

NYSERDA Drive Clean Rebate Ownership Survey: 2020 Results

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NYSERDA Drive Clean Rebate Ownership Survey: 2020 Results

Final Report

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Abstract

This report summarizes the results of a survey collected from rebate recipients approximately one year after adopting an electric vehicle (EV) through the New York State Energy Research and Development Authority’s (NYSERDA) Drive Clean Rebate Program between January 1, 2020 and December 31, 2020. The program offered point-of-sale rebates on new car purchases and leases for eligible electric cars.

Survey results are grouped by technology type, i.e., plug-in hybrid electric vehicles (PHEVs) and battery electric vehicles (BEVs). Results summarize demographics, that is, homeowners versus renters, residence type, gender, age, income and racial/ethnic identity, electric car driving patterns, charging behaviors and concerns.

The Ownership Survey showed high levels of participant satisfaction. Charging infrastructure, speed of charging and vehicle range limitations were the most commonly reported concerns. Similar to the 2018-2019 Ownership Survey results, BEV drivers were more likely to report using their car for long (>50 miles from home) trips. Relative to results from the 2018-2019 Ownership Survey, BEV drivers were charging their cars at home less frequently and were more likely to use public chargers.

Keywords

Electric cars, electric vehicles (EVs), plug-in electric hybrid vehicles (PHEVs), battery electric vehicles (BEVs), all-battery cars, Drive Clean Rebate Program, point-of-sale rebates, rebate importance, *Rebate Essentiality*, auto dealers, EV adoption

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Executive Summary

NYSERDA's Drive Clean Rebate Program provides point-of-sale rebates to consumers who purchase or lease eligible new electric vehicles, including plug-in hybrid and battery vehicles. The program launched in March 2017, administered by the Center for Sustainable Energy (CSE). Participants in the program are invited to take an Ownership Survey approximately one year after acquiring their car. The survey asks about ownership experience and what could make electric car ownership more attractive. This report summarizes findings for rebated vehicles purchased or leased between January 1, 2020 and December 31, 2020.

The year of 2020 included the onset of the COVID-19 pandemic. Although the report does not analyze the impact of COVID-19, year-to-year survey result comparisons¹ may illustrate the differences in participant driving patterns, charging behaviors, satisfaction with EV ownership, and concerns after experiencing ownership of an EV.

A total of 13,286 program participants received a rebate for vehicles purchased during this time, and each received an invitation to complete the survey. Of these, 3,239 completed the survey, with a response rate of 24%. Twenty-one respondents were disqualified because they no longer own the electric car that they were incentivized for. Four responses experienced a technical error that allowed them to bypass the survey screening process meant to preserve the validity of responses. In total, 25 responses were removed from the analysis. After eliminating these responses, 3,214 (24%) valid responses remained and were analyzed in this report. To better represent the larger population of program participants, survey data were then weighted; key findings include the following:

- Respondents have driven an average² of:
 - 9,701 miles (for plug-in hybrid electric vehicles, or PHEVs).
 - 10,707 miles (for all-battery electric vehicles, or BEVs).
- Typical vehicle uses³ include:
 - Running Errands (89%)
 - Commuting (67%)
- Respondents are satisfied with their electric cars:
 - 94% are “very” or “extremely” satisfied with their ownership experience.
 - 94% would “probably” or “definitely” recommend electric vehicle (EV) ownership to others.

Despite the high levels of overall satisfaction reported by participants, challenges remain.

- Most respondents have concerns about the availability of public charging infrastructure:
 - 64% of respondents selected “Access to public charging stations” as one of the top three challenges of owning an electric car, and 72% disagreed with the statement “there are enough public chargers.”
 - 25% of BEV respondents agreed with the statement, “I frequently see gasoline-fueled cars parked in spaces with public electric car chargers.”
- Respondents ranked car performance in cold weather as less of a concern than in the last edition of the report:
 - 31% of BEV respondents selected this as one of their top three challenges (versus 39% in the previous report).
 - Among PHEV respondents, this number dropped from 33% to 21%.
- Charging behavior of both BEV and PHEV drivers is different from the 2018-2019 Ownership Survey Results:
 - The percentage of BEV drivers who charge at home daily decreased from 68% to 41% while PHEV drivers increased from 43% to 54%.
 - The percentage of BEV drivers who never use public chargers decreased from 58% to 22%.
 - The percentage of PHEV drivers who never use public chargers increased from 23% to 61%.

1 Introduction

NYSERDA’s Drive Clean Rebate Program provides point-of-sale rebates to consumers who purchase or lease eligible new all-battery or plug-in hybrid electric cars. Hydrogen fuel-cell electric cars will be eligible when they are available in New York State.

The program launched in March 2017 and is administered by the Center for Sustainable Energy (CSE). Individual program participants⁴ are invited to take two voluntary surveys designed to help researchers better understand owner experience and behavior. The first, the Adoption Survey, is shared with participants two weeks after the rebate is approved. This report summarizes findings from the second survey—the Ownership Survey—designed to more fully comprehend rebated electric car ownership experiences in New York State and identify ways to make ownership attractive and sustainable.

1.1 Administration Details

The Drive Clean Rebate Ownership Survey is administered on a quarterly basis. Program participants receive a survey invitation by email approximately one year after they acquired a car.⁵ The participants included in this analysis purchased or leased electric cars between January 1, 2020 and December 31, 2020 (Table 1). A total of 13,286 participants received a rebate for cars acquired during this window and were invited to take the survey.

Table 1. 2020 Drive Clean Rebate Ownership Survey

Details	Date Ranges
Survey Administration Dates	March 30, 2021—November 2, 2021
Responses Received	March 30, 2021—April 2, 2022
Rebate Application Approval Dates	January 15, 2020—October 8, 2021 ^a
Vehicle Purchase/Lease Dates	January 1, 2020—December 31, 2020 ^b

^a Of the survey sample. Note that the last rebate approval date occurs over nine months after the last vehicle purchase in this data set. While dealers are required to submit applications within 90 days of the date of sale, NYSERDA occasionally grants exceptions so that dealers can submit applications outside of this eligibility window.

^b Of the survey sample.

Of those invited to take the survey, 3,239 responded, resulting in a response rate of 24%. These respondents completed the survey between March 30, 2021 and April 2, 2022. Twenty-one respondents were disqualified because they no longer own the electric car that they were incentivized for. Additional cleaning and review identified four responses that experienced a technical error that allowed them to bypass the screening process meant to preserve the validity of survey responses. After eliminating these responses, 3,214 valid responses remained and were analyzed in this report (a 24% response rate).

An updated version of the Ownership Survey was released on March 30, 2021. While most survey questions remain unchanged from the previous survey edition, some questions were edited for clarity or to reflect current best practices for asking demographic questions. Due to some changes in questions and response options, question results displayed in this report may differ from previous reports, and caution should be taken to compare year over year. Questions with changes are indicated with a †.

Further analysis of the results from this report should also consider the impacts of the COVID-19 pandemic. Program participants purchased or leased their electric cars during 2020, which included the onset of the COVID-19 pandemic. As the Ownership Survey invitations were sent a year after participants acquired their car, responses may capture participants' electric car ownership experience during COVID-19. Although the report does not analyze the impact of COVID-19, year-to-year survey result comparisons may illustrate the differences in participant driving patterns, charging behaviors, satisfaction with EV ownership, and concerns after experiencing ownership of an EV.

1.2 Representativeness and Weighting

Since the Ownership Survey is voluntary and not everyone chooses to complete it, responses may not be representative of the entire Drive Clean Rebate participant population. However, using application information available for all program participants, response weights were created to compensate for over- or under-representation among various groups.⁶ The dimensions used for weighting were car model, purchase versus lease, county, and technology type (plug-in hybrid electric vehicle [PHEV] versus battery electric vehicle [BEV]). The weights were calculated using the raking method.⁷ In this report, responses are segmented by technology type when the differences between these two are statistically significant.⁸ Rao-Scott adjusted Pearson's Chi-square testing with weighted data was used to test for differences between PHEV and BEV respondents.⁹ A summary of the participant population represented, survey sample size, and weighting method and dimensions can be found in Table 2.

Table 2. 2020 Drive Clean Rebate Ownership Survey Sample Size and Representativeness

Details	Sample size and representativeness
Program Participant Population	N = 13,251*
Responses in Data Set	n = 3,214 (24%)
Weighting Method	Raking
Representative Dimensions	Car Model, Purchase vs. Lease, County, Technology Type

* 35 rebate recipients were excluded from the program population because no corresponding survey response was represented in one or more of the strata used to weight.

Frequencies shown in figures throughout this report have been made proportionate based on the applied weights. In other words, all “%” results given below are proportionately weighted. Although the weighted frequency percentages tend to be the most-used summary statistics, the reader can approximate the number of program participants per each response option, if desired, using the program population size (N=13,251) and the percentages given in the charts below.

2 Results

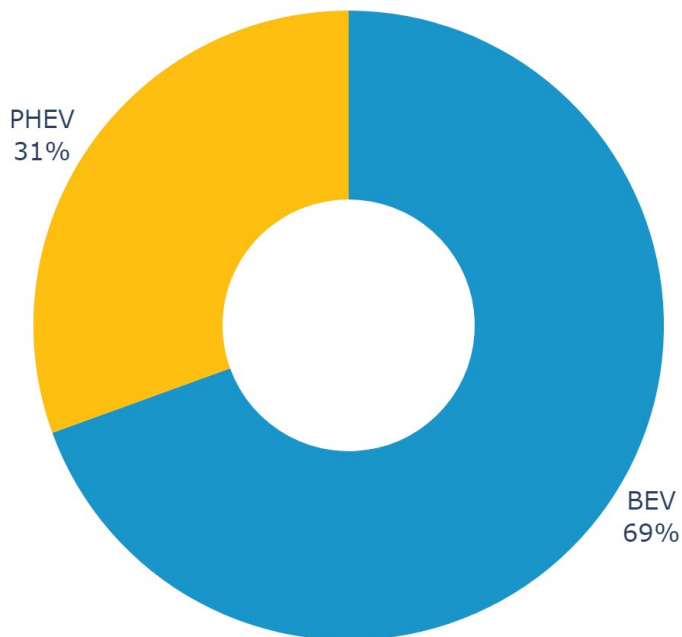
Please note, all frequencies and percentages given below are proportionately weighted.

2.1 Technology Types

Figure 1 shows that BEVs were more commonly rebated than PHEVs during this time period (69% versus 31%), and represents the first time BEVs have dominated the program. The proportion of BEVs among program participants has been growing substantially, representing only 28% of participants in the 2017-2018 Ownership Survey report and 44% in the 2018-2019 Ownership Survey.

Figure 1. Rebates by Technology Type

(n = 3,214)



2.2 Car Status

Nearly all 3,235 respondents (99.4%) said their household still had the rebated electric car. Only 0.5% (15 respondents) reported that their household now has a different electric car, and the remaining 0.2% (6 respondents) no longer own any electric car. Of the six who no longer had the rebated car, three sold or traded it in, and one had their electric car damaged or stolen, one selected “other” and one did not select a response. The exact question wording can be found in Appendix: Ownership Survey Questionnaire.

2.3 Demographics and Housing Characteristics

Table 3 compares program participants with new car buyers in the United States, based on data from the National Household Travel Survey (NHTS).¹⁰

Table 3. Comparison of Program Participants with New Car Buyers in the United States

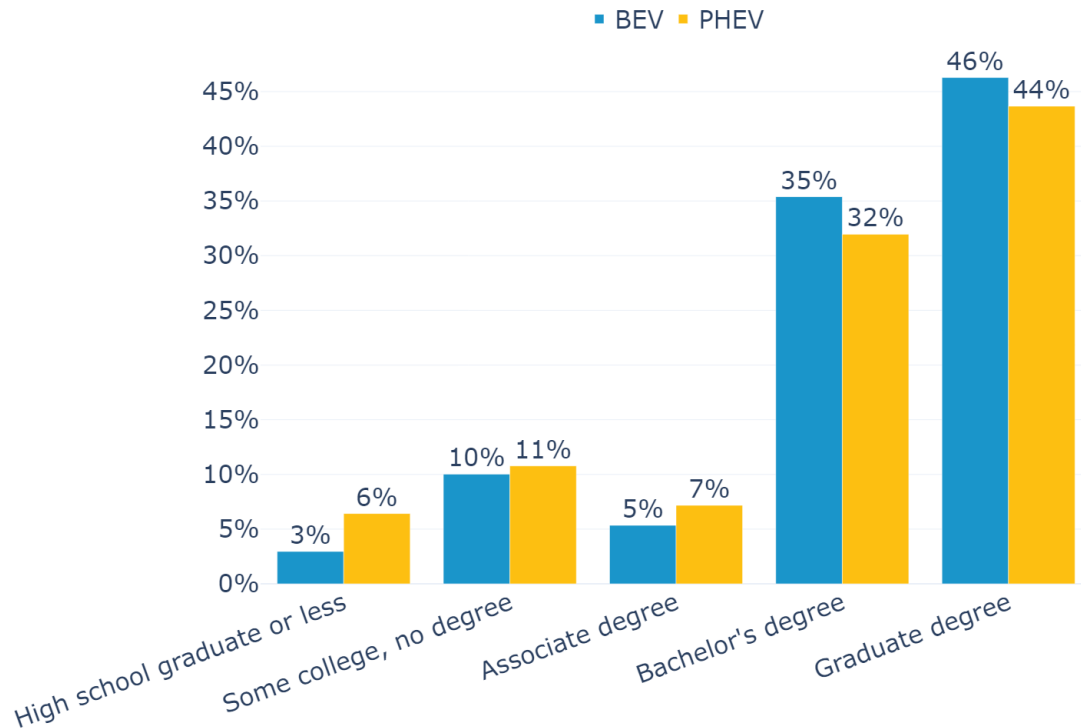
Characteristic	Drive Clean Program Participants	New Car Buyers in the US (NHTS 2017)
Male	75%	49%
Selected Solely White/Caucasian	78%	74%
50+ Years Old	53%	43%
Bachelor's Degree or Higher	80%	50%
Family Income \$150,000+	53%	23%
Own Home	84%	73%

Table 3 provides a helpful reference point when interpreting the data from rebate recipients, shown in greater detail below. This is because new car buyers—rather than the population of New York State in general as a whole—are a more appropriate basis for comparison.

Program participants more frequently have college degrees, have higher incomes, and are older than average new car buyers in the United States. Eighty percent of program participants have at least a bachelor's degree (relative to 50% of new car buyers). Figure 2 shows significant education differences between PHEV and BEV drivers, with BEV drivers more likely to have a college degree.

Figure 2. Highest Level of Education Completed by Technology Type

Responses from PHEV and BEV consumers are significantly different (chi-squared test: $\chi^2 = 27$, $p < 0.01$, $n = 3,114$).



Fifty-three percent of program participants have an annual household income of \$150,000 or more compared to 23% of new car buyers. Figure 3 shows that there were also significant differences in income between PHEV and BEV drivers, with BEV drivers more likely to report annual household incomes of \$400,000 or more.

Fifty-three percent of rebate recipients are 50 years old or older, versus 43% of new car buyers overall. This is a notable decrease from the 2017-2018 Ownership Survey results, in which 64% of respondents were 50 years old or older, but relatively unchanged from last year's report, where 56% of respondents were 50 or older. Figure 4 shows significant age differences between PHEV and BEV drivers, with BEV drivers being younger than PHEV drivers.

While new car buyers in the U.S. are evenly split between male and female (49% male), program participants were 75% male. Figure 5 shows that females make up a larger portion of PHEV drivers than BEV drivers (36% versus 19%, respectively). The 19% share of BEV drivers who are female is similar to the 2018-2019 survey results of 18% but continues to remain a decrease from 25% in the 2017-2018 survey.

Figure 3. Annual Gross Household Income from All Sources by Technology Type

Responses from PHEV and BEV consumers are significantly different (chi-squared test: $\chi^2 = 279$, $p < 0.01$, $n = 2,618$).

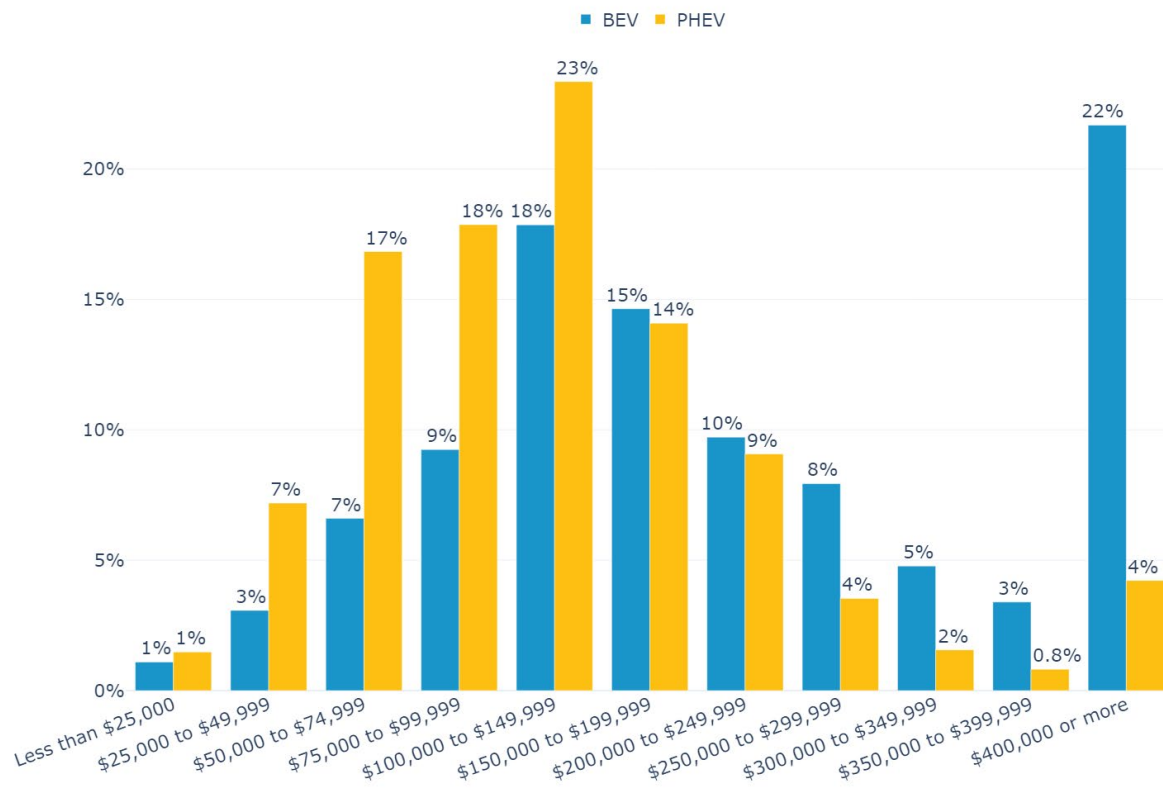


Figure 4. Age by Technology Type

Responses from PHEV and BEV consumers are significantly different (chi-squared test: $\chi^2 = 85$, $p < 0.01$, $n = 3,143$).

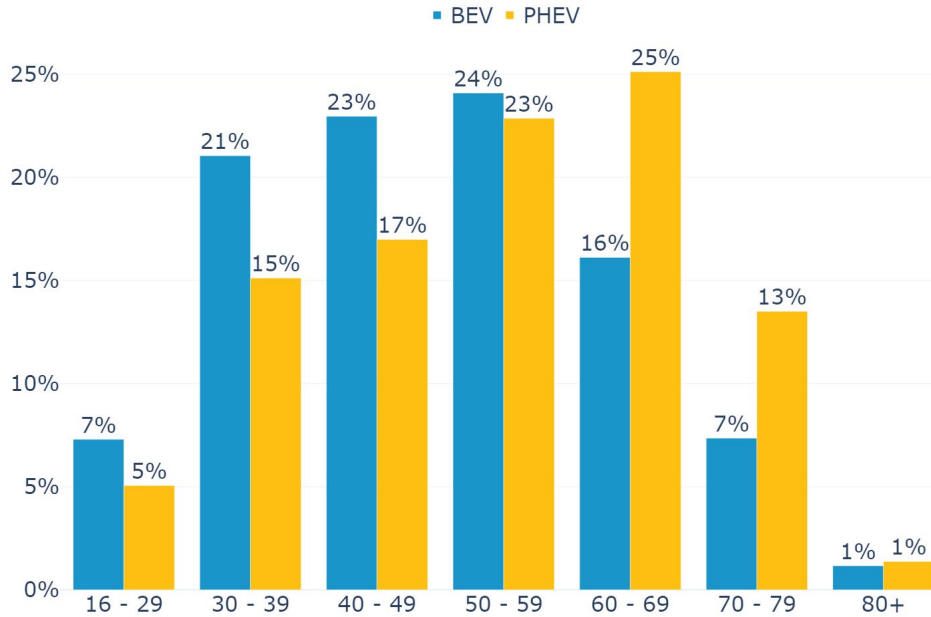


Figure 5. Gender by Technology Type†

Responses from PHEV and BEV consumers are significantly different (chi-squared test: $\chi^2 = 108$, $p < 0.01$, $n = 3,099$).

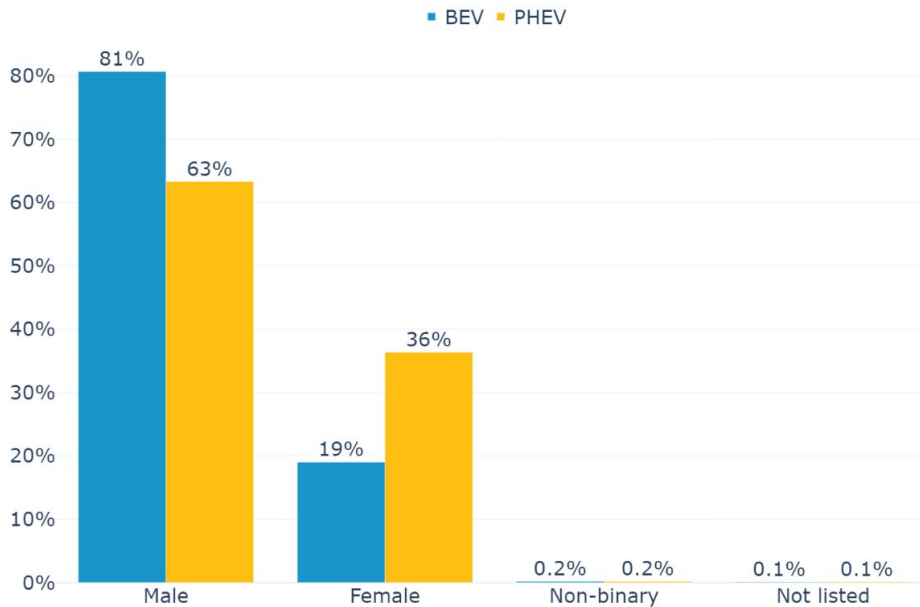


Figure 6. Responses to “How Do You Prefer to Describe Your Racial/Ethnic Identity?” by Technology Type†

Responses from PHEV and BEV consumers are significantly different (chi-squared test: $\chi^2 = 71$, $p < 0.01$, $n = 2,769$). Note: Respondents can select all that apply for this question. Any respondent who selected two or more races is included in “More than one race.”

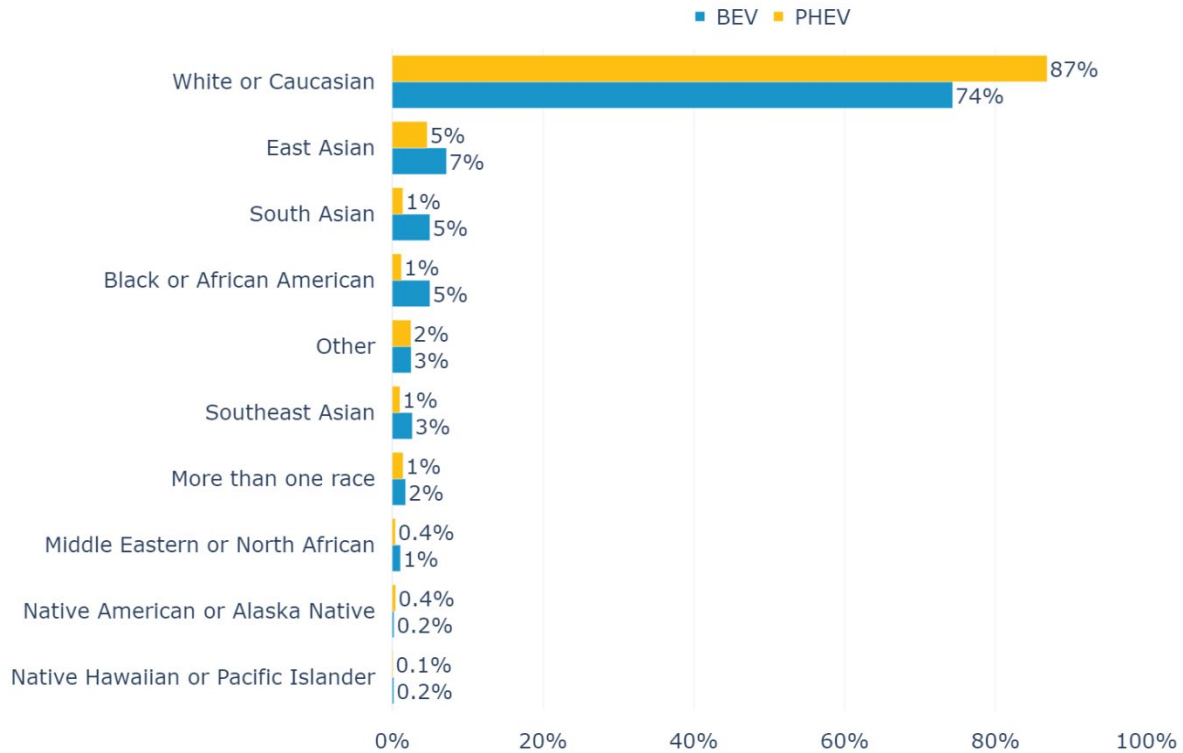


Figure 6 shows that program participants are more likely to identify as White or Caucasian than new car buyers overall (78% versus 74%). Seven percent of respondents identified themselves as “Latino/a or Hispanic.”

Figure 7. Responses to “Do You Own or Rent Your Residence?”†

(n = 3,130)

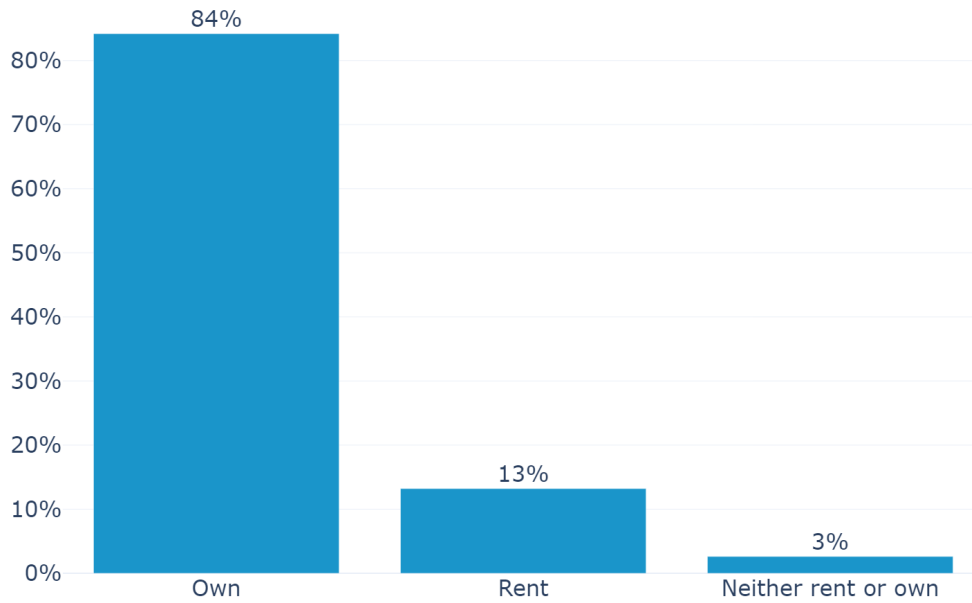


Figure 8. Responses to "What Type of Residence Do You Live In?" by Technology Type

Responses from PHEV and BEV consumers are significantly different (chi-squared test: $\chi^2 = 16$, $p < 0.01$, $n = 3,142$).

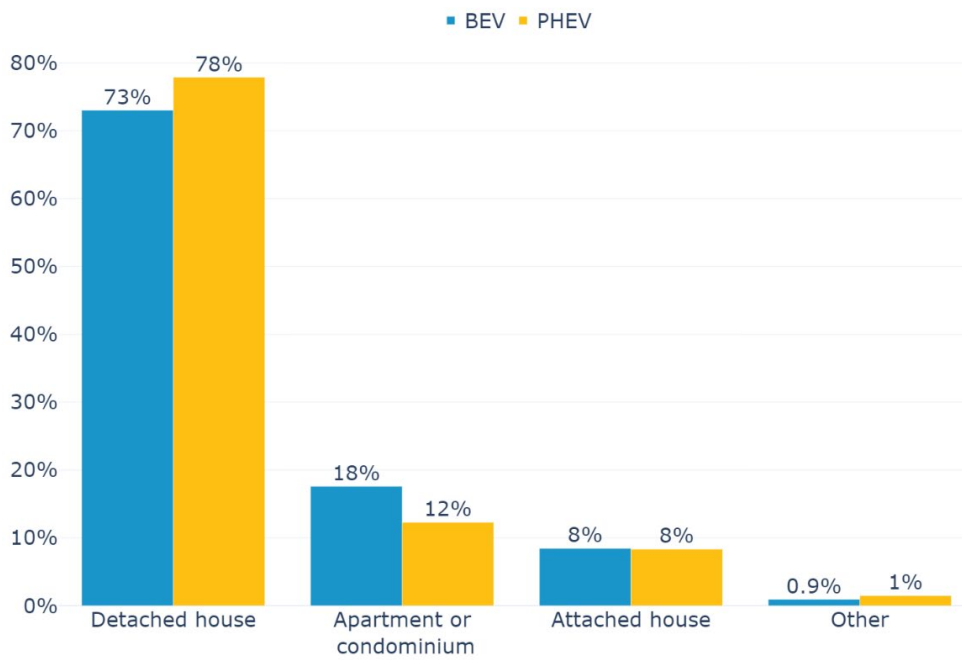
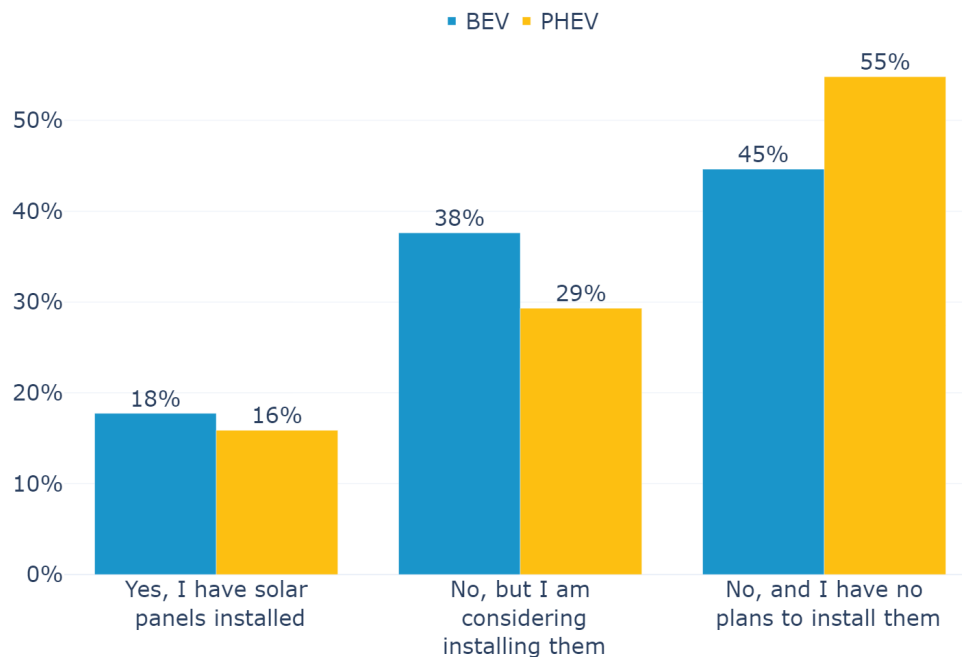


Figure 7 shows that respondents are more likely to be homeowners than the average new car buyer (84% versus 73%, respectively). There was no significant difference between BEV and PHEV drivers for home ownership. Figure 8 shows that three-quarters (75%) of respondents live in detached houses.

Overall, 17% of respondents own solar panels (Figure 9), with BEV drivers more likely than PHEV drivers to have solar panels installed at their residences (18% versus 16%, respectively).

Figure 9. Responses to "Do You Have Solar Panels at Your Residence?" by Technology Type†

Responses from PHEV and BEV consumers are significantly different (chi-squared test: $\chi^2 = 29$, $p < 0.01$, $n = 3,206$).

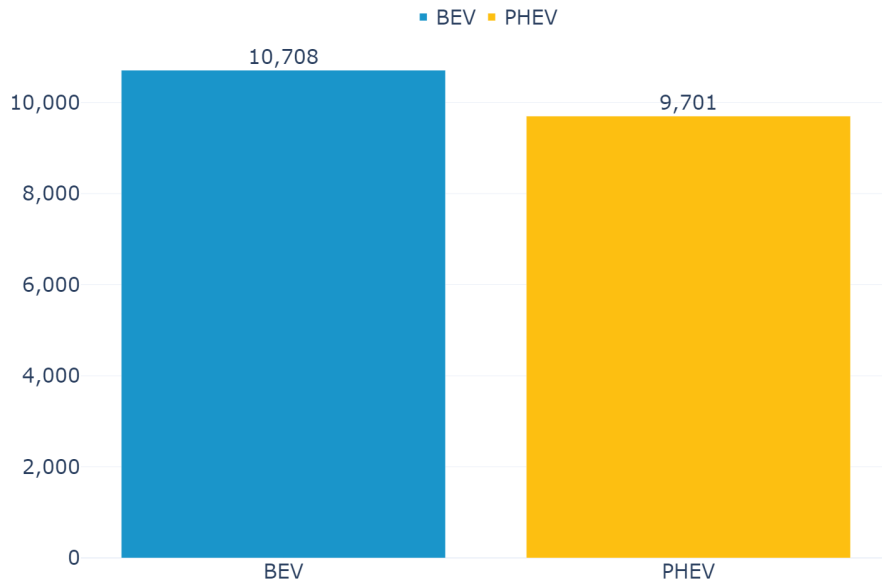


2.4 Electric Car Driving

Respondents were asked how many miles they drive their electric car per day and the total miles driven since acquiring their car. Total miles driven should approximate the respondent’s annual mileage since they have owned the car for about one year. BEV respondents averaged 36.6 miles driven per day, and PHEV respondents averaged 28.3 miles. Despite these typical daily driving distances only being eight miles apart, the annual mileage is about 1,007 miles larger for BEV than for PHEV respondents, as shown in Figure 10. BEV respondents had a similar average annual mileage as the 2018-2019 Ownership Survey result (10,708 miles and 10,574 miles, respectively), but there is a notable decrease in average for PHEV respondents with 9,701 miles this year and 11,542 miles from the 2018-2019 survey results.

Figure 10. Average of Responses to “How Many Total Miles Have You Driven Your Electric Car So Far?” by Technology Type†

(n = 3,214)



Respondents were asked how often they use their electric car for a variety of tasks. Sixty-seven percent of respondents reported using their car at least a few times a week for their commute (Figure 11), with no significant difference between PHEV and BEV respondents. Twenty-two percent of respondents reported using their car at least a few times a week for a partial commute (Figure 12). Most respondents (89%) reported using their car a few times a week to run errands (Figure 13).

Figure 11. Frequency of Full Commute

(n = 2,770)

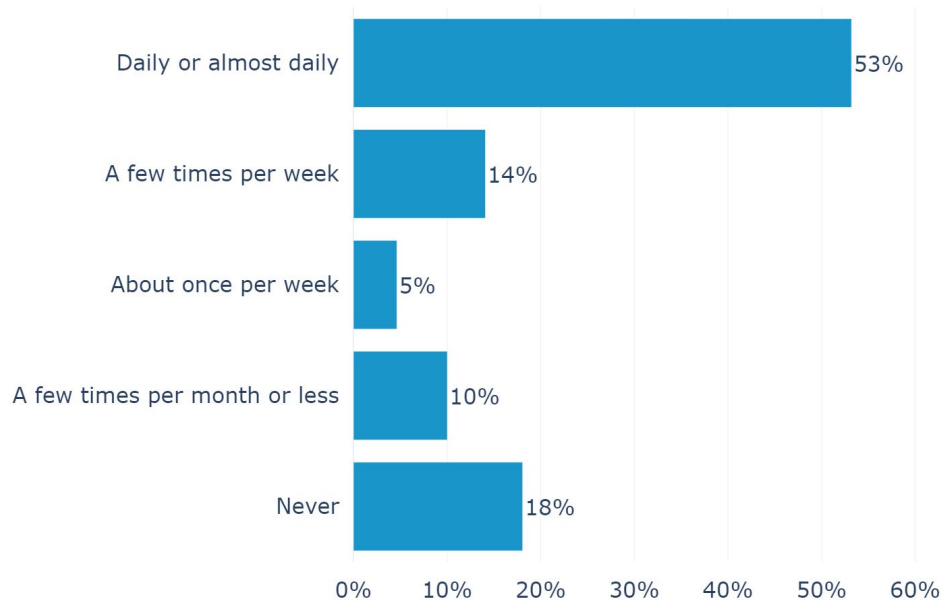


Figure 12. Frequency of Partial Commute by Technology Type

Responses from PHEV and BEV consumers are significantly different (chi-squared test: $\chi^2 = 14$, $p < 0.01$, $n = 2,330$).

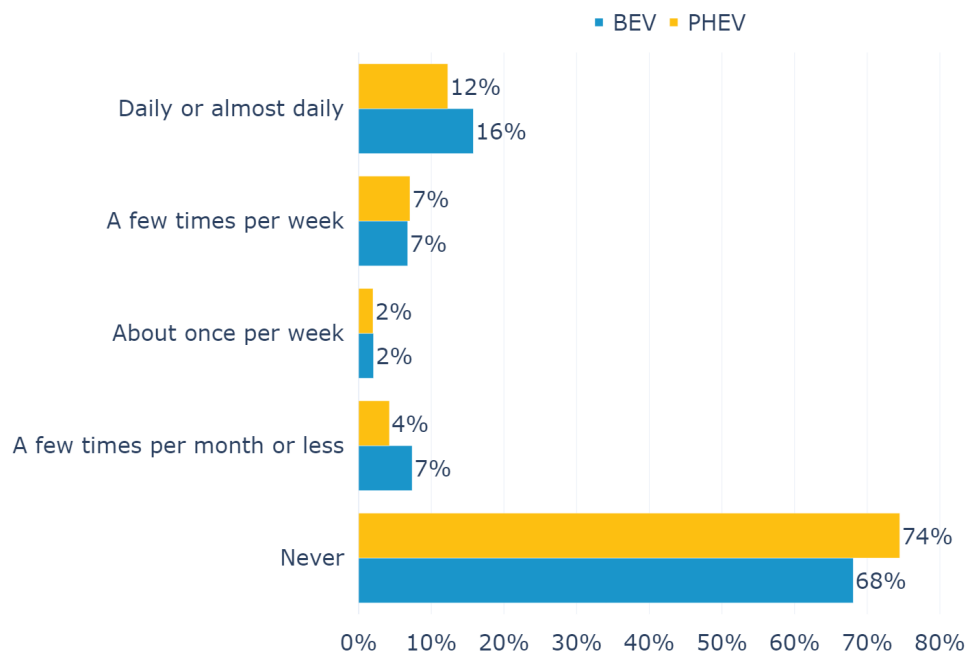


Figure 13. Frequency of Running Errands by Technology Type

Responses from PHEV and BEV consumers are significantly different (chi-squared test: $\chi^2 = 23$, $p < 0.01$, $n = 3,184$).

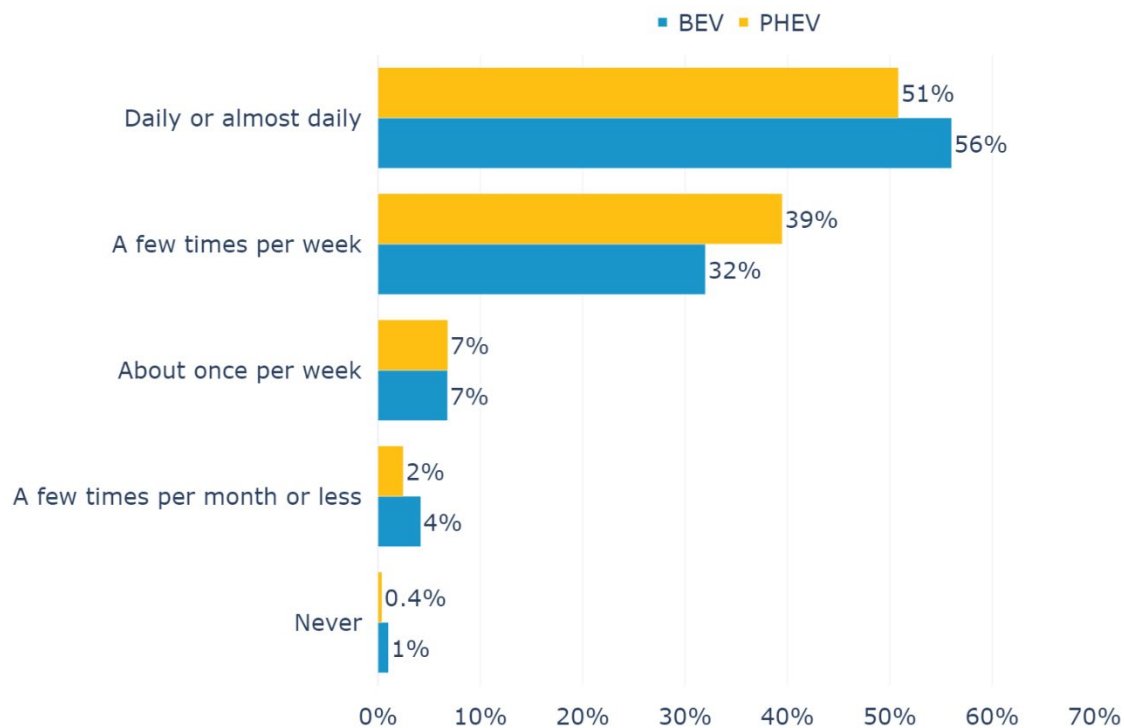


Figure 14 shows how often respondents use their BEV or PHEV for long trips (greater than 50 miles from home). Sixty-nine percent of respondents use their car a few times a month or less for long trips. A continual change from previous surveys is that BEV drivers are more likely to use their car for long trips. The proportion of BEV drivers that report never using their car for long trips fell from 22% in the 2017-2018 survey to 8% in the 2018-2019 survey, with 5% reporting never using their car for long trips. When PHEV and BEV respondents were asked about the frequency of car use to provide ride-sharing services, 96% of respondents reported they never used their electric car for this task (Figure 15).

Figure 14. Frequency of Long Trips (>50 miles from home) by Technology Type

Responses from PHEV and BEV consumers are significantly different (chi-squared test: $\chi^2 = 54$, $p < 0.01$, $n = 3,146$).

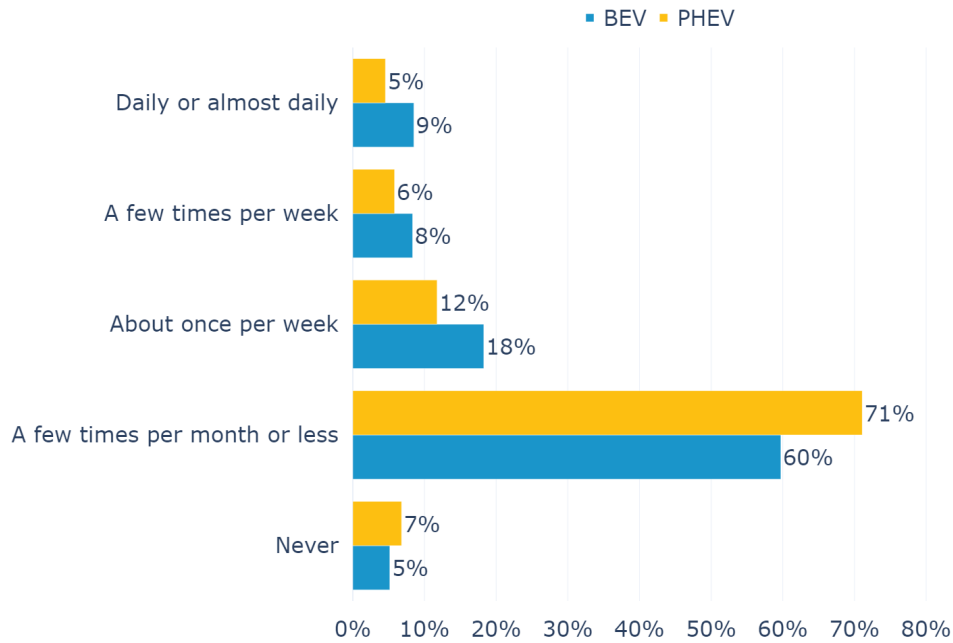
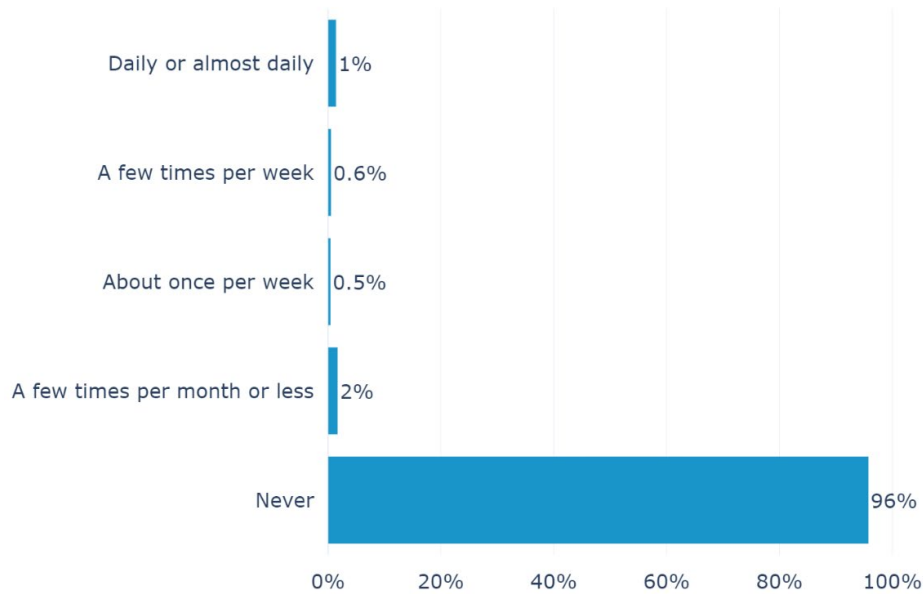


Figure 15. Frequency of Providing Ride-Sharing Services (e.g., Uber/Lyft)

($n = 2,598$).



2.5 Participant Satisfaction

Respondents were asked how satisfied they were with the experience of owning an electric car. Overall, 94% of respondents rated their satisfaction as “Very satisfied” or “Extremely satisfied” (Figure 16). Only 0.4% of respondents described themselves as “Not at all satisfied.”

Respondents were also asked how likely they were to purchase an electric car again. Overall, 95% said they are likely or extremely likely to repeat an electric car purchase. Figure 17 displays the breakdown between BEV and PHEV respondents.

Figure 16. Participant Satisfaction by Technology Type

Responses from PHEV and BEV consumers are significantly different (chi-squared test: $\chi^2 = 113$, $p < 0.01$, $n = 3,184$).

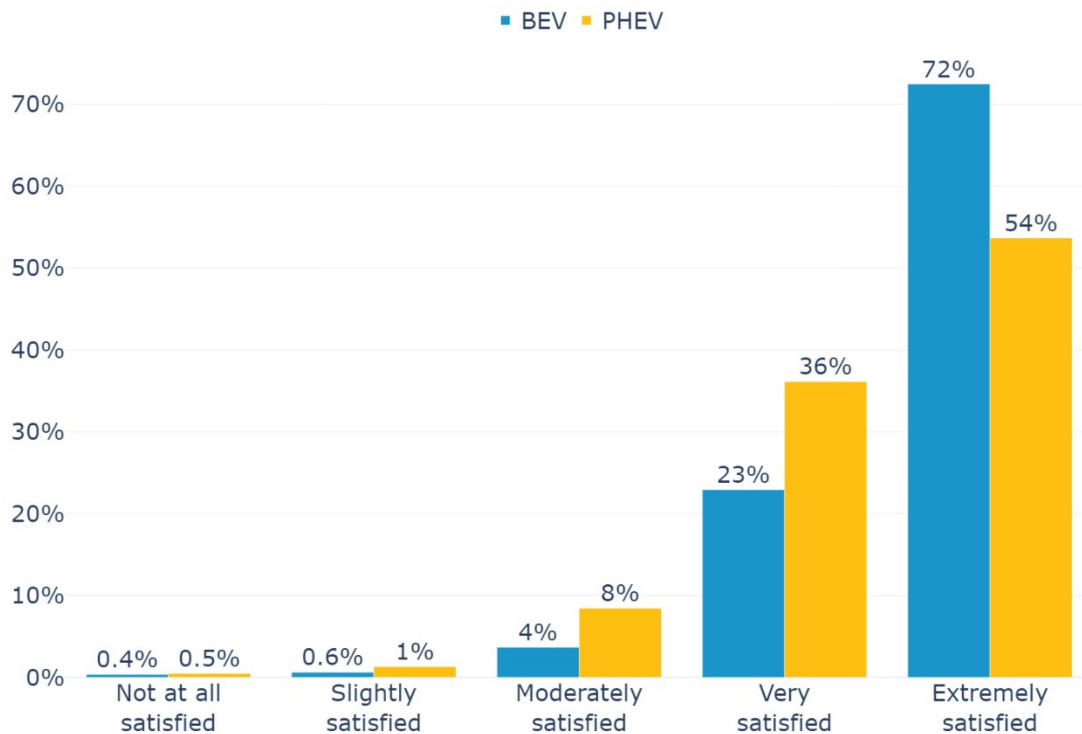
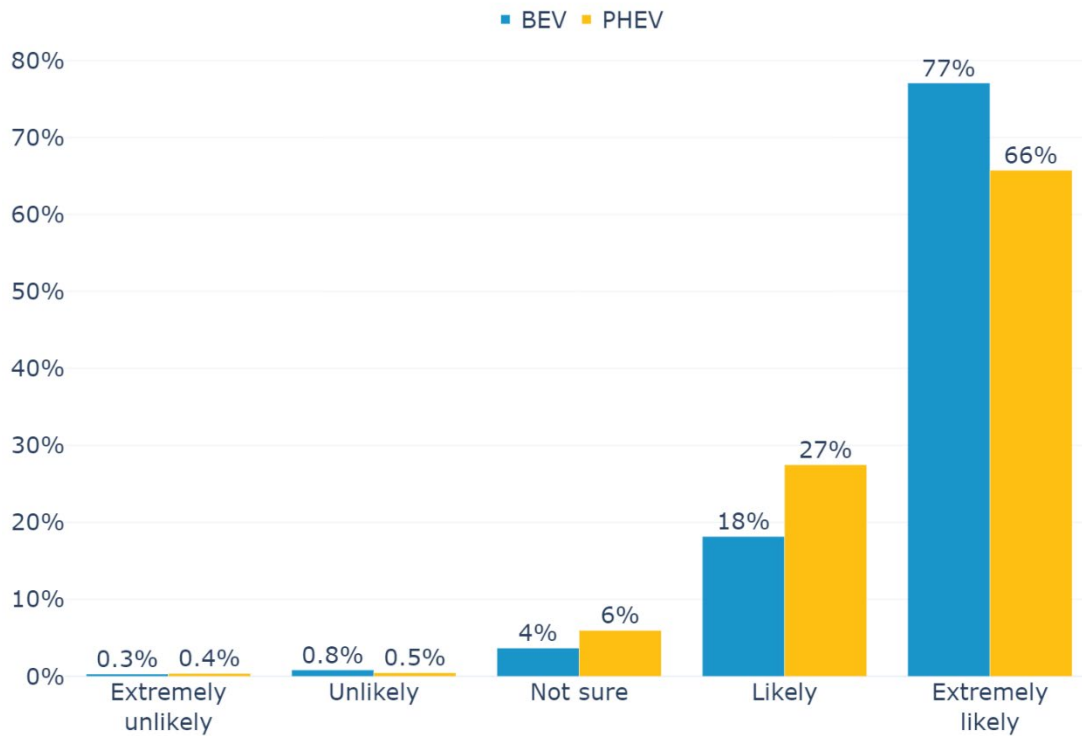


Figure 17. Responses to “How Likely Are You to Purchase/Lease Another Electric Car in the Future?” by Technology Type†

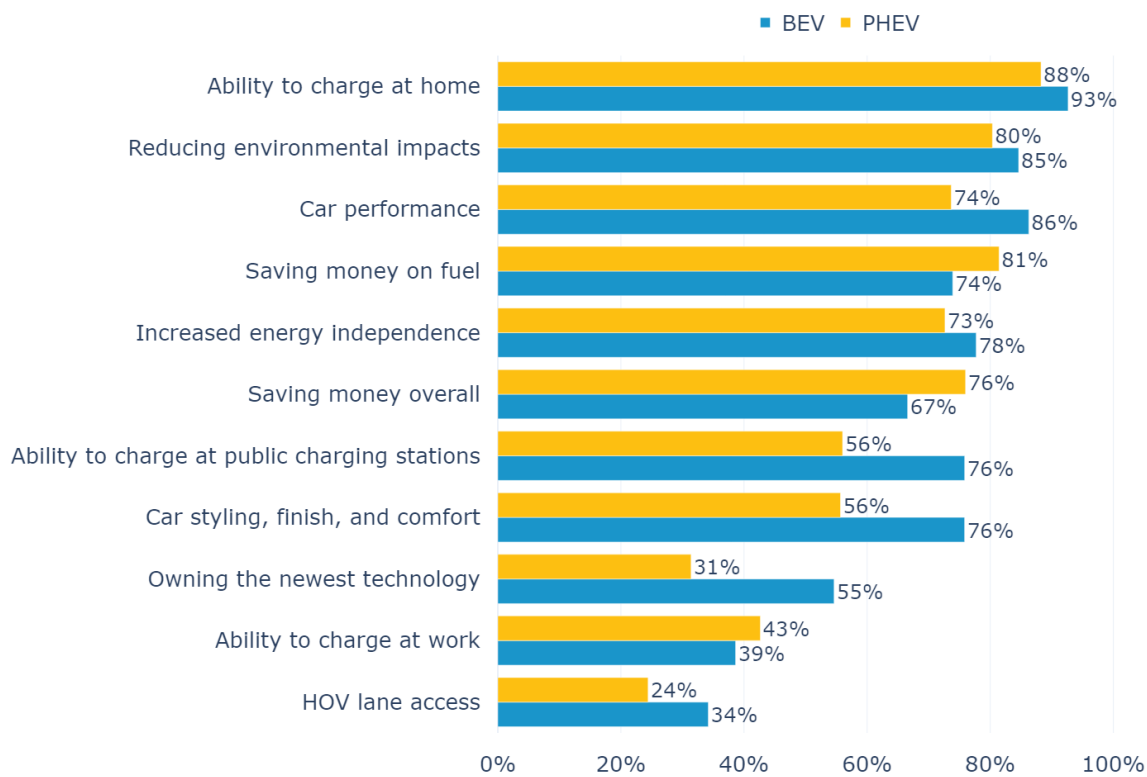
Responses from PHEV and BEV consumers are significantly different (chi-squared test: $\chi^2 = 50$, $p < 0.01$, $n = 3,204$).



Respondents were asked to rate the importance of various aspects of owning an electric car, from “Not at all important” to “Extremely important.” Figure 18 shows the proportion of respondents who rated each factor “Very” or “Extremely Important.” Across all respondents, the most important factors were “Ability to charge at home,” “Reducing environmental impacts,” and “Car performance.”

Figure 18. Important Aspects of Electric Car Ownership by Technology Type (Percent Responding “Very” or “Extremely Important”)[†]

Responses from BEV and PHEV consumers are significantly different for ability to charge at home (chi-squared test: $\chi^2 = 16$, $p < 0.01$, $n = 3,202$), reducing environmental impacts (chi-squared test: $\chi^2 = 8$, $p < 0.01$, $n = 3,197$), car performance (chi-squared test: $\chi^2 = 74$, $p < 0.01$, $n = 3,205$), saving money on fuel (chi-squared test: $\chi^2 = 21$, $p < 0.01$, $n = 3,198$), increased energy independence (chi-squared test: $\chi^2 = 9$, $p < 0.01$, $n = 3,196$), saving money overall (chi-squared test: $\chi^2 = 28$, $p < 0.01$, $n = 3,200$), ability to charge at public charging stations (chi-squared test: $\chi^2 = 126$, $p < 0.01$, $n = 3,201$), car styling, finish, and comfort (chi-squared test: $\chi^2 = 130$, $p < 0.01$, $n = 3,201$), owning the newest technology (chi-squared test: $\chi^2 = 148$, $p < 0.01$, $n = 3,204$), ability to charge at work (chi-squared test: $\chi^2 = 4$, $p < 0.04$, $n = 3,187$), HOV lane access (chi-squared test: $\chi^2 = 29$, $p < 0.01$, $n = 3,195$).



2.6 Program Performance

Survey respondents were very likely to be electric car promoters, with 94% reporting that they would “probably” (17%) or “definitely” (77%) recommend electric car ownership to others. BEV drivers were more likely than PHEV drivers to indicate that they would “definitely” recommend electric car ownership (Figure 19). Forty-seven percent have had at least one family member or friend purchase an electric car since their own acquisition of an electric car. BEV respondents are more likely than PHEV respondents to report that a friend or family member has purchased an electric car (Figure 20).

Figure 19. Respondents Who Would Recommend Electric Car Ownership to Others by Technology Type

Responses from PHEV and BEV consumers are significantly different (chi-squared test: $\chi^2 = 52$, $p < 0.01$, $n = 3,206$).

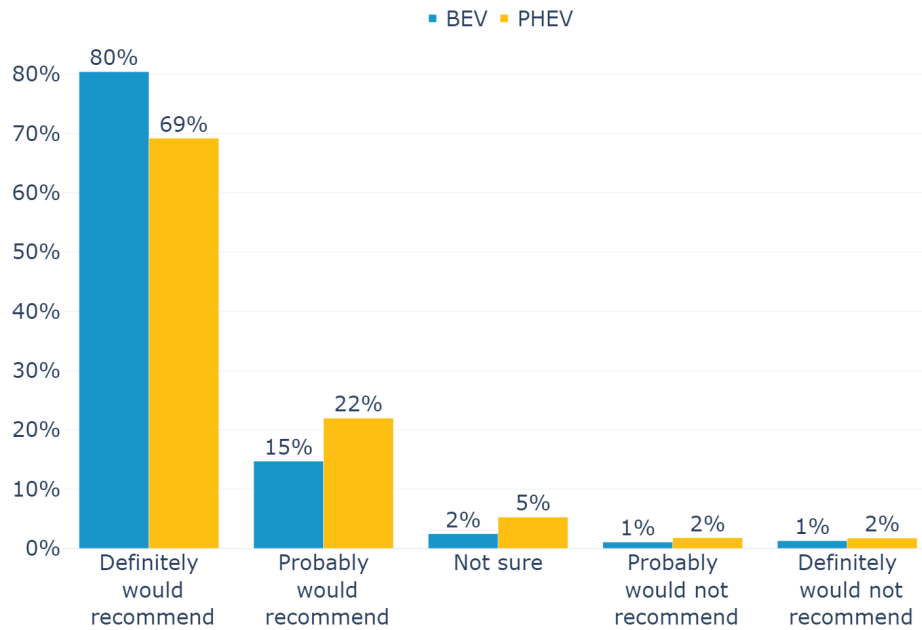
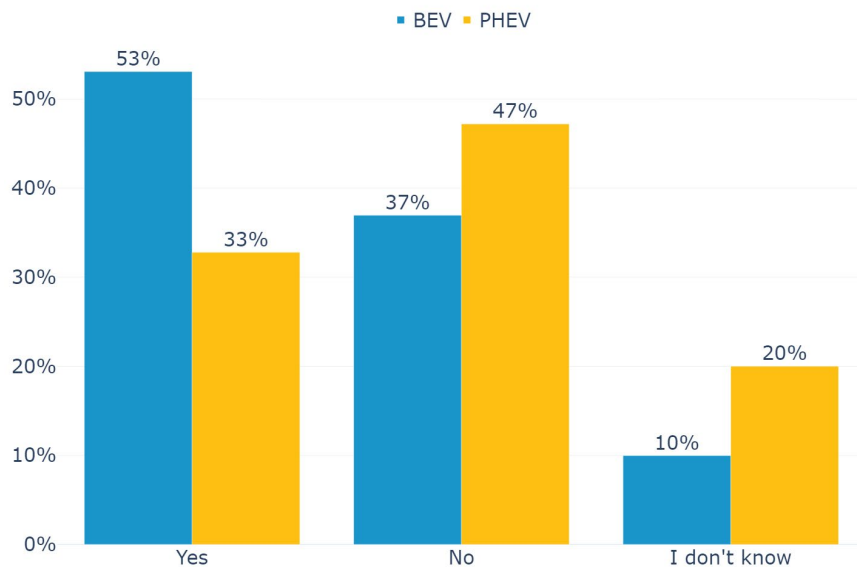


Figure 20. Respondents Whose Friends or Family Purchased/Leased an Electric Car since the Purchase of Their Electric Car by Technology Type

Responses from PHEV and BEV consumers are significantly different (chi-squared test: $\chi^2 = 130$, $p < 0.01$, $n = 3,208$).

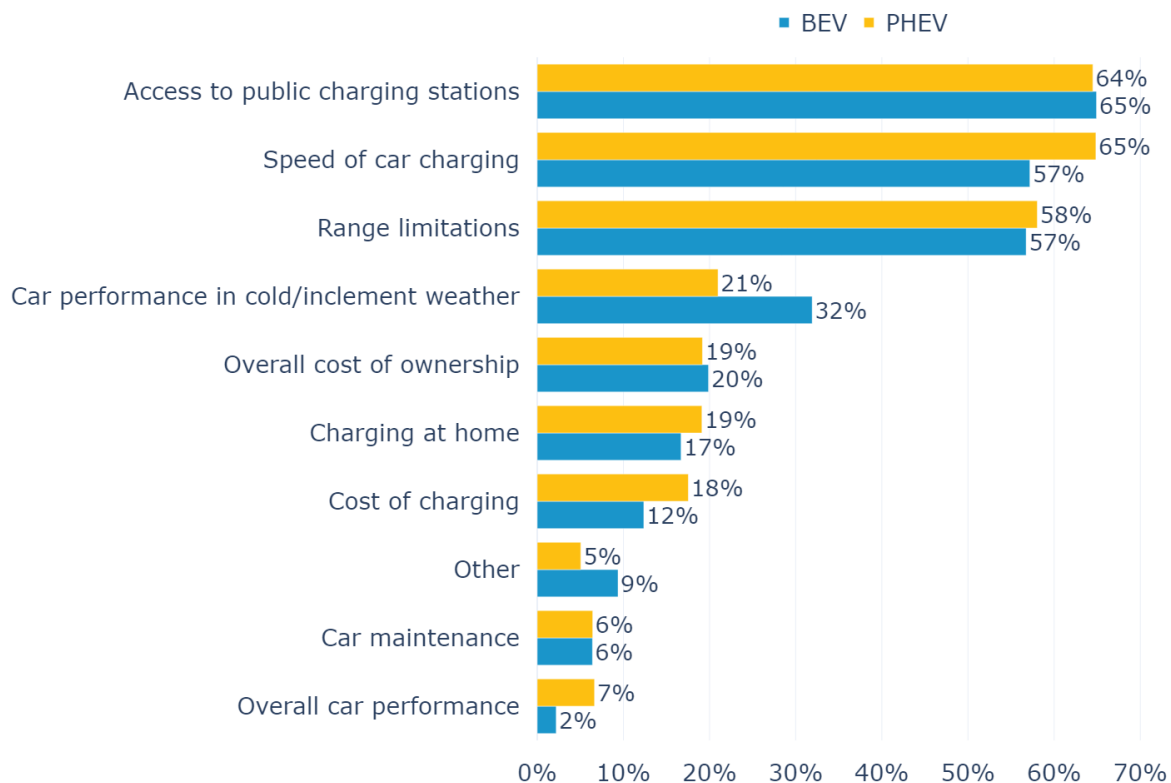


2.7 Participant Concerns

To understand the program participants' concerns and challenges, respondents were asked to select "the three greatest challenges to owning an electric car in New York" from a list of possible options. The challenges most frequently selected by participants were "Access to public charging stations," "Speed of car charging," and "Range limitations" (Figure 21). In contrast to previous years, PHEV respondents were more likely to select "range limitations" as a top challenge in comparison to BEV respondents. Performance in cold weather continues to be more often selected for BEV respondents than for PHEV respondents.

Figure 21. Greatest Challenges of Owning an Electric Car in New York State†

Responses from PHEV and BEV consumers are significantly different for cost of charging (chi-squared test: $\chi^2 = 14$, $p < 0.01$, $n = 3,173$), car performance in cold/inclement weather (chi-squared test: $\chi^2 = 38$, $p < 0.01$, $n = 3,173$), overall car performance (chi-squared test: $\chi^2 = 37$, $p < 0.01$, $n = 3,173$), speed of car charging (chi-squared test: $\chi^2 = 16$, $p < 0.01$, $n = 3,173$), and other (chi-squared test: $\chi^2 = 16$, $p < 0.01$, $n = 3,173$). There was no significant difference for overall cost of ownership ($n = 3,173$), car maintenance ($n = 3,173$), charging at home ($n = 3,173$), access to public charging stations ($n = 3,173$), and range limitations ($n = 3,173$).



2.8 Charging

Figure 22. Responses to "Do You Have Access to Charging at Your Place of Work?" by Technology Type

Responses from PHEV and BEV consumers are significantly different (chi-squared test: $\chi^2 = 11$, $p < 0.01$, $n = 2,532$).

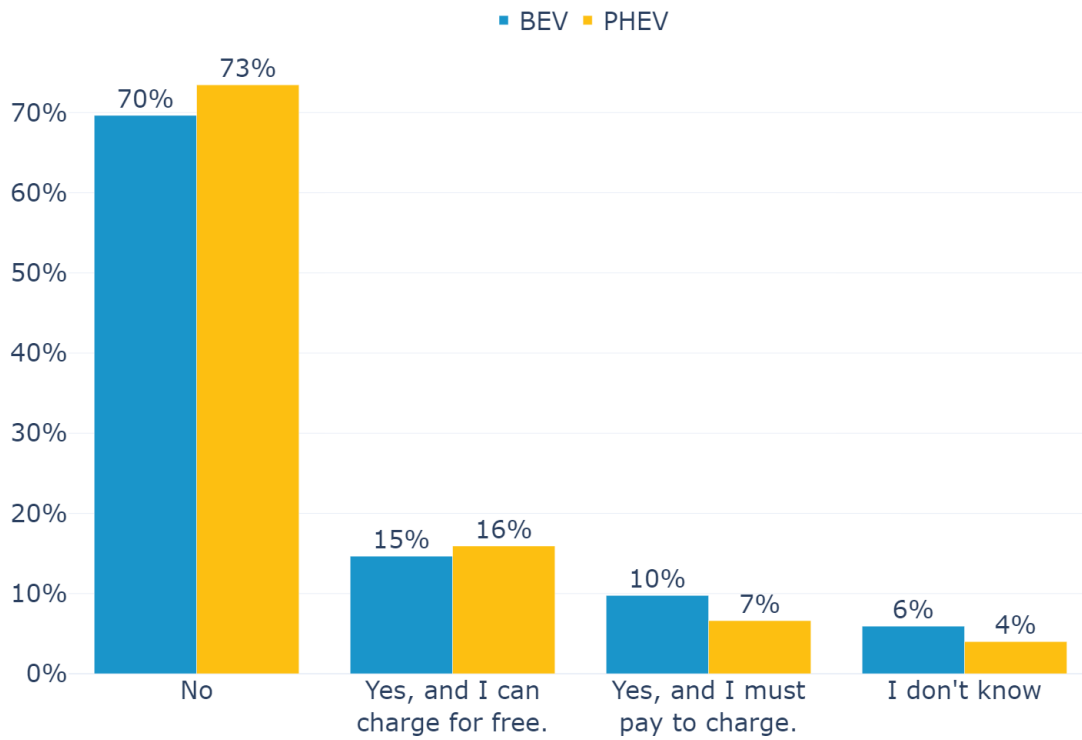


Figure 22 shows that only 24% of respondents have access to charging at their workplace. Figure 23 shows that of the respondents who do have access to workplace charging, 70% of BEV drivers and 77% of PHEV drivers charge at work at least occasionally.

Figure 23. Frequency of Charging at Given Locations by Technology Type

Responses from PHEV and BEV consumers are significantly different for charging at home (chi-squared test: $\chi^2 = 92$, $p < 0.01$, $n = 3,194$), charging on-site at work (chi-squared test: $\chi^2 = 17$, $p < 0.01$, $n = 585$), public charging (chi-squared test: $\chi^2 = 482$, $p < 0.01$, $n = 3,169$), and charging at other locations (chi-squared test: $\chi^2 = 53$, $p < 0.01$, $n = 2,663$). There was no significant difference for charging off-site at work ($n = 2,305$).

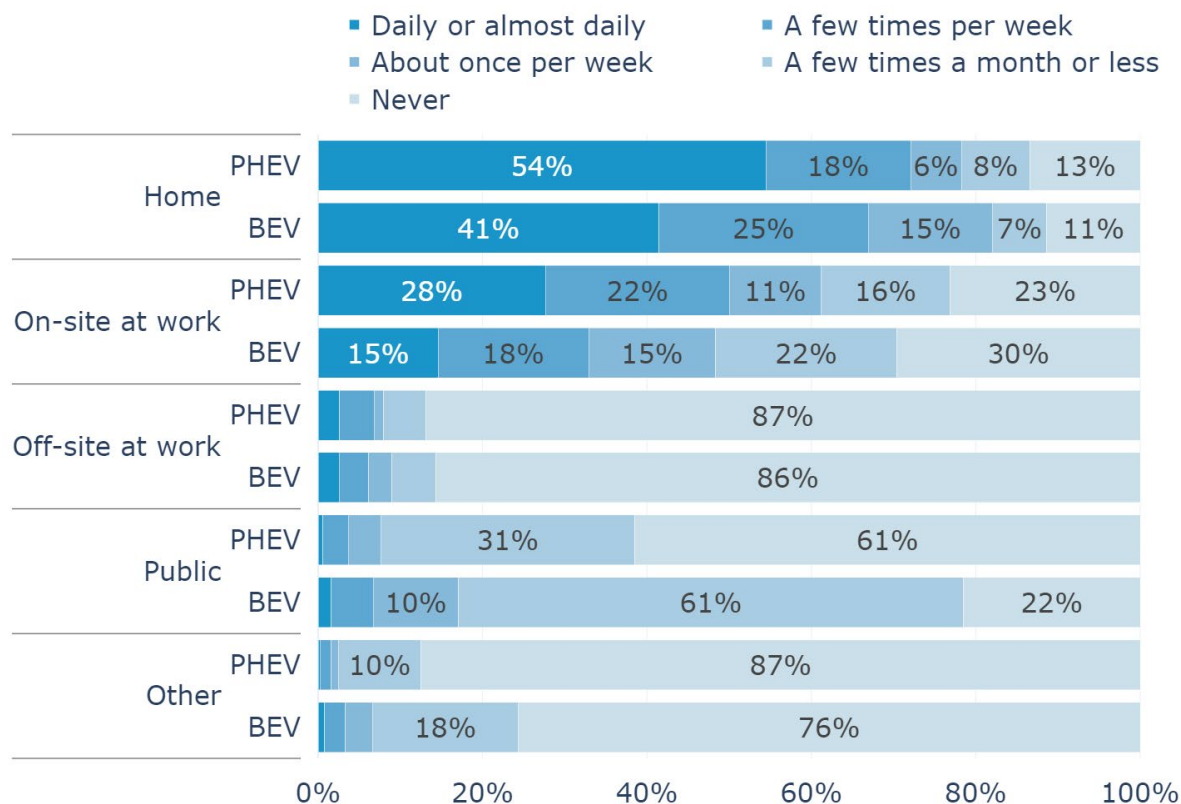


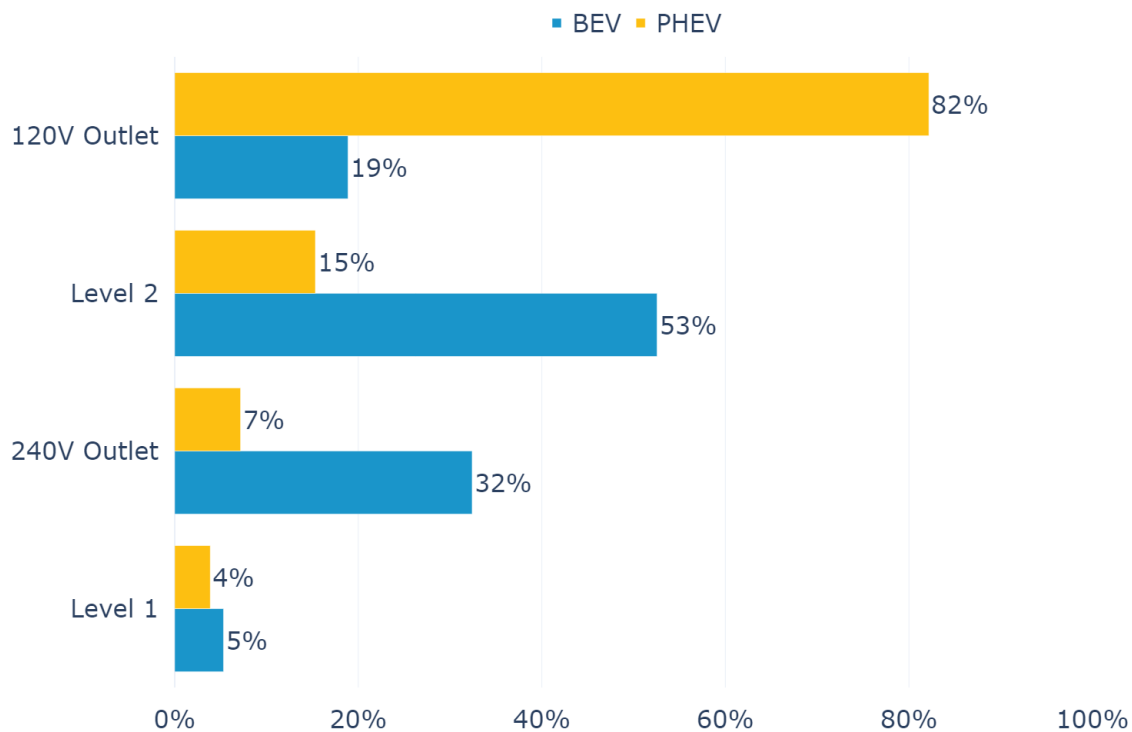
Figure 23 shows that almost all respondents charge their cars at home, with only 12% saying they never charge at home. This is a slight increase from the 8% in the 2018-2019 survey results. The share of respondents who reported never charging at home increased from 8% to 11% for BEVs and 8% to 13% for PHEVs. Although BEV drivers are more likely to charge at home, they charge less frequently than the 2018-2019 survey results. The share of BEV respondents who charge daily or almost daily dropped from 68% to 41% and increased from 13% to 25% for charging a few times a week, while charging about once per week increased from 4% to 15%. In contrast, PHEV drivers are charging more frequently compared to the 2018-2019 survey results. PHEV respondents who charge daily or almost daily increased from 43% to 54%, which reflects the decrease in charging a few times per week (26% to 18%) and about once per week (15% to 6%). BEV drivers are now more likely than PHEV drivers to charge at public charging stations (68% versus 39%, respectively); this is a reversal from the 2018-2019

survey in which PHEV drivers were more likely to use public charging stations than BEV drivers (77% versus 42%) but reflects similar results from 2017-2018 survey where 70% of BEV drivers charge at public charging stations at least a few times a month or less versus 38% of PHEV drivers. It is also important to note that many of the write-in responses for “Other” (N = 2663) included interstate highway charging stations, local stores or malls, parking garages, and Tesla supercharging stations, so the number of respondents who selected public charging may be an underestimate of the number who use them.

Figure 24 shows that PHEV respondents who charge at home are much more likely to report using a standard 120V outlet (82% versus 19%), while BEV respondents were more likely to use a Level 2 charger (53% versus 15%).¹¹ Eighty-one percent of BEV drivers use either a 240V outlet (typical clothes dryer outlet) or a Level 2 charging station. The higher prevalence of Level 2 charging among BEV respondents is unsurprising given the larger battery size of these cars and the inability to fall back on gasoline if a battery is not adequately charged.

Figure 24. How Respondents Charge at Home by Technology Type†

Responses are significantly different for 120V outlet (chi-squared test: $\chi^2 = 995$, $p < 0.01$, $n = 2,785$), 240V outlet (chi-squared test: $\chi^2 = 199$, $p < 0.01$, $n = 2,785$), and Level 2 (chi-squared test: $\chi^2 = 334$, $p < 0.01$, $n = 2,785$). There was no significant difference for Level 1 ($n = 2,785$).



The survey results indicate that many respondents have concerns about the availability of public charging stations. Figure 25 shows that a large majority of respondents (72%) disagreed with the statement, “There are enough public chargers.”

Figure 25. Agreement/Disagreement with the Statement "There Are Enough Public Chargers" by Technology Type

Responses from PHEV and BEV consumers are significantly different (chi-squared test: $\chi^2 = 49$, $p < 0.01$, $n = 3,200$).

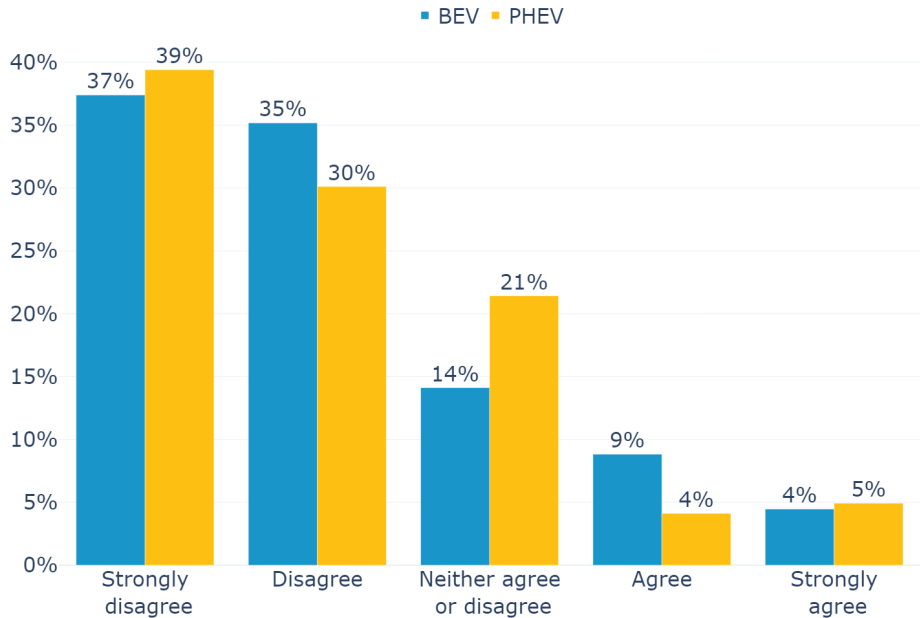
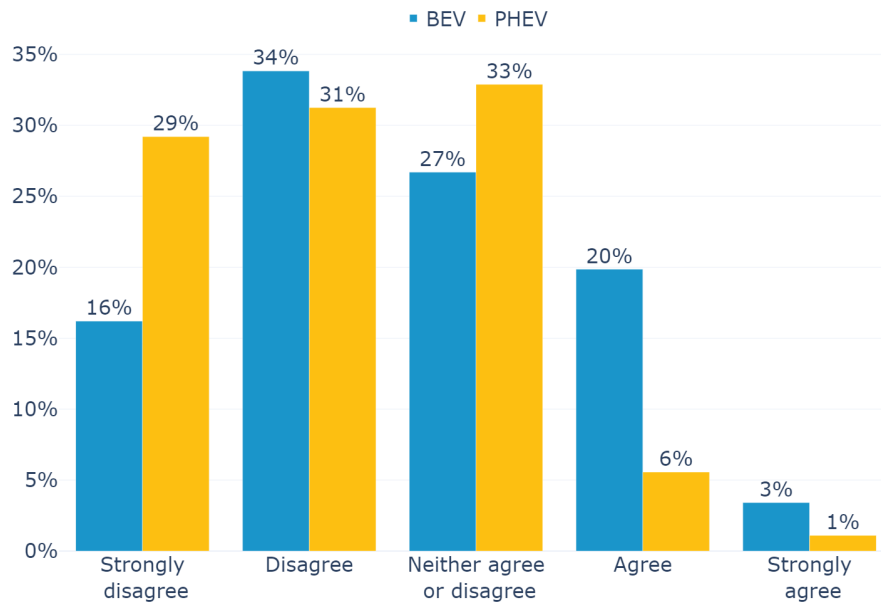


Figure 26. Agreement/Disagreement with the Statement "There Are Public Charging Stations in the Places Where I need Them" by Technology Type

Responses from PHEV and BEV consumers are significantly different (chi-squared test: $\chi^2 = 171$, $p < 0.01$, $n = 3,198$).



Echoing the top concerns reported by respondents, only 18% of respondents agreed with the statement, “There are public charging stations in the places where I need them.” However, for PHEV respondents, these results represent a notable improvement since the last ownership survey results. In the 2018-2019 survey, 38% of PHEV respondents selected “strongly disagree,” versus 29% in this year’s survey. BEV respondent results also represent a slight improvement over the previous ownership survey results. In the 2018-2019 survey, 18% of BEV drivers selected “strongly disagree,” versus 16% in this year’s survey. The proportion of BEV who selected “agree” or “strongly agree” increased from 19% to 23%. Figure 26 shows that BEV respondents are more likely to agree with the statement than PHEV respondents.

For the next statement, “I frequently see gasoline-fueled cars parked in spaces with public electric car chargers,” approximately 25% of respondents agreed or strongly agreed, with BEV respondents selecting this as a more common concern (Figure 27).

Figure 27. Agreement/Disagreement with the Statement "I Frequently See Gasoline-Fueled Cars Parked in Spaces with Public Electric Car Chargers" by Technology Type

Responses from PHEV and BEV consumers are significantly different (chi-squared test: $\chi^2 = 115$, $p < 0.01$, $n = 3,187$).

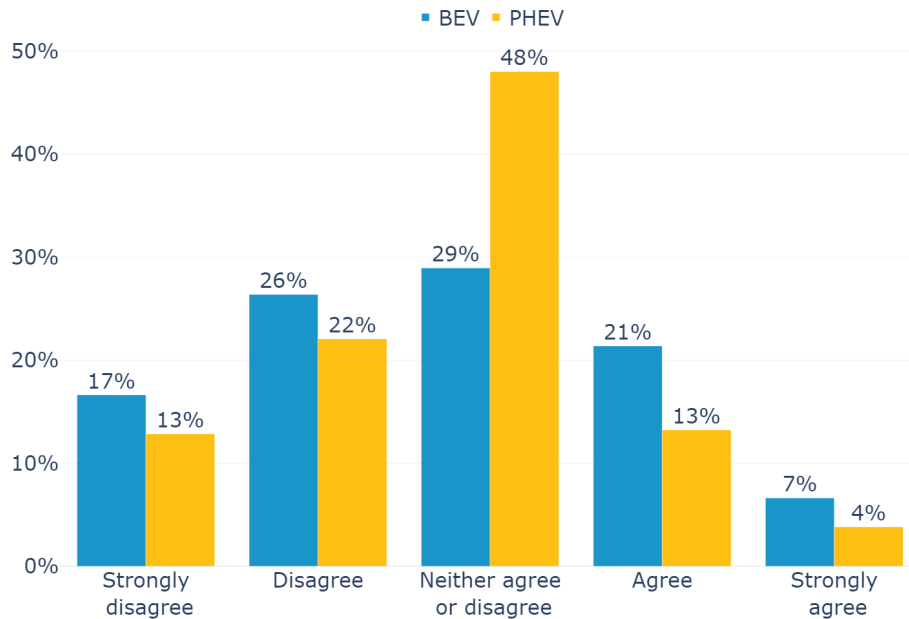


Figure 28. Agreement/Disagreement with the Statement "Public Charging Stations Are Often in Use by Others When I Want to Charge" by Technology Type

Responses from PHEV and BEV consumers are significantly different (chi-squared test: $\chi^2 = 119$, $p < 0.01$, $n = 3,183$).

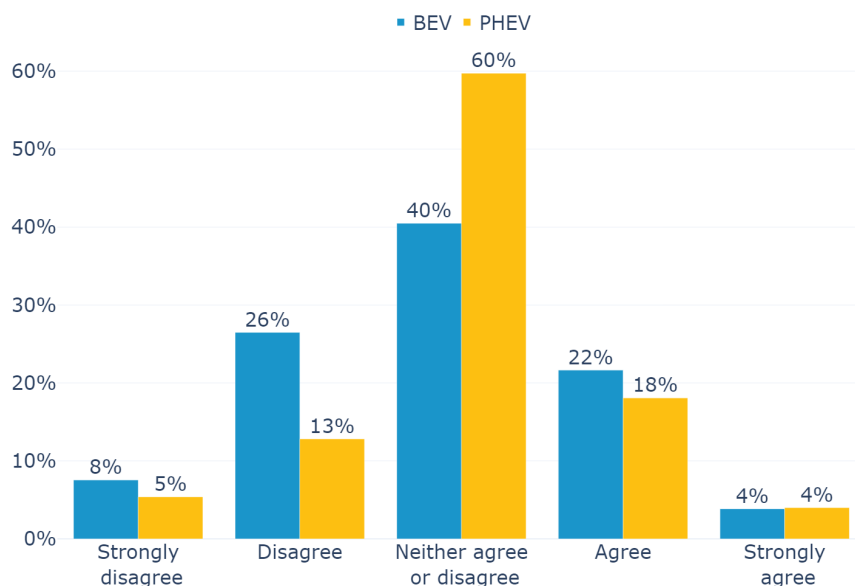


Figure 29. Agreement/Disagreement with the Statement “Public Charging Stations Are Often Not Working When I Want to Use Them” by Technology Type

Responses from PHEV and BEV consumers are significantly different (chi-squared test: $\chi^2 = 188$, $p < 0.01$, $n = 3,187$).

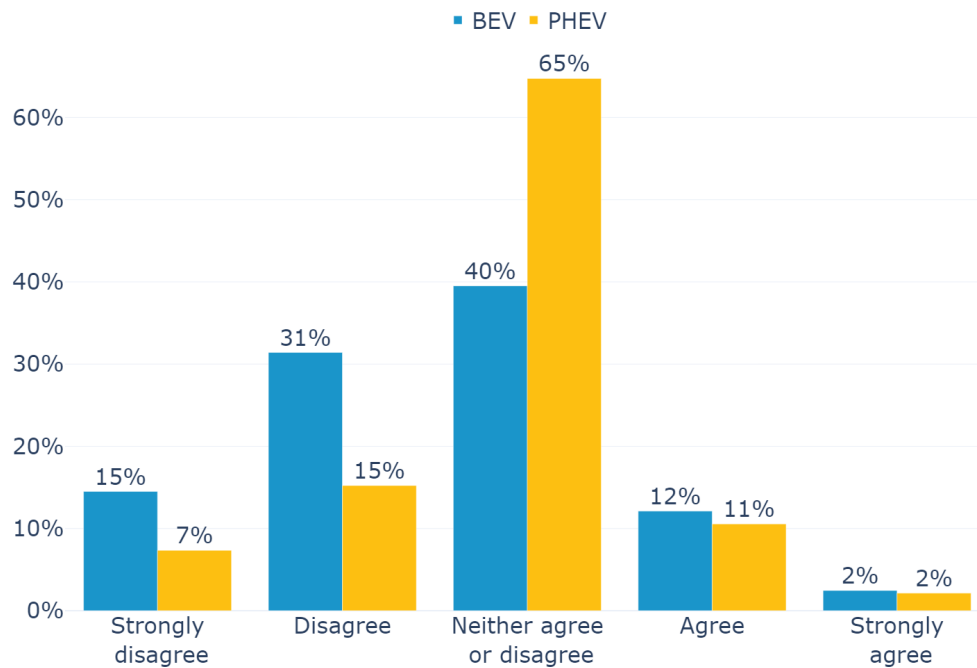


Figure 28 shows about 24% of respondents agreed or strongly agreed with the statement, “Public charging stations are often in use by others when I want to charge,” while 29% disagreed or strongly disagreed. BEV respondents are more likely to disagree with the statement than PHEV respondents. Responses to the statement, “Public charging stations are often not working when I want to use them,” has a higher percentage of disagreement (39%) than agreement (14%), with BEV respondents more likely to disagree with the statement than PHEV respondents (Figure 29).

2.9 Disadvantaged Communities Participation

Disadvantaged communities (DACs) are impacted by economic and environmental burdens and need to be prioritized to achieve environmental justice. New York State has established interim criteria to define DACs.¹² Based on these criteria, DACs have a higher proportion of minority residents and lower household incomes relative to New York State as a whole. Approximately 27% of New York State residents live in a DAC.

Overall, 15% of Drive Clean Rebate program participants with vehicles purchased between January 1, 2020 and December 31, 2020 were within DACs (Figure 30). DAC residents were proportionally represented among survey respondents, making up 15%. DAC residents were more likely to purchase BEVs than non-DAC residents; BEVs made up only 69% of non-DAC rebates versus 71% of DAC rebates (Figure 31).

Figure 30. Percentage of Participants within an Interim Disadvantaged Community Status

(n = 13,233)

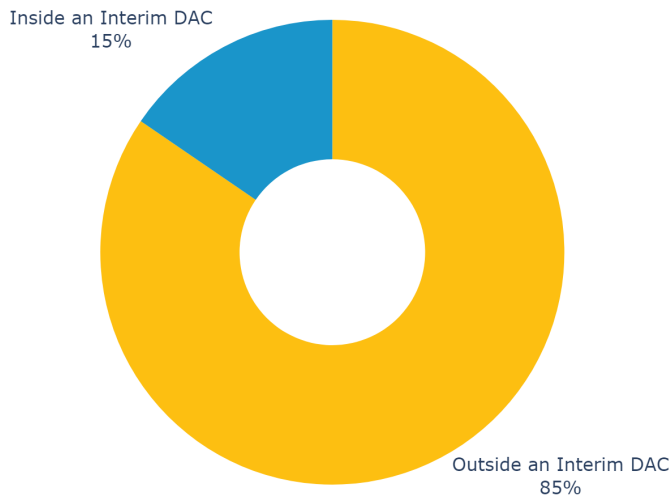
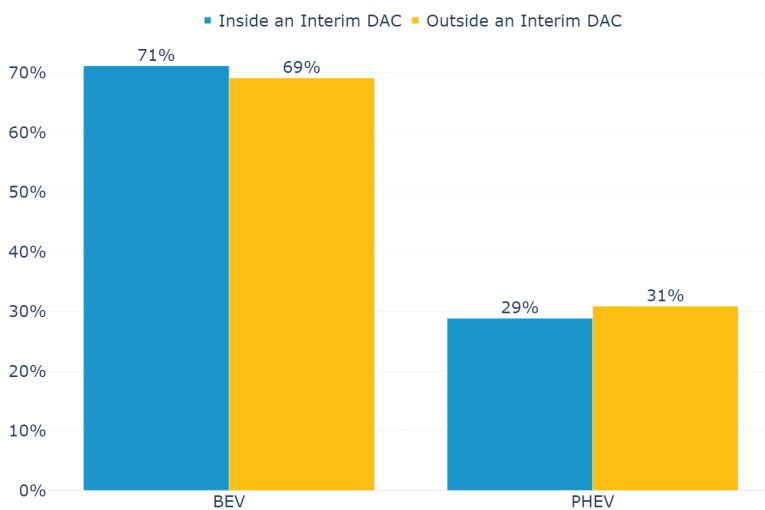


Figure 31. Interim Disadvantaged Community Status by Technology Type

Responses from participants within an Interim DAC and those outside of an Interim DAC are not significantly different (n = 13,233).



Both DAC and non-DAC residents reported similar satisfaction levels with owning an electric car (Figure 32) in addition to the likeliness to purchase another electric car (Figure 33).

Figure 32. Participant Satisfaction with Owning an Electric Car within Interim Disadvantaged Community Status

Responses from participants within an Interim DAC and those outside of an Interim DAC are not significantly different (n = 3,179).

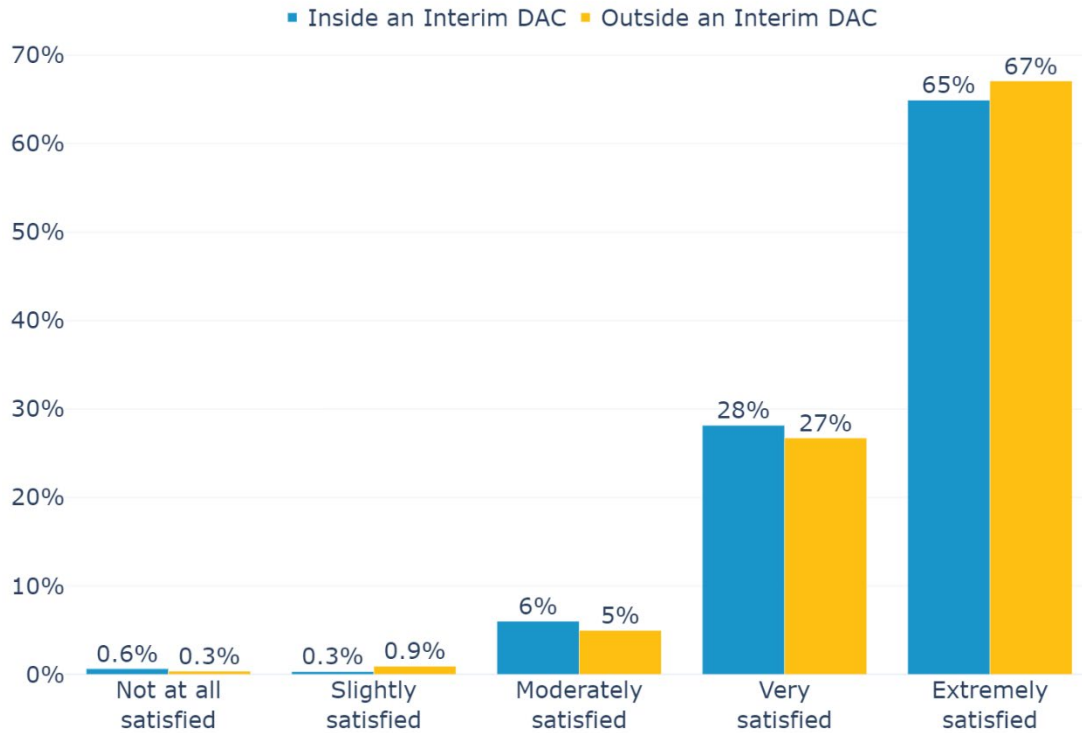
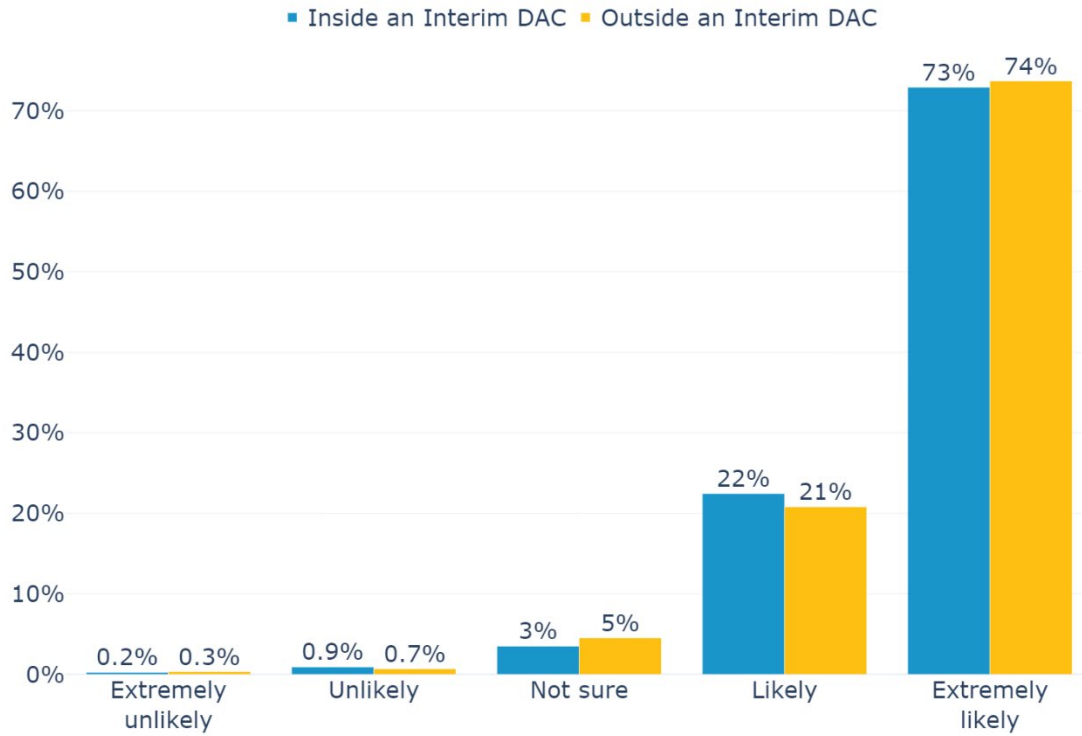


Figure 33. Responses to "How Likely Are You to Purchase/Lease Another Electric Car in the Future?" within Interim Disadvantaged Community Status

Responses from participants within an Interim DAC and those outside of an Interim DAC are not significantly different (n = 3,200).



DAC residents are much less likely to live in a detached house than non-DAC residents (Figure 34). Based on the Interim DAC criteria, DAC residents have lower incomes and are less likely to be White (Figure 35 and Figure 36).

Figure 34. Responses to “What Type of Residence Do You Live In?” within Interim Disadvantaged Community Status

Responses from participants within an Interim DAC and those outside of an Interim DAC are significantly different (chi-squared test: $\chi^2 = 158, p < 0.01, n = 3,137$).

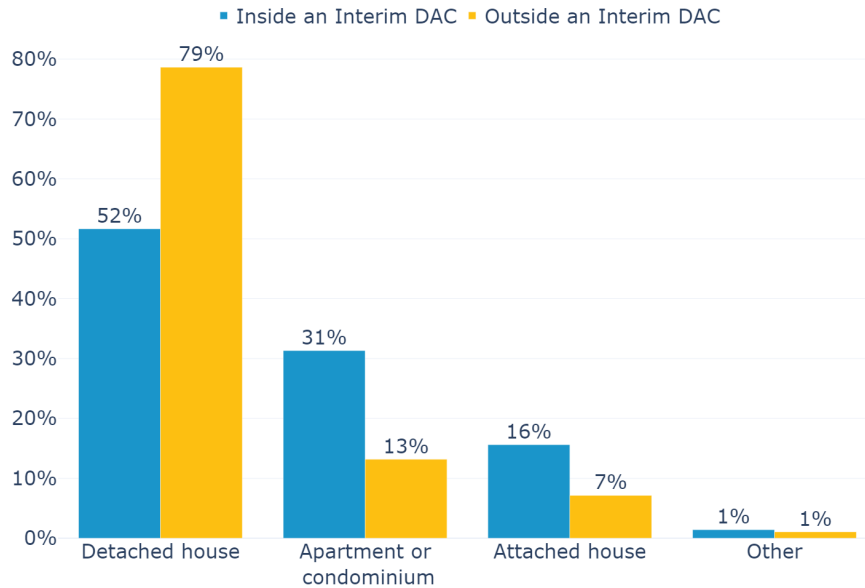


Figure 35. Annual Gross (Pre-Tax) Household Income from All Sources within Interim Disadvantaged Community Status

Responses from participants within an Interim DAC and those outside of an Interim DAC are significantly different (chi-squared test: $\chi^2 = 45, p < 0.01, n = 2,614$).

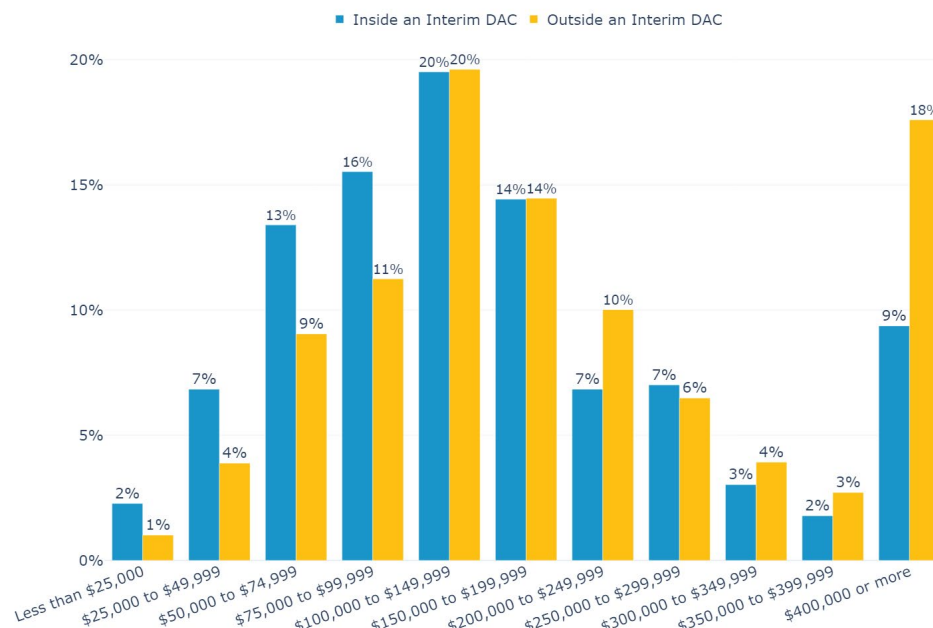
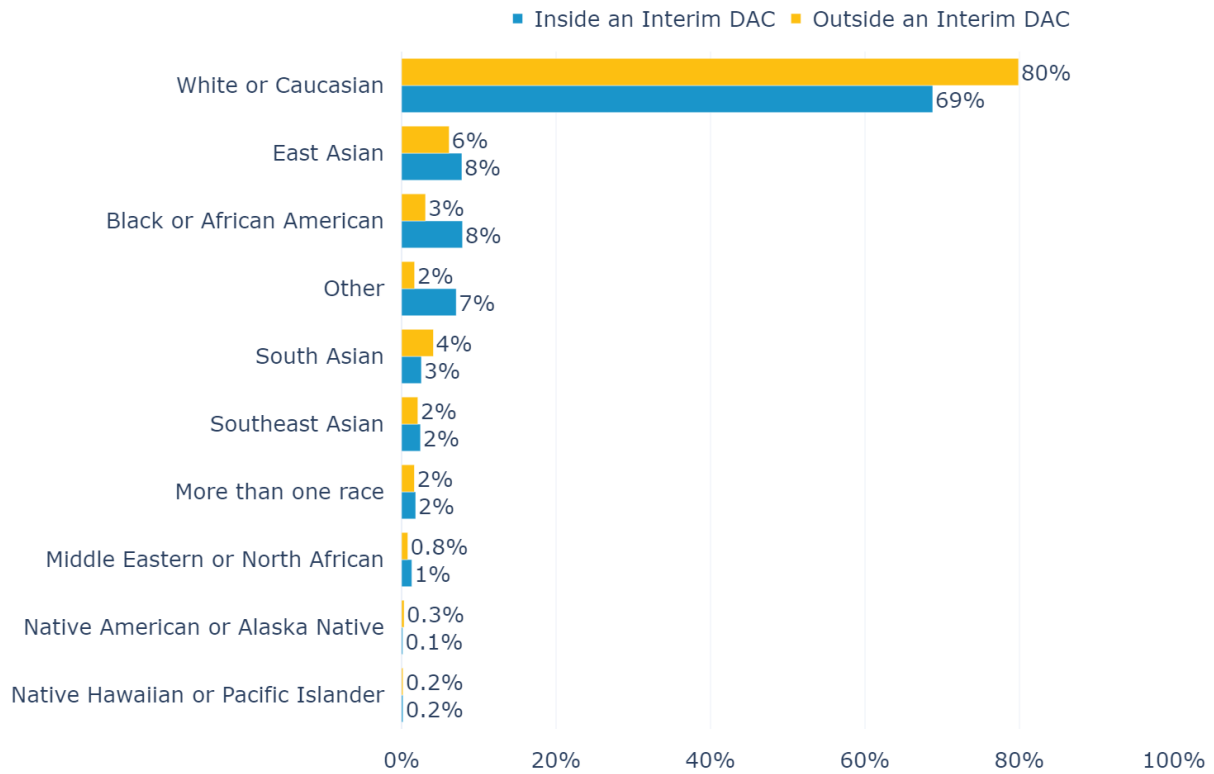


Figure 36. Responses to “How Do You Prefer to Describe Your Racial/Ethnic Identity?” within Interim Disadvantaged Community Status†

Responses from participants within an Interim DAC and those outside of an Interim DAC are significantly different (chi-squared test: $\chi^2 = 74$, $p < 0.01$, $n = 2,764$).



3 Discussion

The Ownership Survey results provide multiple indications that participants continue to be satisfied with their electric cars. Almost all respondents (94%) said they were very or extremely satisfied, and 94% said they would “probably” or “definitely” recommend EV ownership to others. Most respondents reported a high likelihood of purchasing an electric car again, with 95% of participants saying they were likely or extremely likely to buy an EV again.

While the overall satisfaction with electric car ownership was high, the survey did highlight some challenges faced by electric car drivers. Participants frequently experienced issues related to charging infrastructure: 64% reported that access to public charging stations was one of the top challenges they faced. Only 12% agreed there were enough public chargers.

In addition to a perceived lack of charging infrastructure, another concern was how electric cars perform in cold weather. This issue was selected as a challenge by 28% of respondents—and 31% of BEV respondents.

Since the previous survey, the percent of BEV drivers who charge at home daily decreased from 68% to 41% and the percent of BEV drivers who never use public chargers decreased from 58% to 22%. The percentage of PHEV drivers who never charge at home rose somewhat from 8% to 13%.

The survey provided insight into respondents' electric car ownership experience and revealed some areas, like public charging infrastructure, where participants still feel development needs to be made. Nevertheless, satisfaction with the amount of charging infrastructure available has increased over the years. Charging behavior continues to evolve among BEV and PHEV drivers as battery capacities change and the EV market matures.

Appendix A. Ownership Survey Questionnaire

A.1 Introduction

A.1.1 Welcome to NYSERDA's Drive Clean Rebate "Electric Car Ownership Survey"

Your participation in this survey is voluntary. However, your input is valuable for enhancing the electric car experience for all New Yorkers, and it is important that you try to answer all of the questions. The information you provide will be kept private to the extent permitted by law. The analysis will only use summary level data; no individual respondents will be identified.

The survey should be completed by the primary driver of the car. If you aren't the primary driver, we encourage you to have them complete the survey.

If you have any questions about this research project or if you experience any technical difficulties, you may contact the Center for Sustainable Energy (CSE), the Drive Clean Rebate Program Administrator for NYSERDA, at:

Phone: (866) 595-7917

Email: NYDriveClean@energycenter.org

Hidden Values

Hidden Value: nymake

Value: [contact("nymake")]

ID: 17

Hidden Value: nymodel

Value: [contact("nymodel")]

ID: 18

Hidden Value: nyfueltype

Value: [contact("nyfueltype")]

ID: 19

Car Status

Page exit logic: Skip / Disqualify Logic**IF:** #1 Question "According to our records, you received a rebate for a [question('value'), id='17'] [question('value'), id='18']. Does your household still have this electric car?" is one of the following answers ("No, but my household has a different electric car", "No, my household no longer owns an electric car") **THEN:** Jump to [page 11 - Disqualification - rebated car no longer in use](#)

Logic: Show/hide trigger exists.

According to our records, you received a rebate for a [question('value'), id='17'] [question('value'), id='18']. Does your household still have this electric car?*

- Yes
- No, but my household has a different electric car
- No, my household no longer owns an electric car

Logic: Hidden unless: #1 Question "According to our records, you received a rebate for a [question('value'), id='17'] [question('value'), id='18']. Does your household still have this electric car?" is one of the following answers ("Yes", "No, but my household has a different electric car")

Are you the primary driver of your electric car?

- Yes
- No

Logic: Hidden unless: #1 Question "According to our records, you received a rebate for a [question('value'), id='17'] [question('value'), id='18']. Does your household still have this electric car?" is one of the following answers ("No, but my household has a different electric car", "No, my household no longer owns an electric car")

Please describe what happened to your rebated [question("value"), id="17"] [question("value"), id="18"].

- I sold it or traded it in.
- I donated it or gave it to someone else.
- It was damaged or stolen.
- Other, please specify:: _____

Household Cars

Please tell us how many of each of the following cars your household currently owns (exclude motorcycles, RVs, and non-highway-capable cars).

	0	1	2	3 or more
Gasoline car:	—	—	—	—
Conventional hybrid car (fueled with gasoline only):	—	—	—	—
Plug-in hybrid electric car (recharged with electricity and/or fueled with gasoline):	—	—	—	—
All-battery electric car (recharged with electricity only):	—	—	—	—
Hydrogen fuel-cell electric car:	—	—	—	—
Diesel car:	—	—	—	—
Compressed natural gas car:	—	—	—	—
Flex-fuel (E85 ethanol) car:	—	—	—	—
Other alternatively fueled car:	—	—	—	—

In this survey, we are going to ask you about your experience with your **electric car**. By car, we mean passenger cars, SUVs, or light duty trucks. Your car might:

- run entirely on electricity from plugging the car in (**all-battery electric car**),
- use a combination of electricity from plugging in and gasoline (**plug-in hybrid electric car**), or
- use hydrogen as fuel (**hydrogen fuel-cell electric car**).

When we refer to **electric cars**, we are referring to all of these.

Satisfaction with Electric Car Ownership

Overall, how satisfied are you with your experience owning an electric car?

- Not at all satisfied
- Slightly satisfied
- Moderately satisfied
- Very satisfied
- Extremely satisfied

On a scale of 1 to 5 (with 1 representing "Not at all important" and 5 representing "Extremely important"), please indicate how important the following aspects of electric car ownership are to you.[†]

	Not at all important (1)	Slightly important (2)	Moderately important (3)	Very important (4)	Extremely important (5)
Saving money on fuel costs	()	()	()	()	()
Saving money overall	()	()	()	()	()
Reducing environmental impacts	()	()	()	()	()
Carpool or High Occupancy Vehicle (HOV) lane access	()	()	()	()	()
Increased energy independence	()	()	()	()	()
Ability to charge at home	()	()	()	()	()
Ability to charge at work	()	()	()	()	()
Ability to charge at public charging stations	()	()	()	()	()
Speed of refueling	()	()	()	()	()
Car performance	()	()	()	()	()
Car styling, finish, and comfort	()	()	()	()	()
Owning the newest technology	()	()	()	()	()

Validation: Max. answers = 3 (if answered)

Logic: Hidden unless: (nyfueltype matches regex pattern "BEV" OR nyfueltype matches regex pattern "PHEV")

What are the three greatest challenges to owning an electric car in New York? †

- Cost of charging
- Overall cost of ownership
- Car performance in cold/inclement weather
- Car maintenance
- Overall car performance
- Charging at home
- Access to public charging stations
- Speed of car charging
- Range limitations
- Other, please specify:: _____

Validation: Max. answers = 3 (if answered)

Logic: Hidden unless: nyfueltype matches regex pattern "FCEV"

What are the three greatest challenges to owning an electric car in New York? †

- Cost of hydrogen fueling
 - Overall cost of ownership
 - Car performance in cold/inclement weather
 - Car maintenance
 - Overall car performance
 - Access to fueling stations
 - Functionality of fueling stations
 - Range limitations
 - Other, please specify:: _____
-

Electric Car Driving

How often do you use your electric car to do the following?

	Never	A few times per month or less	About once per week	A few times per week	Daily or almost daily
Commute all the way to and from work	()	()	()	()	()
Commute partway to or from work (e.g., driving to a park-and-ride lot)	()	()	()	()	()
Run local errands (< 10 miles from home)	()	()	()	()	()
Take long trips (>50 miles from home)	()	()	()	()	()
As a car for ride sourcing services (e.g., Uber, Lyft)	()	()	()	()	()

Validation: Min = 0 Max = 500 Must be numeric Whole numbers only Positive numbers only
Min character count = 0

About how many miles do you drive your electric car per day?

Validation: Min = 0 Max = 75000 Must be numeric Whole numbers only Positive numbers only

How many total miles have you driven your electric car so far?[†]

Validation: Min = 0 Max = 100

Logic: Hidden unless: nyfueltype matches regex pattern "PHEV"

What percent of your total miles driven have been **electric** miles?

0 _____ [] _____ 100

Please list the 5-digit ZIP code of your place of employment, if applicable.

Validation: Max character count = 5 Min character count = 5

Logic: Show/hide trigger exists.

ZIP code: _____

Logic: Show/hide trigger exists. Hidden unless: Question "ZIP code:"

OR select one of the following:

- I don't work
 - I work at home
 - My work location varies
-

Page entry logic: This page will show when: (nyfueltype matches regex pattern "PHEV" OR nyfueltype matches regex pattern "BEV")

Charging

Logic: Show/hide trigger exists. Hidden unless: Question "OR select one of the following:" is not one of the following answers ("I don't work", "I work at home")

Do you have access to charging at your place of work?

- Yes, and I can charge for free.
- Yes, and I must pay to charge.
- No
- I don't know

How often do you charge at each of the following locations?

	Never	A few times a month or less	About once per week	A few times per week	Daily or almost daily
At my home:	()	()	()	()	()
Onsite at my workplace:	()	()	()	()	()
Where I park during work (I don't park onsite at work):	()	()	()	()	()
At other public charging stations:	()	()	()	()	()
Other	()	()	()	()	()

Logic: Hidden unless: Question "Other" is one of the following answers ("A few times a month or less", "About once per week", "A few times per week", "Daily or almost daily")

Please specify the other charging location

Logic: Hidden unless: Question "At my home:" is one of the following answers ("A few times a month or less", "About once per week", "A few times per week", "Daily or almost daily")

Which charging method(s) are you currently using when charging at home? [select all that apply]†

- Plugging directly into a 120V outlet (typical household outlet)
- Plugging directly into a 240V outlet (e.g., dryer outlet)
- Using a level 1 (120V) charging station
- Using a level 2 (240V) charging station

How much do you disagree or agree with the following statements?

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
There are enough public chargers.	()	()	()	()	()
Public charging stations are often in use by others when I want to charge.	()	()	()	()	()
There are public charging stations in the places where I need them.	()	()	()	()	()
Public charging stations are often not working when I want to use them.	()	()	()	()	()
I frequently see gasoline-fueled cars parked in spaces with public electric car chargers.	()	()	()	()	()

Logic: Hidden unless: #14 Question "Do you have access to charging at your place of work?" is one of the following answers ("Yes, and I can charge for free.," "Yes, and I must pay to charge.")

How much do you disagree or agree with the following statements?

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
There are enough workplace chargers.	()	()	()	()	()
Workplace charging stations are often in use by others when I want to charge.	()	()	()	()	()
Workplace stations are often not working when I want to use them.	()	()	()	()	()
I frequently see gasoline-fueled cars parked in spaces with workplace electric car chargers.	()	()	()	()	()
	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree

Page entry logic: This page will show when: nyfueltype matches regex pattern "FCEV"

Fueling

How often do you refuel your fuel-cell electric car?

- Less than once per month
- About once per month
- A few times per month
- About once per week
- A few times per week
- Daily or almost daily

When you visit a fueling station, how often is it out of order?

- I have never encountered a station that was out of order
 - Rarely
 - Sometimes
 - Frequently
 - Almost always
-

Program Performance/Efficacy

Logic: Show/hide trigger exists.

Would you recommend electric car ownership to other people?

- Definitely would not recommend
- Probably would not recommend
- Not sure
- Probably would recommend
- Definitely would recommend

Logic: Hidden unless: #22 Question "Would you recommend electric car ownership to other people?" is one of the following answers ("Definitely would not recommend", "Probably would not recommend")

Please share the main reason(s) why you wouldn't recommend an electric car.

Have any of your friends or family purchased/leased an electric car since you acquired your electric car?

- Yes
- No
- I don't know

How likely are you to purchase/lease another electric car in the future?†

- Not at all likely/Extremely unlikely
- Unlikely
- Not sure
- Likely
- Extremely likely

Would you purchase or lease another electric car if the New York State electric car rebate (Drive Clean Rebate) were not available?

- Yes
- No

Household and Demographic Characteristics

In this final section, we will be asking some questions about you and your household so we can learn more about the characteristics of electric car adopters in New York. The information you provide will be **kept private** to the extent permitted by law. The analysis will only use summary level data; no individual respondents will be identified.

Do you own or rent your residence?†*

- Own
- Rent
- Neither rent or own
- Prefer not to answer

What type of residence do you live in?*

- Detached house (single family home)
- Attached house (e.g., townhome, duplex, triplex)
- Apartment/condominium
- Other, please specify: _____*
- Prefer not to answer

Do you have solar panels at your residence?[†]

- Yes, I have solar panels installed.
- No, but I am considering installing them.
- No, and I have no plans to install them.

How many people live in your household, including yourself?[†]

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9 or more

What is your age?*

- 16–20
- 21–29
- 30–39
- 40–49
- 50–59
- 60–69
- 70–79
- 80+
- Prefer not to answer

What is your gender?*

- Female
- Male
- Non-binary/third gender
- Prefer to self-describe:: _____
- Prefer not to answer

What is the highest level of education you have completed?*

- High school graduate or less
- Some college, no degree
- Associate degree
- Bachelor's degree
- Graduate degree
- Prefer not to answer

What is your current annual gross household income from all sources (i.e., before taxes)?*

- Less than \$25,000
- \$25,000 to \$49,999
- \$50,000 to \$74,999
- \$75,000 to \$99,999
- \$100,000 to \$149,999
- \$150,000 to \$199,999
- \$200,000 to \$249,999
- \$250,000 to \$299,999
- \$300,000 to \$349,999
- \$350,000 to \$399,999
- \$400,000 or more
- Prefer not to answer

Are you Hispanic or Latino/a?*†

- Yes
- No
- Prefer not to answer

How do you prefer to describe your racial/ethnic identity? [select all that apply]*†

- Black or African American
- East Asian
- Middle Eastern or North African
- Native American or Alaska Native
- Native Hawaiian or Pacific Islander
- South Asian
- Southeast Asian
- White or Caucasian
- Other, please specify: _____ *
- Prefer not to answer

Other comments

Page exit logic: Skip / Disqualify Logic **IF:** #1 Question "According to our records, you received a rebate for a [question('value'), id='17'] [question('value'), id='18']. Does your household still have this electric car?" is one of the following answers ("Yes") **THEN:** Jump to [page 12 - Thank You!](#) Flag response as complete

Please share any additional comments about your electric car ownership experience or this survey in the box below.

Please be sure to click "Next" at the bottom of the page to complete the survey.

Disqualification - rebated car no longer in use

Unfortunately, you do not qualify for this survey at this time. You indicated that you no longer own the car associated with your survey invitation.

However, we welcome you to provide any feedback you have about the Drive Clean Rebate and your experience owning your electric car in the comment box below. Please be sure to select "Submit" so your comments are saved.

If you have any questions, please email NYDriveClean@energycenter.org. We thank you for your time and appreciate your interest.

Please share any comments in the box below.

Thank You!

Thank you for your participation in this survey. Your feedback is greatly appreciated and will help inform and support the development of electric car markets in New York. If you have any questions about this research project, you may contact the Center for Sustainable Energy (CSE), the Drive Clean Rebate Program Administrator for NYSERDA, at:

Phone: (866) 595-7917

Email: NYDriveClean@energycenter.org

Endnotes

- ¹ An updated version of the Ownership Survey was released in early 2020, and caution should be taken to compare year over year.
- ² Program participants are invited to take the Ownership Survey once per quarter. The time since they have acquired their vehicle ranges from 10.5 – 13.5 months.
- ³ Defined as using their vehicle a few times per week or more.
- ⁴ Program participants are defined as applicants who applied for and received a rebate for an electric car through NYSERDA’s Drive Clean Rebate Program.
- ⁵ For example, participants who purchased their car anytime during Q1 2020 receive the survey invitation in the middle of Q1 2021. Therefore, they may have been in possession of their car anywhere from 10.5 – 13.5 months.
- ⁶ The weighting approach was developed in 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, Center for Sustainable Energy (CSE), San Diego CA, 2017. <https://cleanvehiclerebate.org/eng/content/summary-documentation-electric-vehicle-consumer-survey-2013-2015-edition> (accessed February 5, 2020).
- ⁷ Raking, also known as iterative proportional fitting, is a technique used to match distributions from a sample to the known distributions of the broader population.
- ⁸ Similar segmentation methodology is used in 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, Center for Sustainable Energy (CSE), San Diego CA, 2018. <https://cleanvehiclerebate.org/eng/content/summary-disadvantaged-community-responses-electric-vehicle-consumer-survey-2013-2015-edition> (accessed July 1, 2020).
- ⁹ Rao, J. N. K., and A. J. Scott. 1984. On chi-squared tests for multiway contingency tables with cell proportions estimated from survey data. *Annals of Statistics* 12: 46–60.
- ¹⁰ The NHTS does not report whether a vehicle was purchased new or used. Information on the age of the car and the odometer reading are used to infer the new or used vehicle status.
- ¹¹ Note that multiple options could be selected, so percentages do not add to 100%.
- ¹² The interim criteria identified for a disadvantaged community as defined by New York State. <https://www.nyserra.ny.gov/ny/disadvantaged-communities>

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