics and their definition, see the EVS36 paper *Rebate Influence on Electric Vehicle Adoption in California*.

Replacement question shown only to those that responded they replaced a vehicle with their rebated EV.

CVRP Consumer Survey, 2020–2022 Interim Dataset. Filtered, question-specific n = 6,485.

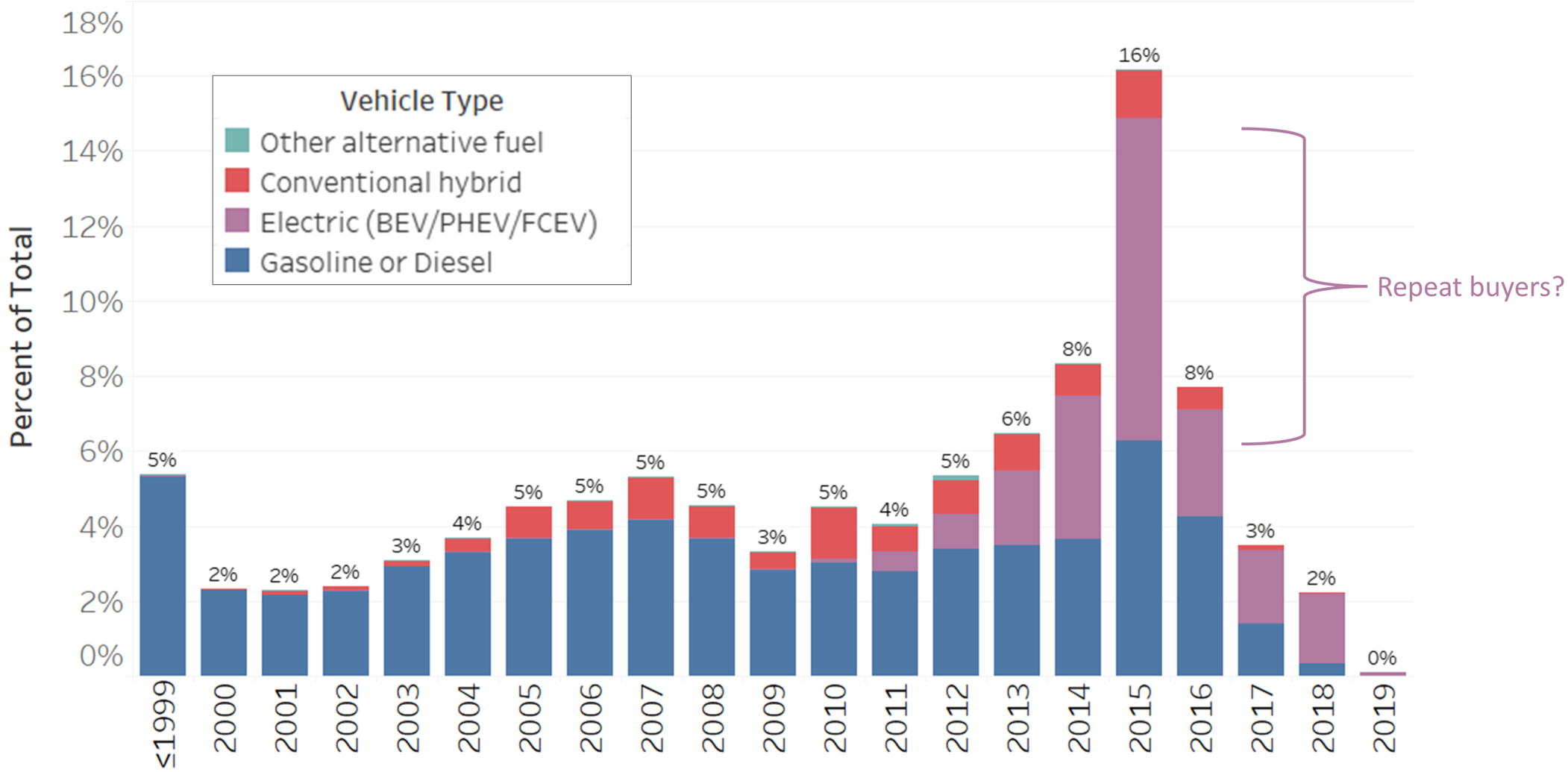
Replaced-Vehicle Technology Types by Rebated-Vehicle Technology Type

2021 Purchases/Leases



Question shown only to those that responded they replaced a vehicle with their rebated EV.
CVRP Consumer Survey, 2020–2022 Interim Dataset. Filtered, question-specific n = 6,513.

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

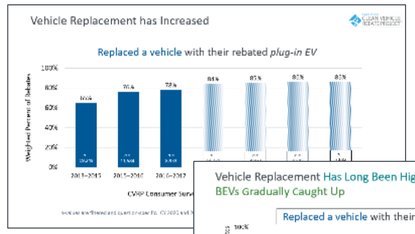


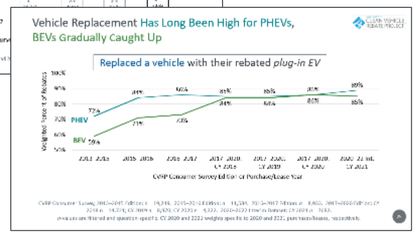
*CVRP Consumer Survey, **2017–2018** edition: weighted, question n= 14,677*

Summary & Select Findings: 2021 Vehicle Replacement

Context

- Program design and COVID-19 fallout shaped impacts in 2021



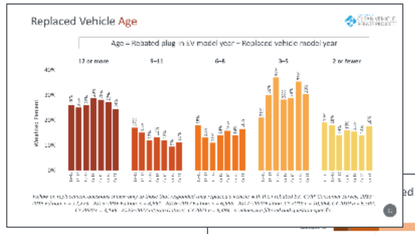


Replacement Rates

- 86% overall and 89% for PHEVs
  - PHEVs produced strong replacement rates early, BEVs gradually caught up

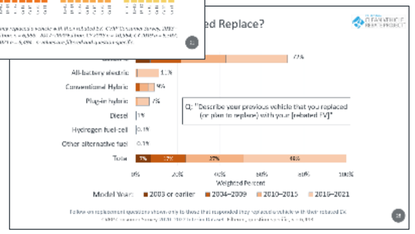
Replaced Age

- **~1/2** were **6+ years old**
  - **~1/4th** were **12+ years old**



Replaced Types

- **> 4/5ths** of replaced vehicles were **gasoline-fueled** (incl. conventional hybrid)
  - non-hybrid gasoline replacement *increased* from 65% (in 2020) to 72%
- **PHEVs replaced slightly 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

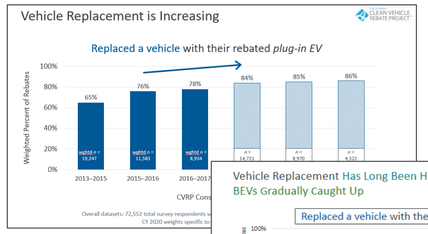
Summary & Select Findings: 2020 Vehicle Replacement
(at the onset of COVID-19)

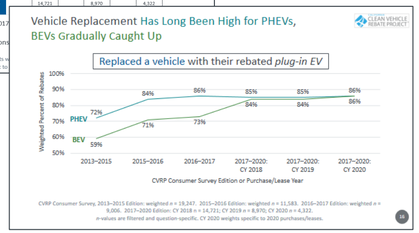
Context

- Program design and COVID-19 shaped impacts in 2020

Replacement Rates

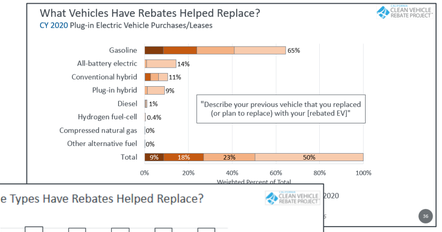
- Replacement rates continue increasing — up to 86% in 2020.
  - PHEVs produced strong replacement rates early, BEVs gradually caught up

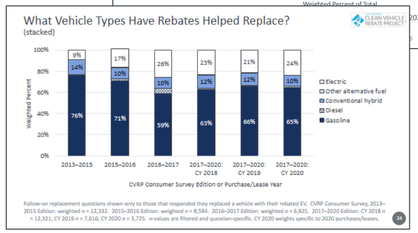




Replaced Age

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





Replaced Types

- **> 3/4ths** of replaced vehicles were **gasoline-fueled** (incl. conventional hybrid)
  - ~2/3rds 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

EV Rebate Program Impacts: Select Publications

- B.D.H. Williams and J.B. Anderson (2024, May). Expanding Electric Vehicle Adoption in Disadvantaged Communities. *Transportation Research Record: Journal of the Transportation Research Board*. https://doi.org/10.1177/03611981241242753. Includes open-access data-summary appendix. Paper. TRB 2024 slides.
- N. Pallonetti, B.D.H. Williams, and B. Sa (2023, Oct.), *CVRP Greenhouse Gas Emission Reductions and Cost-Effectiveness: 2021 Purchases/Leases*, Clean Vehicle Rebate Project. DOI: 10.13140/RG.2.2.28157.95207. Paper. CVRP Posting. GHG compilation.
- B.D.H. Williams and N. Pallonetti (2023, Mar.), New York State's Drive Clean Rebate for Electric Vehicles: Measures of Impact, *36th International Electric Vehicle Symposium (EVS36)*, EDTA, Sacramento CA, USA. Paper. Slides. CSE posting.
- B.D.H. Williams and N. Pallonetti (2023, Mar.), Rebate Influence on Electric Vehicle Adoption in California, *36th International Electric Vehicle Symposium (EVS36)*, EDTA, Sacramento CA, USA. Paper. CSE posting. Precursor slides. Conference slides with updates.
- N. Pallonetti and B.D.H. Williams (2023, Mar.), Vehicle Replacement: Findings from California's Clean Vehicle Rebate Project, *36th International Electric Vehicle Symposium* (EVS36), EDTA, Sacramento CA, USA. Paper. CSE posting. Precursor slides.
- B.D.H. Williams (2023, Apr.), Assessing progress and equity in the distribution of electric vehicle rebates using appropriate comparisons, *Transport Policy*, *137*, 141–151. DOI: 10.1016/J.TRANPOL.2023.04.009. Paper. CVRP posting. CSE posting. Precursor video. Slides.
- B.D.H Williams and J.B. Anderson (2022, Sep.), From Low Initial Interest to Electric Vehicle Adoption: "EV Converts" in New York State's Rebate Program. *Transportation Research Record: Journal of the Transport. Research Board*, 2677, 866–882. DOI: 10.1177/03611981221118537. Data-summary appendix.
- B.D.H. Williams (2022, Jun.), Targeting Incentives Cost Effectively: "Rebate Essential" Consumers in the New York State Electric Vehicle Rebate Program, *35th International Electric Vehicle Symposium (EVS35)*, AVERE, Oslo, Norway. Paper. Slides.
- B.D.H. Williams, J.B. Anderson (2022, Jun.), Lessons Learned About Electric Vehicle Consumers Who Found the U.S. Federal Tax Credit Extremely Important in Enabling Their Purchase, *35th International Electric Vehicle Symposium (EVS35),* Oslo, Norway. Paper. Slides.
- B.D.H. Williams (2021, Oct.), *An Electric-Vehicle Consumer Segmentation Roadmap: Strategically Amplifying Participation in the New York Drive Clean Rebate Program*, Report 21-30, *Clean Transportation Reports*, NYSERDA.
- 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 Report, San Diego CA. DOI: 10.13140/RG.2.2.36500.58243.
- 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). DOI: 10.13140/RG.2.2.24448.00004. CSE posting.
- C. Johnson, B.D. Williams (2017, Jan.), Characterizing Plug-In Hybrid Electric Vehicle Consumers Most Influenced by California's Electric Vehicle Rebate, *Transportation Research Record: Journal of the Transport. Research Board,* 2628, 23–31.

(Reverse Chronological, as of 5/2024. Additional related items.)

EV Rebate Program Impacts: Select Presentations & Videos

- CVRP 2021 Data Brief: Vehicle Replacement (2024, Apr.). CVRP posting.
- NY Drive Clean Rebate: Vehicle Replacement & Rebate Influence thru 2022 (2024, Mar.).
- Amplifying Electric Vehicle Adoption in Disadvantaged Communities, Consumer Segmentation Roadmaps, and Additional Equity Considerations (2024, Jan). TRB posting.
- Pickup Trucks: The Path to Electrification and CVRP Participation Through Q1 2023 (2023, Dec.). CVRP posting.
- CVRP 2021 Data Brief: Consumer Characteristics (2023, Dec.).
- CVRP 2021 Data Compilation: Incentive Influence and MSRP Considerations (2023, Oct.).
- NY Drive Clean Rebates: Select Impacts Through 2021 (2023, Jun. 12). Paper. CSE posting.
- Lessons Learned About Electric Vehicle Consumers Who Rated the U.S. Federal Tax Credit 'Extremely Important' (2022, Jun. 15). Paper.
- Targeting Incentives Cost Effectively: 'Rebate Essential' Consumers in the New York State Electric Vehicle Rebate Program (2022, Jun. 13). Paper.
- Conference video: "HEC 2022 Panel - Electrification and Transportation," opening pres. minutes 2–10; 40-min. panel total, (2022, May). Slides.
- CARB Video: "CVRP 2020 Data Brief: Consumer Characteristics," time 1:05:43–1:26:09, (2022, Mar.). Slides. Related journal article.
- 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, (2022, Feb.). Slides.
- Data from Statewide Electric Vehicle Rebate Programs: Vehicles, Consumers, Impacts, and Effectiveness (2021, Jul.).
- What Vehicles Are Electric Vehicles Replacing and Why? (2019, Nov.).
- Electric Vehicle Incentives and Policies (2019, Nov.).
- Targeting EV Consumer Segments & Incentivizing Dealers (2017, Jun.).
- Yale Webinar: "Supporting EV Commercialization with Rebates: Statewide Programs, Vehicle & Consumer Data, and Findings," 58 minutes, (2017, Apr.). Slides.
- Electric Vehicle Rebates in Disadvantaged Communities: Evaluating Progress with Appropriate Comparisons (2016, Oct.)
- Characterizing California Electric Vehicle Consumer Segments (2016).

(Reverse Chronological, as of 4/2024. Additional related items.)

Recommended citation:

B.D.H. Williams and N. Pallonetti (2024, July), Presentation: “CVRP 2022 Data Brief: Vehicle Replacement,” prepared by the Center for Sustainable Energy for the Clean Vehicle Rebate Project, California Air Resources Board, Sacramento USA.

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CleanVehicleRebate.org

Center for Sustainable Energy™

California Climate Investments
Cap and Trade Dollars at Work

California Air Resources Board