



Percent of Eligible-Model Vehicles Rebated Before and After Income- Based Consumer Eligibility



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Overview

This report summarizes an analysis of the percent of eligible vehicles rebated by the Clean Vehicle Rebate Project (CVRP), California’s state rebate program for light-duty plug-in and fuel-cell electric vehicles and zero-emission motorcycles. The analysis focuses on changes to the percent of the eligible-model light-duty vehicle sales that were rebated following the implementation of income-based consumer eligibility requirements in 2016. We find that the share of eligible vehicle sales that were rebated decreased from 75% to 55% following the implementation of income-based eligibility requirements. In addition to evaluating variations in the percent of eligible vehicles rebated across time, variability by county, vehicle category and vehicle model are described. Factors that contribute to this variability and sources of uncertainty for these estimates are discussed.

Introduction

CVRP provides rebates to California individuals, businesses, and government agencies for the purchase and lease of qualified clean vehicles including plug-in hybrid electric vehicles (PHEVs), battery electric vehicles (BEVs), range-extended battery electric vehicles (BEVx vehicles) and fuel-cell electric vehicles (FCEVs)¹. It is useful to know the share of the vehicles purchased that are eligible for a rebate independent of the consumer’s eligibility status (or “eligible-model vehicle sales”) for assessing program participation, evaluating program impact, projecting program demand and estimating regional sales from freely-available rebate data. These and other activities inform clean-vehicle stakeholders such as policymakers, planners, and utilities.

We estimated the percent of eligible light-duty vehicles rebated (or “rebate rate”) by comparing CVRP rebate data to registration data for newly purchased vehicles² identified as eligible for CVRP based on vehicle model³ (independent of consumer eligibility status) for the period March 2010 through December 2018. One of the primary goals of this analysis was to assess the impact of the income-based eligibility requirements introduced in 2016⁴ on the rebate rate. We focus on the income-based eligibility requirement that restricted eligibility to households with incomes below prescribed thresholds—or “income cap”—since this made a consumer segment that traditionally received a large number of rebates

¹ We dropped ZEMs from the analysis due to their low number of rebates.

² Registration data licensed from IHS Markit; Copyright IHS Markit, 2020. All rights reserved.

³ Vehicles are identified as CVRP eligible by make (brand), model and registration month.

⁴ More information about eligibility is available on the program website: <https://cleanvehiclerebate.org/eng/eligibility-guidelines>

ineligible moving forward. In addition to the income cap, the change in income-based eligibility requirements included increased rebate levels for low- to moderate-income (LMI) households, but we assume that these increased rebates did not meaningfully contribute to changes in the rebate rate given this program change did not impact overall program eligibility and LMI program participation is relatively low. Accordingly, we focus on the income cap in this analysis and compare the rebate rates between the “pre-income cap” and the “post-income cap” periods (Figure 1).⁵ It should be noted that the rebate rates presented herein should be considered an approximation of the true values; known sources of error and uncertainty are described in the Appendix.

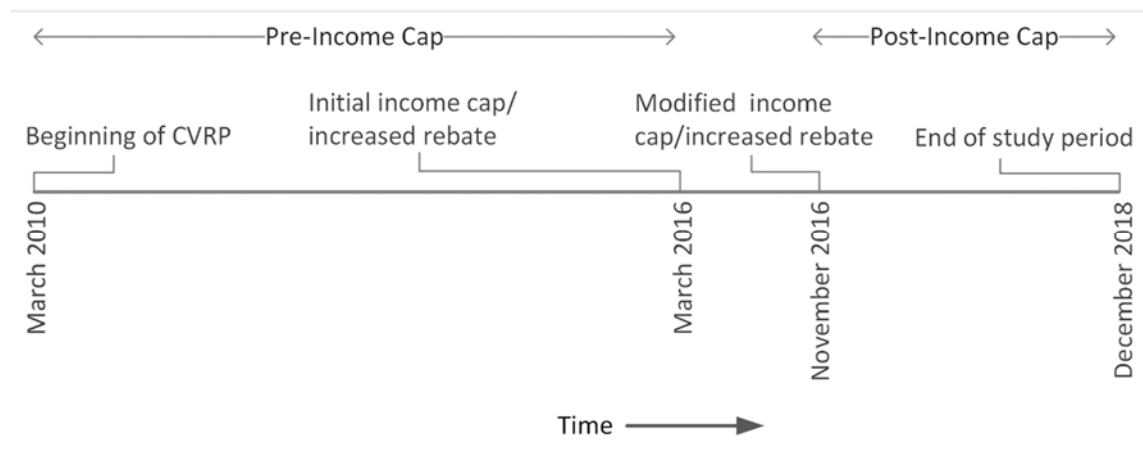


Figure 1. Timeline of program changes during the study period.

Rebate Rate: Overall and by Vehicle Category and Model

The percent of eligible vehicles rebated for March 2010 through December 2018 was approximately 63%, however, the rebate rate varied significantly across time. Indeed, quarterly rebate rates varied between 49% to 82% from 2012-2018 (Figure 2). The highest rebate rates corresponded to the pre-income cap period when they averaged approximately 75%, but rebate rates decreased rapidly following the establishment of the cap, averaging 55% in the post-income cap period.

The percent of eligible vehicles rebated also varied across vehicle category and model. The rebate rate for BEVs and PHEVs averaged approximately 67% and 59%, respectively, across the study period (Figure 3). However, the relative similarity of these rates is misleading as BEVs had a substantially higher rebate rate

⁵ Increased rebates for low-/moderate-income households were also implemented during this time, but they are unlikely to have significantly impacted rebate rates since they did not affect consumer eligibility.

prior to the income cap relative to PHEVs, but BEVs experienced a greater decrease in the rebate rate following the income eligibility (Figures 2 and 3). Indeed, the percent of eligible vehicles rebated for BEVs decreased from 83% to 57% compared to 68% to 51% for PHEVs. The large decline in rebate rates for BEVs was driven, in large part, by the Tesla Model S which declined from 82% to 31%. That said, the income cap did not correspond to large decreases in rebate rates for all major BEV models; for example, the FIAT 500e, Ford Focus Electric and the smart fortwo showed almost no change (Figure 3). Further, although the percent of eligible vehicles rebated for PHEVs decreased to a lesser degree following the income cap, some PHEV models experienced more substantial declines, particularly the Audi A3 e-tron (Figure 3).

The percent of eligible vehicles rebated for minor vehicle categories, i.e., BEVx and FCEV, also displayed differences between the pre- and post-income cap periods. The rebate rate for BEVx vehicles decreased from 51% to 41%, whereas the rate for FCEVs increased from 85% to 90% (Tables A2-A4). The slight increase in the rebate rate for FCEVs is not surprising given that the income cap did not apply to FCEVs and suggests that the decreases in the rebate rate observed across all other vehicle categories can be attributed, to a large degree, to the income cap.

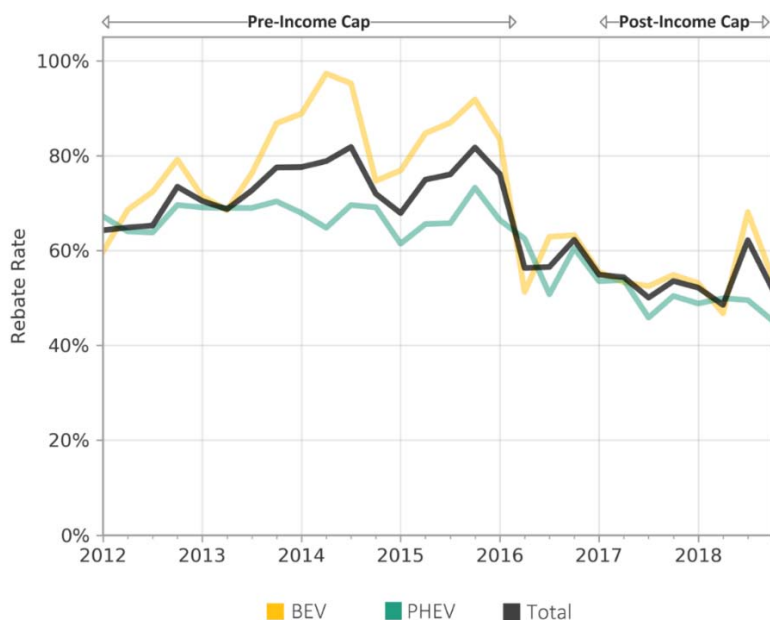


Figure 2. Percent of eligible vehicles rebated by quarter across all vehicle categories and stratified by major category type.⁶

⁶ BEVx and FCEV vehicles are not displayed due to the small market for these vehicle categories and large changes in the corresponding rebate rates. Likewise, 2010-2011 were not shown because of the relatively small clean vehicle market size during this time.

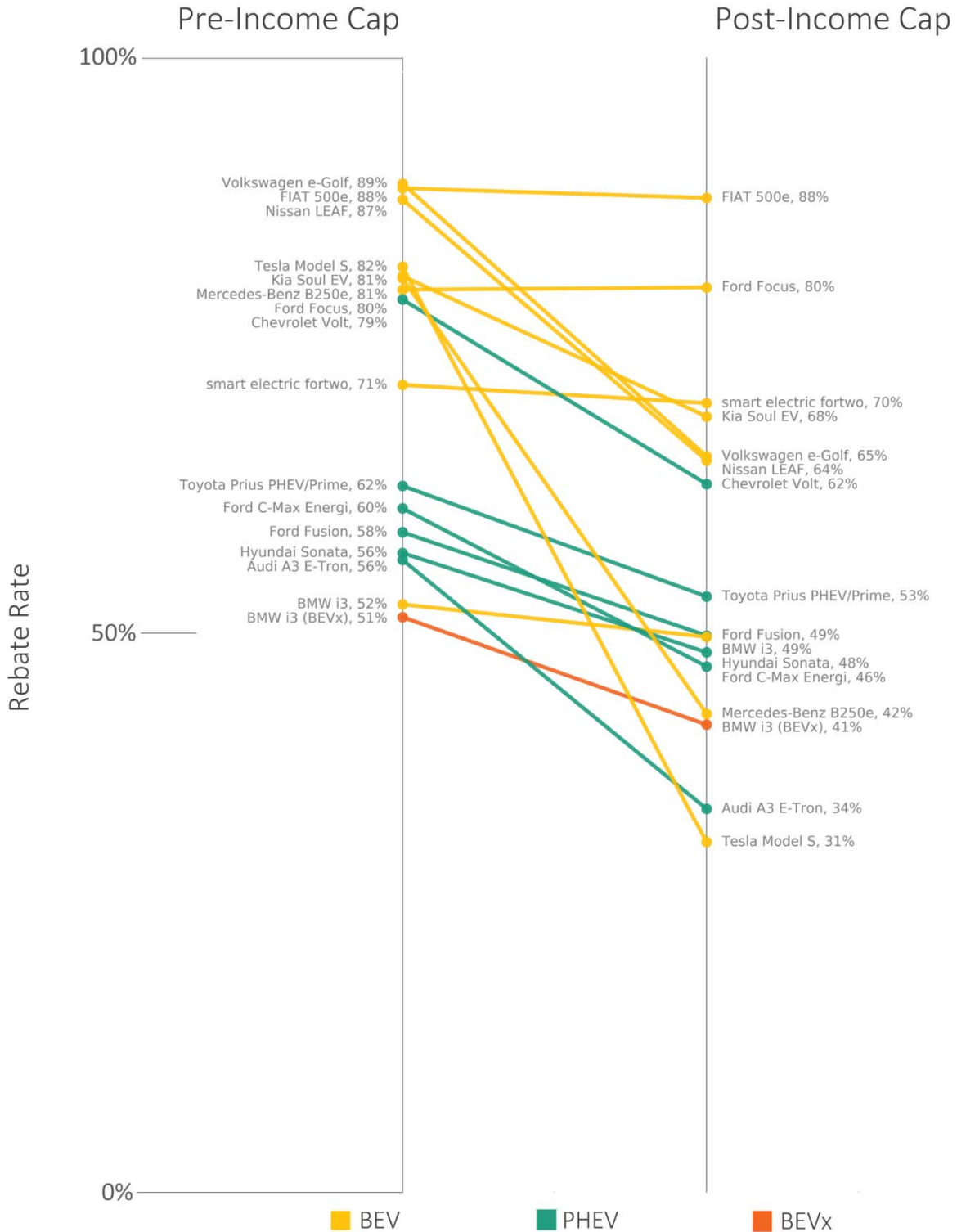


Figure 3. Change in the rebate rate between pre- and post-income eligibility periods by vehicle category and model.⁷

Rebate Rate: By County

The percent of eligible vehicles rebated also varied strongly by county. The lowest overall rebate rates were in coastal counties in the Bay Area, and the highest rates observed were in counties in the southern portion of the Central Valley (Figure 4, left). For example, San Francisco County had an overall rebate rate of 48% compared to 83% in Fresno County. The percent of eligible vehicles rebated decreased across nearly all counties following the income cap, but the magnitude of this decrease was inconsistent (Figure 4, right). For example, rebate rate decreases of greater than 30% occurred in several counties in the Bay Area; whereas many counties outside of large urban centers decreased less than 15% (Figure 4).

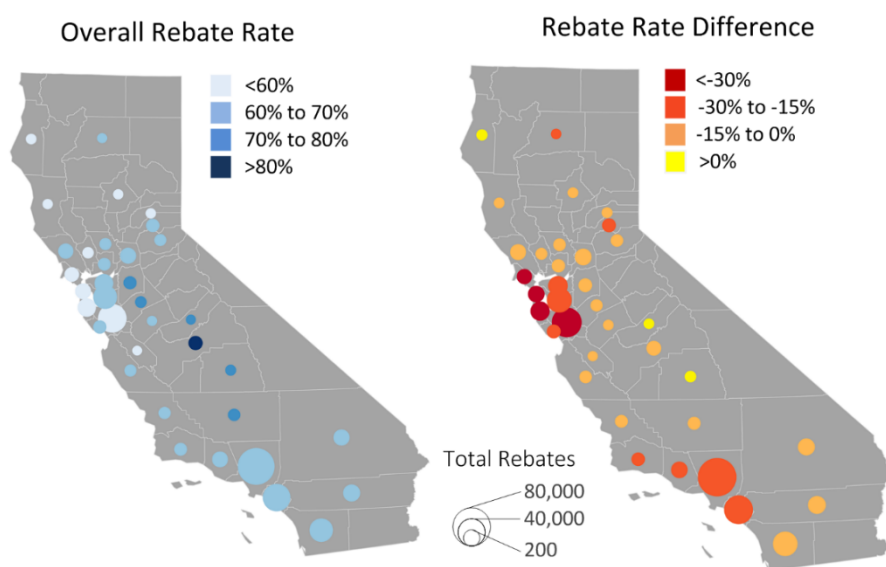


Figure 3. Overall rebate rate (left) and difference in rebate rates between pre- and post-income eligibility periods (right).⁸

The geographic patterns observed for the differences in rebate rates across counties following the income cap likely reflect income and, in turn, eligibility differences between the populations. In general, higher-income counties experienced a greater decrease in rebate rates than lower income counties⁹ (Figure 5). For instance, the average rebate rate across the ten counties with the lowest median household income decreased from 78% to 70%, whereas the average across the ten with the highest median income decreased from 76% to 51%. This suggests the decrease in rebate rates due to the income cap far outweighed any increase in rebate rates due to LMI increased rebate levels.

⁷ Models with less than 100 rebates in the pre- or post-income cap period not shown.

⁸ Counties with less than 100 rebates in the pre- or post-income criteria period not shown.

⁹ Data source for income: U.S. Census Bureau, 2013-2017 American Community Survey 5-Year Estimates, Median Household Income by County.

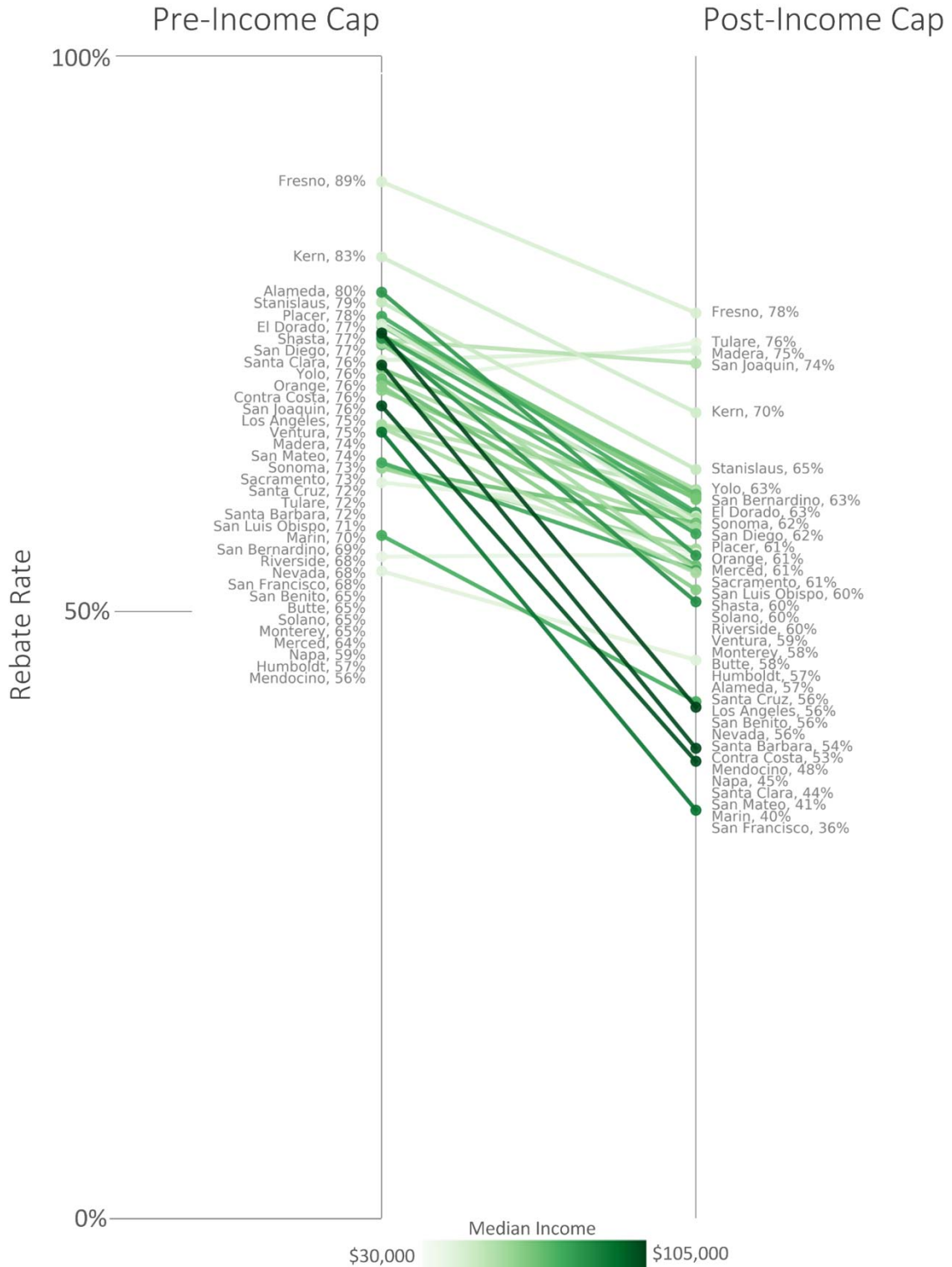


Figure 4. Change in the rebate rate between pre- and post-income eligibility periods by county and median household income.⁴

Summary and Discussion

From March 2010 through December 2018 approximately 63% of all eligible vehicle model sales were rebated through the California Air Resources Board's Clean Vehicle Rebate Project. However, the percent of eligible vehicles rebated decreased following the establishment of an income cap that made many consumers ineligible for the rebate beginning in 2016 (Figure 1). Indeed approximately 75% of eligible vehicles were rebated prior to the income cap but only 55% were rebated following the cap (Figure 2).

The decrease in rebate rates following the income cap was not uniform across vehicle categories, models (Figure 3) or counties (Figures 4 and 5), but the differences were largely predictable given the nature of the eligibility requirements: high-income counties and high-cost models tended to experience the greatest rebate rate decreases. The change in the rebate rates observed are not completely attributable to the income cap since other time-varying market and economic factors likely played a role, but the income cap was likely the dominant factor.

The decrease in the percent of eligible vehicles rebated indicates that many consumers have purchased eligible, clean vehicles without the added incentive of a rebate. This is a positive indicator for the clean vehicle market as it shows that clean vehicle adoption among high-income consumers do not always require a rebate incentive. That said, this does not preclude the possibility that the income eligibility prevented clean vehicle adoption by other high-income consumers. As such, future analyses should evaluate whether the income eligibility negatively affected clean vehicle adoption in high-income (ineligible) populations.

Appendix

Participation Calculation Considerations

The rebate rates presented in this report are estimates and are subject to several known sources of potential bias and error as described below. A table of vehicles that received rebates but were excluded from the calculations are provided in Table A1.

Pre-eligibility Volts. The Chevrolet Volt's were not eligible for CVRP eligibility when introduced as the internal combustion engine was not certified to emissions standards. At least 1,861 Volts were sold before a "low-emissions package" was released in February 2012. Volts registered prior to this month were removed from the registration data and do not impact participation calculations. However, the project received applications for a small number of ineligible vehicles following February 2012, indicating a small number of ineligible Volts continued to be registered. Since they could not be distinguished from eligible Volts, some ineligible Volts are likely present in the registration data. Their presence in the registration data artificially inflates the number of eligible vehicles during this period and would result in an underestimation of rebate rates.

Tesla Model X. When the Tesla Model X was introduced (prior to the income eligibility) there was a low number of registrations relative to rebate applications. The cause of this discrepancy is not clear, but Tesla Model X records occurring prior to March 2016 were dropped from both the registration and CVRP data to minimize the effect of the discrepancy. Given that other Tesla models corresponded to relatively high rebate rates, particularly prior to the income eligibility, it is likely that this resulted in an underestimation of rebate rates.

Insufficient registration data. Data records for 25 models, including motorcycles, medium-/heavy-duty vehicles, and low-speed neighborhood electric vehicles, were missing (or appeared inconsistently) in the registration data (Table A1). The 6,070 (1.9%) rebates corresponding to these models were dropped to avoid biasing the participation calculations, but their relatively small numbers limited their impact on the rebate rates.

Unknown lease terms. Vehicles leased for terms of less than 36 months were ineligible to participate in the CVRP until fiscal year 2014–2015, when the requirement was lowered to 30 months. The registration data does not provide the term of lease which inhibits exclusion of ineligible, short-term leases from the

participation calculations. The inclusion of vehicles with short-term leases artificially decreases rebate rates.

Table A1: Vehicles excluded from participation calculations.

Make and model	Rebates
Alta Motors Redshift	7
Bluecar Bluecar	43
BMW C evolution	4
Brammo Empulse	26
Brammo Enertia	22
Chevrolet Volt*	4
Coda	49
Energica Ego	2
Energica Eva	4
GEM Models	112
Honda Fit EV	442
Hyundai Ioniq Electric	583
Hyundai Ioniq PHEV	870
Kia Niro Plug-In Hybrid	1,087
Mercedes-Benz F-Cell	24
Miles EV ZX40S AD	35
Navistar eStar 300 Series	10
Smith Newton 1-9	39
Tesla Model X*	1,951
Th!nk City	54
Vantage EVX1000	1
Vectrix VX-1	5
Victory Empulse TT	12
Wheego Life	2
Zero	682
Total	6,070

* indicates vehicles that were not excluded across the entire study period. See text above for more details.

Table A2: Rebate Rate by County and Vehicle Category (March 2010 – December 2018)

County	BEV	BEVx	FCEV	PHEV	Total
Alameda	71%	43%	--	62%	67%
Butte	68%	--	--	51%	59%
Contra Costa	66%	34%	--	59%	63%
El Dorado	72%	--	--	65%	69%
Fresno	90%	--	--	65%	83%
Humboldt	67%	--	--	52%	56%
Kern	84%	--	--	66%	74%
Kings	91%	--	--	--	70%
Lake	--	--	--	--	56%
Los Angeles	67%	48%	92%	61%	64%
Madera	91%	--	--	--	77%
Marin	55%	36%	--	50%	53%
Mendocino	66%	--	--	43%	52%
Merced	75%	--	--	54%	63%
Monterey	68%	--	--	50%	60%
Napa	54%	--	--	45%	50%
Nevada	69%	--	--	48%	60%
Orange	71%	50%	93%	61%	67%
Placer	73%	--	--	61%	67%
Riverside	72%	38%	95%	56%	62%
Sacramento	70%	--	94%	59%	65%
San Benito	71%	--	--	51%	58%
San Bernardino	76%	43%	93%	56%	64%
San Diego	73%	53%	92%	61%	68%
San Francisco	50%	32%	--	47%	48%
San Joaquin	80%	--	--	66%	74%
San Luis Obispo	69%	--	--	57%	63%
San Mateo	55%	39%	88%	54%	55%
Santa Barbara	64%	--	--	56%	60%
Santa Clara	59%	41%	82%	58%	59%
Santa Cruz	69%	--	--	56%	63%
Shasta	70%	--	--	62%	66%
Solano	74%	--	--	52%	61%
Sonoma	75%	47%	--	57%	66%
Stanislaus	80%	--	--	57%	71%
Tulare	82%	--	--	58%	74%
Ventura	72%	31%	--	61%	65%
Yolo	75%	--	--	60%	68%

The double dash (--) indicates the data was insufficient (<100 rebates) for calculating an accurate rebate rate. Counties with insufficient data to calculate the combined BEV, BEVx, PHEV and FCEV rebate rate (last column) have been omitted.

Table A3: Rebate Rate by County and Vehicle Category Prior to Income eligibility (March 2010 – March 2016)

County	BEV	BEVx	FCEV	PHEV	Total
Alameda	87%	53%	--	71%	80%
Butte	--	--	--	--	65%
Contra Costa	86%	--	--	67%	76%
El Dorado	87%	--	--	69%	77%
Fresno	98%	--	--	66%	89%
Humboldt	--	--	--	52%	57%
Kern	90%	--	--	75%	83%
Los Angeles	83%	52%	--	71%	75%
Madera	--	--	--	--	75%
Marin	79%	--	--	59%	70%
Mendocino	--	--	--	--	56%
Monterey	--	--	--	--	64%
Napa	73%	--	--	57%	65%
Nevada	70%	--	--	47%	59%
Orange	--	--	--	--	68%
Placer	86%	51%	--	69%	76%
Riverside	87%	--	--	69%	78%
Sacramento	82%	--	--	62%	68%
San Benito	79%	--	--	66%	73%
San Bernardino	--	--	--	--	65%
San Diego	85%	--	--	61%	69%
San Francisco	83%	60%	--	68%	77%
San Joaquin	77%	35%	--	59%	68%
San Luis Obispo	83%	--	--	67%	76%
San Mateo	80%	--	--	61%	71%
Santa Barbara	79%	53%	--	65%	74%
Santa Clara	83%	--	--	61%	72%
Santa Cruz	82%	52%	--	69%	76%
Shasta	86%	--	--	58%	72%
Solano	--	--	--	--	77%
Sonoma	83%	--	--	55%	65%
Stanislaus	90%	--	--	59%	73%
Tulare	92%	--	--	61%	79%
Ventura	--	--	--	--	72%
Yolo	86%	--	--	70%	75%

The double dash (--) indicates the data was insufficient (<100 rebates) for calculating an accurate rebate rate. Counties with insufficient data to calculate the combined BEV, BEVx, PHEV and FCEV rebate rate (last column) have been omitted.

Table A4: Rebate Rate by County and Vehicle Category After Income eligibility (November 2016 – December 2018)

County*	BEV	BEVx	FCEV	PHEV	Total
Alameda	59%	31%	--	54%	57%
Butte	--	--	--	--	58%
Contra Costa	55%	--	--	51%	53%
El Dorado	64%	--	--	61%	63%
Fresno	84%	--	--	64%	78%
Humboldt	--	--	--	54%	57%
Kern	78%	--	--	60%	69%
Kings	--	--	--	--	79%
Los Angeles	58%	45%	92%	53%	56%
Madera	--	--	--	--	75%
Marin	40%	--	--	39%	39%
Mendocino	--	--	--	--	48%
Merced	--	--	--	--	61%
Monterey	66%	--	--	45%	58%
Napa	45%	--	--	44%	45%
Nevada	59%	--	--	--	56%
Orange	65%	52%	93%	52%	61%
Placer	65%	--	--	55%	61%
Riverside	69%	43%	--	52%	60%
Sacramento	66%	--	--	52%	61%
San Benito	--	--	--	--	56%
San Bernardino	74%	--	95%	52%	63%
San Diego	66%	50%	93%	55%	62%
San Francisco	36%	--	--	34%	36%
San Joaquin	79%	--	--	66%	74%
San Luis Obispo	64%	--	--	55%	60%
San Mateo	40%	--	86%	42%	41%
Santa Barbara	56%	--	--	51%	54%
Santa Clara	43%	26%	85%	45%	44%
Santa Cruz	58%	--	--	53%	56%
Shasta	--	--	--	--	60%
Solano	70%	--	--	50%	60%
Sonoma	68%	--	--	55%	62%
Stanislaus	72%	--	--	55%	65%
Tulare	82%	--	--	62%	76%
Ventura	66%	--	--	52%	59%
Yolo	68%	--	--	56%	63%

The double dash (--) indicates the data was insufficient (<100 rebates) for calculating an accurate rebate rate. Counties with insufficient data to calculate the combined BEV, BEVx, PHEV and FCEV rebate rate (last column) have been omitted.



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