What Vehicles are Electric Vehicles Replacing and Why?

Findings from California's Clean Vehicle Rebate Project

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CleanVehicleRebate.org

Purpose

This investigation aims to enhance the understanding of what would have happened had a given electric vehicle (EV) not been deployed, in order to:

1. Enable more detailed assessment of the emission and market benefits of the California Clean Vehicle Rebate Project (CVRP)
2. Inform assessment of the impacts of EV deployment in other contexts
3. Provide broader insights into the evolving EV market

Data

EV rebate program overview (as of 30 Sept. 2019)

	CVRP (CA)	MOR-EV (MA)	CHEAPR (CT)	Drive Clean NY
Fuel-Cell EVs (FCEVs)	$5,000	$1,500	$5,000	≥120 e-miles $2,000 ≥40 e-miles $1,700 ≥20 e-miles $1,100 <20 e-miles $500
All-Battery EVs (BEVs)	$2,500	$1,500	≥200 e-miles $2,000 ≥120 e-miles $1,500 <120 e-miles $500	
Plug-in Hybrid EVs (PHEVs)	$2,500 (i3 REx) $1,500	BEVx only: $1,500	≥45 e-miles $1,000 <45 e-miles $500	
Zero-Emission Motorcycles	$900	$450	—	—
Program Design Highlights	• ≥20 UDDS e-miles • Income cap • Increased rebates for lower-income households (+$2,000)	• Purchase price ≤$50k • No fleet rebates Program ended 9/30/19	• BEVs & PHEVs ≤ $50k base MSRP, FCEVs ≤$60k • Point-of-sale option • $150 dealer incentive	• Base MSRP ≥$60k = $500 • Point-of-sale

CVRP Consumer Survey Data: Plug-in EVs*

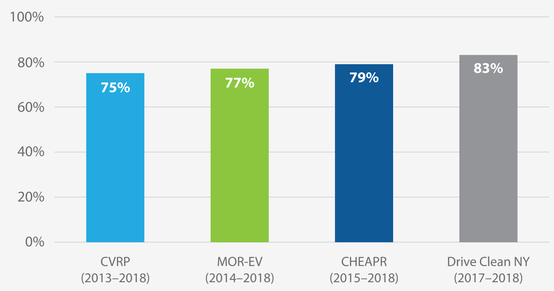
(Shows rebates to individuals only)

	2013–2015 Edition	2015–2016 Edition	2016–2017 Edition	2017–2018 Edition	Total
Vehicle Purchase/ Lease Dates	Sep. 2012 – May 2015	April 2015 – May 2016	May 2016 – May 2017	June 2017 – Dec. 2018	Sep. 2012 – Dec. 2018
Survey Responses (total n)**	19,460	11,611	8,957	20,864	60,892
Program Population (N)	91,081	45,698	46,839	89,944	273,562

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

Four-state context

Replaced a vehicle with their rebated clean vehicle

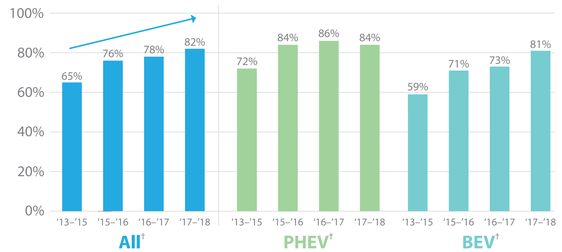


Overall datasets: 70,020 total survey respondents weighted to represent 301,619 rebate recipients

What vehicles are electric vehicles replacing?

Replaced vehicle details

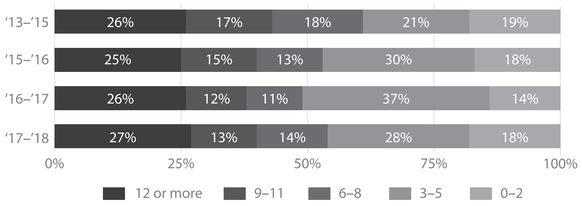
Replaced a vehicle with their rebated plug-in EV



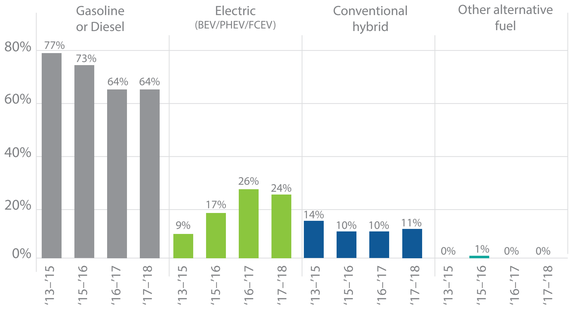
†Difference across survey editions and between technology types are all statistically significant ($p < 0.05$)

Replaced vehicle age

Age = Rebated EV model year - Replaced vehicle model year

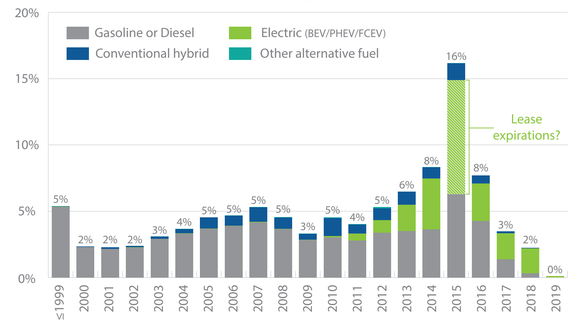


What vehicle types have rebates helped replace?



Model-year distribution of vehicles replaced

2017–2018 Edition

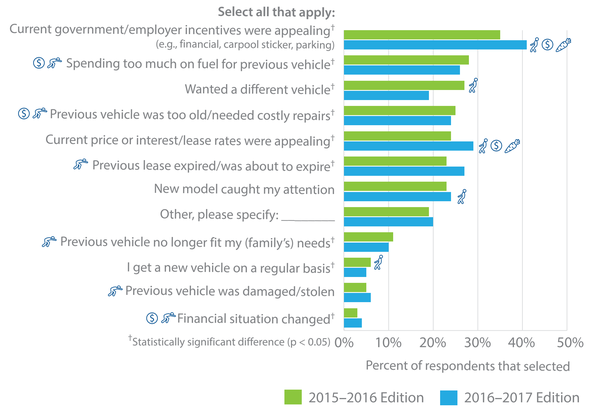


What motivated vehicle replacement?

Replacement decision factors

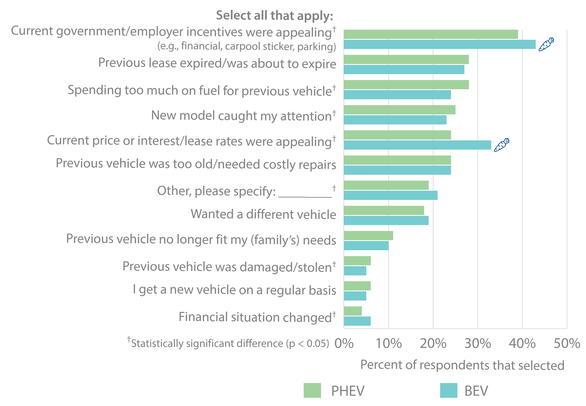
Pushed 6 factors ≈ 41% of selections
Pulled 5 factors ≈ 50% of selections
Lured 2 factors ≈ 30% of selections

Factors influencing the decision to replace



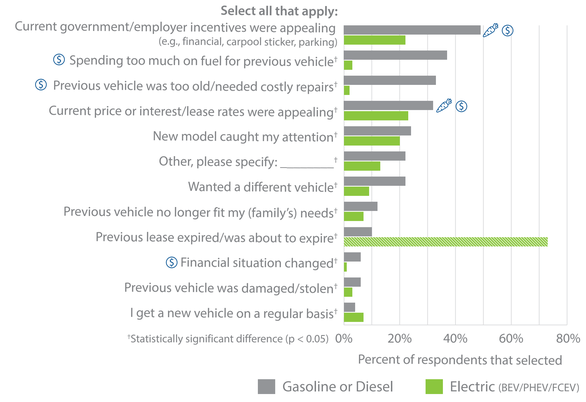
Financial lures are important to entice replacement with BEVs

2016–2017 Edition



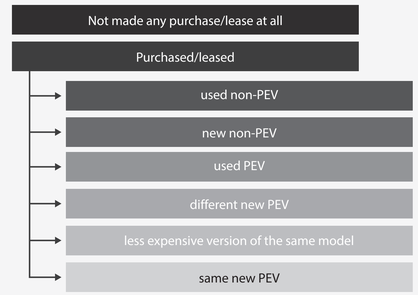
Factors influencing the decision to replace by replaced-vehicle technology type

2016–2017 Edition



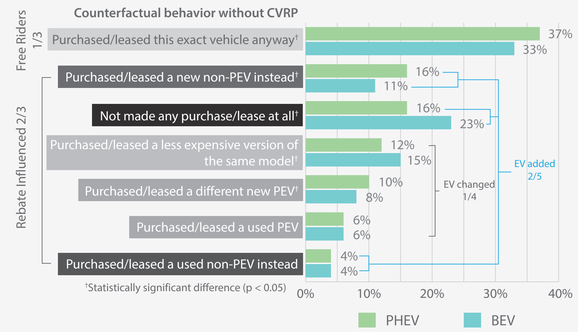
What might have happened without the rebate?

Counterfactual behaviors



What would the consumer have done if the state vehicle rebate (CVRP) were not available?

2017–2018 Edition



Select findings

- **~4/5** of rebated EVs ***replaced*** older, more polluting vehicles
- **PHEVs** produced strong replacement rates early, **BEVs** catching up
- These and other **impacts tend to be *increasing*** over time
- Replaced vehicles:
  - **1/4 are ≥12 years old**, 1/2 are >5 years old
  - **2/3 are gasoline**, down from 3/4, but stabilized/rebounding
- Vehicle replacement is most often **influenced by financial factors**, including appealing incentives
- In absence of the rebate, **2/3** of consumers may have **used a different vehicle than rebated**, 1/3 a non-EV, and **1/5 their old vehicle**
- Related research: when compared to buying a new non-EV, rebated EVs may be saving >30 tons of GHG emissions per vehicle (12-year life) at costs <$100/ton

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