Energy Technologies Area
Lawrence Berkeley National Laboratory

The false dichotomies of plug-in electric vehicle markets

Margaret Taylor, K. Sydny Fujita, and Nica Campbell

March 2024

This work was supported by the U.S. Department of Energy under Lawrence Berkeley National Laboratory Contract No. DE-AC02-05CH11231, and the U.S. Environmental Protection Agency.

Disclaimer

Copyright Notice

The False Dichotomies of Plug-in Electric Vehicle Markets

Margaret Taylor, K. Sydny Fujita, and Nica Campbell
Lawrence Berkeley National Laboratory
Energy Technologies Area

March 2024

Prepared for the
U.S. Environmental Department Agency

Ernest Orlando Lawrence Berkeley National Laboratory
1 Cyclotron Road, MS 90R4000
Berkeley CA 94720-8136

The work described in this study was completed under Lawrence Berkeley National Laboratory Contract No. DE-AC02-05CH11231, and funded through an interagency agreement with the U.S. Environmental Protection Agency.

Acknowledgements

The work described in this study was funded by funded by the U.S. Environmental Protection Agency through an interagency agreement with Lawrence Berkeley National Laboratory.

This report was reviewed by Hung-Chia Yang of Lawrence Berkeley National Laboratory and Dana Jackman of the U.S. Environmental Protection Agency. Special thanks for providing us with data access go to Joshua Linn and his team at Resources for the Future, as well as Joann Zhou, Xinyi Wu and their colleagues at Argonne National Laboratory. We also thank staff at J.D. Power for their technical assistance.

Table of Contents

Table of Figures

List of Tables

Executive Summary

An archetypal electric vehicle (EV) driver has emerged in the public consciousness. This archetype can generally be characterized as a high-income, highly-educated, urban-dwelling, married, middle-aged white male who owns his home and values the latest technology and/or the environment. For those who see the widespread market for EVs as an important element of transportation decarbonization, this archetype has pluses and minuses. A plus is that if one follows the aphorism, "you can tell a lot about a person by the car they drive," EVs are now widespread enough to have something to say about the identities of their drivers. A minus, however, is that the EV driver archetype could potentially have an unintentional exclusionary effect. For the consumer who departs from the demographic characteristics of the archetypal EV driver – perhaps with the exception of pro-environmental or technophilic attitudes – there is a danger that the archetype will dampen the consumer's interest in purchasing or leasing an EV. A parallel danger for the analyst, modeler, or policy-maker is that they approach the topic of EV demand with an unintended bias toward consumers who fit the archetype, thereby missing latent demand. In these ways, both the prospective consumer and the analyst are at risk of allowing the demographic characteristics of the EV driver archetype to oppositionally frame the non-EV driver through falsely dichotomous pairings.

In addition to potentially setting up false dichotomies which could dampen EV demand and unintentionally bias analysis and policy-making, the EV driver archetype has another possible problem: it may be out-of-date, particularly given the changes observed in recent years in the vehicles offered for sale in the U.S. We particularly focus in this report on model years (MY) 2016-23. The report's introduction discusses data from this period which shows that there has been an increasing diversity of battery electric vehicle (BEV) and plug-in hybrid electric vehicle (PHEV) body style offerings on the U.S. market, which is helping to overcome a long-cited barrier to vehicle adoption. Also over this time period, BEV electric range has increased dramatically, although PHEV electric range has generally stayed unchanged at levels only about a tenth of that of BEVs. Meanwhile, the price gap between higher-priced BEVs and conventional internal combustion engine (ICE) vehicles has generally been closing.

The bulk of the report focuses on the question of how the demand for BEVs and PHEVs – collectively known as plug-in electric vehicles (PEVs) – has changed with these changes in the supply of new vehicles, and considers the implications of any changes for the EV driver archetype, with its potential for inducing false dichotomies. After introducing key terminology and describing data sources and methods, the report focuses on presenting information on the characteristics of the shopper and buyer of new vehicles, and of the shopper, buyer, and rejecter of new PEVs. For these topics, the main sources we rely on in this report for current data are: the MY2023 J.D. Power U.S. Electric Vehicle Consideration Study (EVCS) and the MY2023 J.D. Power Electric Vehicle Ownership Study (EVOS). For past data, we draw from our own prior work with Strategic Vision's New Vehicle Experience Survey (NVES) for MY2014-2016 (Fujita et al., 2022; Strategic Vision, 2016) and from the MaritzCX New Vehicle Customer Survey (NVCS) for the calendar years 2016-2020 (MaritzCX, 2020).

Section 3.1 reflects on what it means for someone to "own" a PEV in light of the rise of multi-vehicle households over recent years. About 90% of PEV owners are part of multi-car households, as are the majority of U.S. households. PEV ownership should perhaps best be represented as a categorical variable with the categories of "PEV Only," "PEV-And," and "Only Not PEV." Note that 49-52% of suburban and rural respondents, respectively, and 61% of urban

respondents to the 2023 EVCS state that they expect to be in the “PEV Only” category within four years.

Section 3.2 considers the preferences of all U.S. new vehicle shoppers during the MY2014-23 period, first in terms of body style and then in terms of other vehicle and non-vehicle attributes. One highlight of this section is data showing how non-negotiable body style is for U.S. new vehicle buyers, and particularly the body styles of pick-up truck and sport utility vehicle (SUV).

Section 3.3 explores the preferences of U.S. new vehicle shoppers as they relate to PEVs. This includes people who ultimately buy PEVs, but also those who are “very” or “somewhat” likely to consider a BEV for their next purchase or lease (BEV considerers), and those who are “very” or “somewhat” unlikely to consider a BEV for their next purchase or lease (BEV rejecters). Section 3.3 begins by considering the overall population of BEV considerers, PEV buyers, and BEV rejecters, then proceeds to explore demographic cross-cuts of MY2023 data.

Section 4.1 provides a detailed summary of results; here, we highlight a few key observations. First, the majority of people who responded to the EVCS are BEV considerers, using the definition provided above (see Appendix A, Table A.1- 1). This holds across all of the income groups we looked at in this report, as well as the three levels of urbanicity we considered, namely urban, suburban, and rural residence. It also holds for men and women, all people under 65, the four racial/ethnic groups we looked at, and both the owners and renters of homes. Unfortunately, we do not have 2023 EVCS data on the education levels of respondents, which precludes assessing BEV consideration by education level.

Second, we see that the condition of being a BEV rejecter, using the definition provided above, declines dramatically for rural, suburban, and urban new vehicle shoppers when their physical experience of BEVs increases from the level of none to that of having had any past experience as a BEV passenger. Never having been in a BEV is tied to BEV rejection for rural respondents at a rate of over 60%, suburban respondents at over 50%, and urban respondents at under 50%. Meanwhile, an experience as a passenger in a BEV is tied to BEV rejection for respondents at a rate of just over 30% for both rural and suburban respondents and at just over 20% for urban respondents. These findings suggest that experiential programs like “ride and drives” are potentially useful for increasing the openness of U.S. consumers to BEVs.

Two key demographic characteristics of today’s BEV considerers differ from those of the EV archetype. First, new vehicle buyers aged 25 to 39 have the highest concentrations of BEV considerers, which contrasts with the middle-aged characteristic of the EV archetype. Second, both in terms of purchase rates for PEV vehicle models between 2017 and 2020 and of BEV consideration, as defined above, Asian Americans (6% of the population) are the leading racial/ethnic group. In the 2023 EVCS, we find that Asian Americans have the highest concentration of BEV-consideration (at 75%), Black Americans (13% of the population) have the second-highest concentration (at 67%), Hispanic/Latino Americans (18% of the population) are next (at 65%), and White Americans (60% of the population) have the lowest level of BEV consideration (59%).

Meanwhile, other demographic characteristics of the EV driver archetype are in the process of changing. According to MY2023 EVCS data, it appears that the gender gap today is 8 percentage points, with BEV consideration expressed by 64% of men and 56% of women. This is lower than the 15 percentage point difference we saw in 2018 survey data analyzed in Spurlock et al. (2019). In addition, the homeownership facet of the EV archetype is likely in flux, given the increased availability of multi-family, workplace, and public charging stations across

the U.S., due both to private and public sector activity. The majority of BEV considerers, regardless of homeownership status, have some form of charging access, either at home or at work. The converse generally holds true as well, however. The majority of BEV rejecters state either that they "cannot install an EV charger at my home and don't have access to an EV charger at my workplace" or that they don't know if they have access to charging or the ability to install a charger at home. The exception is homeowners who are "somewhat unlikely" to consider a BEV for their next purchase, just under 60% of whom already have a home EV charger and/or access to a charger at work, or could install a charger at home if necessary. Finally, having access to EV charging at work appears to be a major factor in increasing the likelihood that a renter will consider purchasing a BEV.

In addition to providing demographic characteristics of BEV considerers and rejecters, this report leverages data in the EVCS and EVOS to better understand the following motivations: of all buyers to purchase a new vehicle; of BEV rejecters to have low consideration of BEVs; of BEV considerers to select a hypothetical top BEV model; and of PEV purchasers to buy the model of PEV they chose.

There is very strong agreement across demographic segments in the EVCS regarding the most common reason people shop for a new vehicle, which is that they want better features/technology. In addition, the top four most commonly cited reasons to shop for a new vehicle, as provided by any demographic segment, are comprised of a universe of only four "wants" for a new vehicle, namely: (1) better features/technology; (2) better reliability; (3) better fuel economy; and (4) better performance. An implication of this is that while interest in new technology is part of the classic EV driver archetype, it is in no way limited to it.

None of the four reasons why people say they shop for new vehicles is a top-four commonly cited factor underlying the low consideration of BEVs by BEV rejecters. Instead, non-vehicle attributes tied to EV charging infrastructure dominate BEV rejection. The top four most commonly cited reasons that the BEV rejecter population gives for their low consideration of BEVs are, in order: (1) lack of charging station availability; (2) purchase price; (3) limited driving distance per charge; and (4) time to charge. Note that major recent federal policy initiatives aim to improve the availability of public EV charging stations across the U.S. and to reduce the purchase price of PEVs for U.S. consumers, particularly through the policy instrument of tax credits. The results of these initiatives, as well as ongoing BEV battery improvements, may well change the nature of BEV rejection over the next few years.

Finally, it is interesting to note that having a pro-environmental sentiment is barely mentioned in the top four most highly cited reasons for BEV selection/PEV purchase by any segment of survey respondents. Of all the demographics of BEV considerers investigated here, only the very small population of "Pre-Boomers" mentions the environment, and only as their third most commonly cited reason for hypothetical BEV model selection. Similarly, only one demographic of PEV purchaser – women – mention it, and only as their fourth most commonly cited reason for PEV purchase. Instead, "design and styling" dominates the most commonly cited reason for PEV purchase by various EVOS segments. This is particularly true for BEV buyers; PHEV buyers most commonly cite "quality and reliability" as a reason for their purchase choice and mention "design and styling" as their second most commonly cited reason for PEV purchase.

There are clearly several indications that the EV driver archetype has already changed and is likely to continue to evolve to better reflect the full diversity of U.S. drivers, although the timing of this is unclear. This suggests that it would be unwise to discount the latent demand for PEVs amongst people who do not share the characteristics of the archetypal EV driver.

1. INTRODUCTION

An archetypal electric vehicle (EV) driver has emerged in the public consciousness. This archetype can generally be characterized as a high-income, highly-educated, urban-dwelling, married, middle-aged white male who owns his home and values the latest technology and/or the environment.

For those who see the widespread market for EVs as an important element of transportation decarbonization, this archetype has pluses and minuses. A plus is that the very existence of this archetype means that EVs have become more mainstream in the years since California began mandating that manufacturers achieve certain EV-related sales targets as part of its pioneering 1990 Zero Emissions Vehicle (ZEV) program. Following the aphorism, "you can tell a lot about a person by the car they drive," EVs are now widespread enough to have something to say about the identities of their drivers. A minus, however, is that the EV driver archetype could potentially have an unintentional exclusionary effect. For the consumer who departs from the demographic characteristics of the archetypal EV driver – perhaps with the exception of pro-environmental or technophilic attitudes – there is a danger that the archetype will dampen the consumer's interest in purchasing or leasing an EV. A parallel danger for the analyst, modeler, or policy-maker is that they approach the topic of EV demand with an unintended bias toward consumers who fit the archetype, thereby missing latent demand. In these ways, both the prospective consumer and the analyst are at risk of allowing the demographic characteristics of the EV driver archetype to oppositionally frame the non-EV driver through falsely dichotomous pairings.

In addition to potentially setting up false dichotomies which could dampen EV demand and unintentionally bias analysis and policy-making, the EV driver archetype has another possible problem: it may be out-of-date. The archetype grew from observations of the drivers of a more limited selection of body styles with less driving range per charge than the plug-in electric vehicle (PEV) models offered for sale in the U.S. today. Figure 1 portrays counts of the sedan/wagon, sport utility vehicle (SUV), van, and pickup truck body styles of battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs) offered for sale in the U.S. for model years (MY) 2016-23.[1] Note that these counts reflect the introduction of models somewhere in the U.S. but not necessarily everywhere across the country.[2]

Over the period covered by MY2016-23, there was both an increase in the overall number of BEV and PHEV models offered for sale in the U.S. as well as notable shifts in how these offerings split across body styles. In MY 2016, the majority of BEV offerings of any type were "hatchback" forms of sedans/wagons, while BEV vans and pickup trucks did not exist.[3] By

[1] BEVs, which are fully electric, and PHEVs, which rely on a combination of gasoline and electricity, share the attribute of being able to charge their batteries by plugging into a stationary power source, which is typically grid-connected. For this reason, the most technical and specific name for the umbrella category of vehicles which BEVS and PHEVs comprise is "plug-in electric vehicles" (PEVs). Common parlance, however, confusingly uses the term "electric vehicles" (EVs) sometimes to mean PEVs and sometimes to mean BEVs.

[2] The representation of models at any given dealership varies across regions of the U.S., and correspondingly affects the opportunity for prospective buyers to test drive and interact with a given model (see Figure 27, below). Note that Figure 28 shows a correlation between a prospective buyer being "very likely" to purchase a PEV and the extent of that person's previous physical access to a PEV (in order from highest to lowest access in Figure 28, responses include previous ownership, rental experience, experience having been a passenger, and never having been in a PEV).

[3] Although not included in this figure, hatchback body styles also dominated pre-2016 PEVs.

MY2023: (1) the main BEV body style offered for sale in the U.S. was sport utility vehicles (SUVs); (2) the number of sedan/wagon offerings had declined to their lowest level since 2017, with a diminished percentage of hatchbacks; and (3) there were a limited number of BEV pickup trucks on the market. In addition, in 2019 and 2020 BEVs were represented in the van body style category.

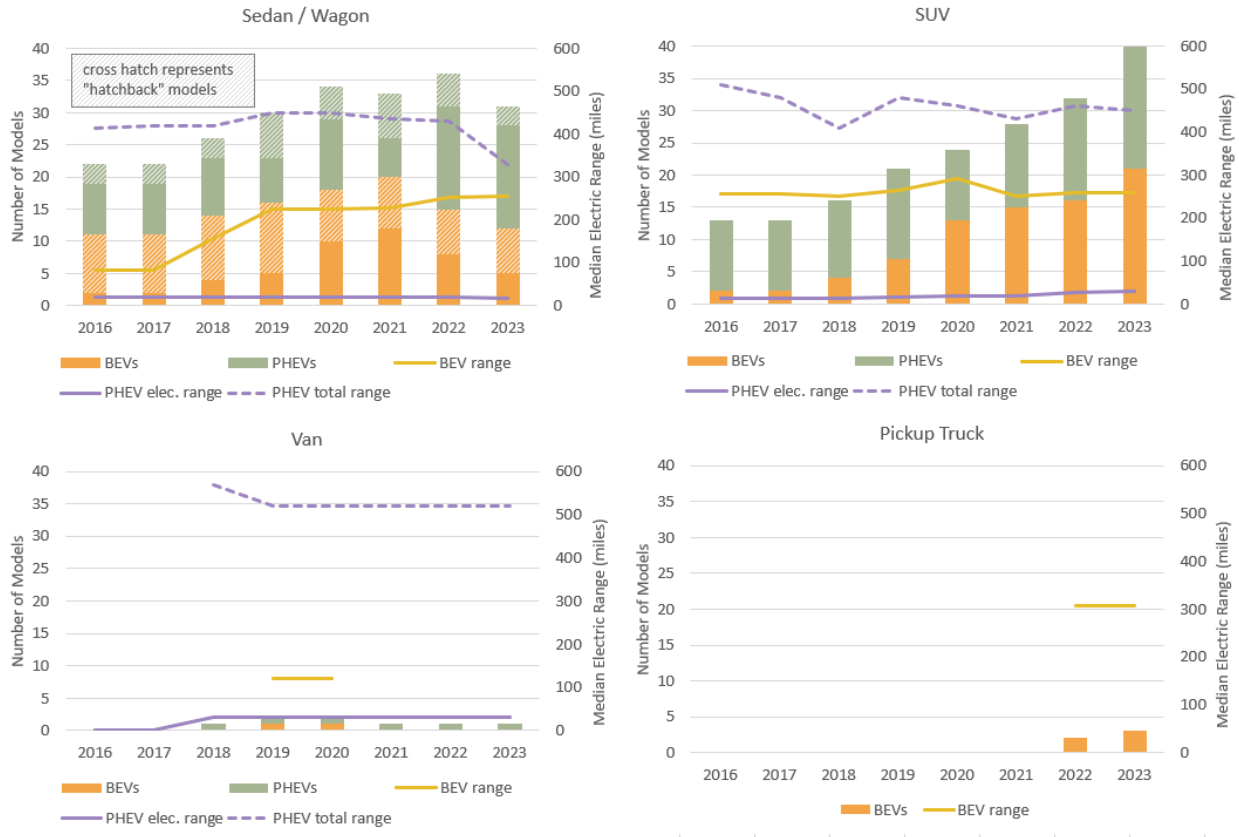


Figure 1: BEV and PHEV models offered for sale in the U.S., 2016-23, by body style and driving range per charge. Note that the "Sedans/Wagons" body style includes the subcategory of "Hatchback" body styles. **Source:** Author calculations using AFDC and DOE/EPA data[4]

In the MY2016-23 period depicted in Figure 1, PHEV offerings shared both similarities and differences with BEV offerings. Similarities include the increase in PHEV offerings overall and with respect to the body styles of sedan/wagon and SUV. Differences include the steady market presence of a PHEV, rather than BEV, van, and an absence of PHEV, rather than BEV, pickup trucks. Another difference is that the absolute number of PHEV hatchback models offered for sale in MY 2023 is generally the same as in MY 2016.

In addition to depicting counts of model offerings by body style, Figure 1 displays the median range per charge of body style offerings for MY 2016-23, with a particular call-out of the total

[4] AFDC data on BEV and PHEV make/model/trim availability by year were collected for MY 2016-2023. Counts may differ from other sources, in part because records were collapsed to the level of models, rather than trim, in order to represent the range of substantively different offerings on the market. AFDC data also include each model's electric range; in cases where several trim levels were combined, we take the average of these to represent the model. Models are grouped into body styles according to categories provided in AFDC data, and broadly align with body style classifications found in other data sources we have analyzed. Total range data for PHEV models were collected from fueleconomy.gov, an informational site jointly maintained by the Department of Energy and the Environmental Protection Agency.

versus electric-only range of PHEVs. BEV sedans and wagons more than doubled their electric range during these years to over 200 miles per charge. BEV SUVs and pickup trucks saw generally flat range trends over these years, albeit at the 200+ mile median range for SUVs and 300+ mile range for pickup trucks. Full-sized BEV vans, which were only on the market in MY2019 and MY2020, had 100+ mile range in both years.

The BEV sedan/wagon, SUV, and pickup truck range improvements illustrated in Figure 1 are tied in the public consciousness to well-known battery innovations (i.e., technological change outcomes of public and private sector investments). Figure 1, however, illustrates that battery innovations were only incorporated into *PHEV* system designs at a level that was just enough to allow for these vehicles to have a very low all-electric range, an attribute that has not significantly improved over time. In the figure, the solid purple line depicts the median electric range of a given body style of PHEV in MY 2016-23, while the dashed purple line depicts the median overall driving range of those same body styles. Throughout this period, PHEV median electric range is startlingly low (~ 20 miles) when contrasted with both PHEV overall range and – as discussed above – with BEV electric range for each of the body styles of sedans/wagons, SUVs, and vans. In addition, PHEV median electric range generally held constant or only slightly increased across the MY 2016-23 offerings. This is actually a slightly better trend than that seen for the overall driving range of PHEVs during this period, which declines for all three extant PHEV body styles – sedans/wagons, SUVs, and vans. Between MY2016 and MY 2023, the median overall PHEV driving range of sedans/wagons declined from 400+ miles to 300+, the range of SUVs declined from ~500 miles to ~450, and the range of the lone PHEV van on the U.S. market declined somewhat from almost 600 miles in MY 2018 to 500+ (note that from MY 2019-2023, the PHEV van range held generally constant at 500+ miles).

The PEV purchase price and its contrast with comparable internal combustion engine (ICE) vehicles – long cited as a barrier to widespread adoption of BEVs, in particular – exhibits a positive trend for consumers the years covered by Figure 1. Against a backdrop of consistently increasing prices in the overall market for new vehicles (Cox Automotive, 2023), the gap has been closing between PEVs and ICE vehicles with respect to purchase price, normalized by range (Plante & Howard, 2022). Between 2022 and 2023, average BEV prices decreased by more than 20%, bringing the price gap with ICE vehicles to about $3,000 (Grieve, 2023). Note that because many luxury and larger models of BEVs are now available, demand for these models can skew the market average price for BEVs and mask the availability of cars with prices quite similar to the market average price for ICEVs. There are a number of new BEV models offered for sale in the U.S. with a manufacturer suggested retail price (MSRP) under or right around $40,000. For more discussion of PEV prices in the U.S., see Section 3.3.1 below, particularly with respect to mass market models in the new and used vehicle markets.

The body style, range, and price changes in the PEVs offered for sale in the U.S. over recent years raise the question of how the concomitant demand has changed and what any changes might imply for the EV driver archetype, with its potential for inducing false dichotomies. We explore these questions in this report, which proceeds as follows. Section 2 introduces key terminology and describes data sources and methods. Section 3 presents information on the characteristics of the shopper and buyer of new vehicles, and of the shopper and buyer of new PEVs, over the period MY2014-23. Section 3.1 reflects on what it means for someone to “own” a PEV in recent years. Section 3.2 considers the preferences of all U.S. new vehicle shoppers during the MY2014-23 period, first in terms of body style – in keeping with Figure 1 – and then in terms of other vehicle and non-vehicle attributes. This latter material is rooted in previous work on MY2014-16 data by some of the authors of this report, but expands on that with a detailed look at data from MY2023.

Section 3.3 explores the preferences of U.S. new vehicle shoppers as they relate to PEVs, including those who ultimately buy PEVs, but also those who are "very" or "somewhat" likely – as opposed to "very" or "somewhat" unlikely – to consider a BEV for their "next purchase or lease." This exploration begins by considering the larger population of these PEV owners, BEV considerers, and BEV rejecters, then proceeds with cross-cuts of the MY2023 data, as structured by demographic characteristics. These demographic characteristics include those of direct relevance to the EV driver archetype – income, degree of urbanicity, gender, age, race/ethnicity, education, and homeownership – as well as housing type, which is particularly relevant to electric vehicle charging equipment. Although we understand that some of these demographics are likely to be correlated (e.g., income and homeownership), we decided it was more valuable in this report to let the data on each demographic speak for itself so the reader can appreciate the evolution of each of the many facets of the EV driver archetype and the existence of any oppositional dichotomies. Section 4 concludes the report with a summary of the data explorations in this report and the implications of this material for the EV driver archetype and for latent U.S. demand for PEVs.

2. METHODS

This section provides more information on the terminology, data sources, and methods we use in Section 3.

2.1 Terminology

As mentioned in the footnote above, the most technical and specific name for the umbrella category of vehicles comprised of battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs) is "plug-in electric vehicles" (PEVs). This is because both BEVs, which are fully electric, and PHEVs, which rely on a combination of gasoline and electricity, share the attribute of being able to charge their batteries by plugging into a stationary power source, which is typically grid-connected.[5] BEVs are the main focus of this report, but when a data source has useful information on PHEVs, we sometimes discuss that material.

There are many places in this report in which we seek a dialogue with the common parlance used outside the world of alternative fuel vehicle expertise. In some instances, common usage overlooks the PHEV category and refers to BEVs as "electric vehicles" (EVs). At other times, common usage refers to the umbrella category for BEVs and PHEVs not as PEVs, but as EVs. This happens most conspicuously in the context of charging infrastructure, which can be used to charge both types of PEV and which the industry generally refers to as electric vehicle service equipment (EVSE). We ask the reader's forbearance with any confusing usage of the term EVs in this report, and hope that contextual information will be sufficient to provide clarity.

This report is informed by the 4-A framework of PEV acceptance put forth in Jackman et al. (2023). The 4-A framework distinguishes between the following, nominally sequential components of PEV acceptance: (1) Awareness; (2) Access; (3) Approval; and (4) Adoption. Each component is defined by a set of consumer behaviors and influenced by a unique set of enablers and obstacles. *Awareness* represents consumer knowledge of PEVs, including the accuracy of that knowledge. *Access* means that a PEV is, or is perceived to be: suitable to

[5] Conventional hybrids are distinct from PHEVs because they lack this external charging capability.

consumer needs; affordable; physically available; and convenient to purchase, use, charge, and service. *Approval* occurs when a consumer perceives that PEVs are viable substitutes for ICE vehicles, and is indicated by a consumer's serious consideration of purchasing a PEV. *Adoption* refers to the first purchase or lease of a PEV, and is the most readily observable of the four components of PEV acceptance. Although this framework was initially expressed in terms of PEVs, in general, it is fully applicable to a more specific focus on BEVs.

In order to distinguish between the traits of people, vehicles, and the contexts in which people purchase and use vehicles, this report also uses terminology established in Taylor and Fujita (2018) and Fujita et al. (2022). In this terminology, the consumer purchase decision making-process has five steps: (1) problem recognition; (2) search; (3) alternative evaluation; (4) purchase; and (5) post-purchase behavior.

In *problem recognition*, a consumer identifies a gap between his or her current situation and his or her needs and/or desires (i.e., the consumer's "ideal situation"). Problem recognition occurs in one of several ways, including: (1) a currently-owned product is almost depleted; (2) a product is regularly/habitually purchased; (3) a currently-owned product is not satisfactory; (4) the consumer has a new need for a product; (5) a currently-owned product has a desired complementary/related product; and (6) a consumer has a new expectation for satisfaction tied to a newly introduced product.

In *search*, the consumer seeks information about possible solutions to the problem in order to generate a list of potential purchase options (the "consideration set"). Consumers consult both internal sources (i.e., "internal search," or information already in the consumer's mind – the perception of brands is a particularly important heuristic) and external information sources (i.e., "external search," e.g., friends and family, third-party reviews, official business sources, direct experiences with products, online resources, etc.). Consumers typically weight internal information and information from friends, family, and other consumers more highly than information from business sources. The consumer "integrates" the information gained in internal and external search through perception, a process through which the consumer senses, selects, and interprets information to derive meaning. Important influences on perception include individual experiences, expectations, and conditions at a given moment.

In *alternative evaluation*, the consumer evaluates the consideration set on criteria which are based on the services the consumer needs or desires to gain from a vehicle because of its attributes. Vehicle attributes can either be objective (e.g., product function, features, etc.) or subjective (e.g., feelings the product elicits from the consumer because of the vehicle's aesthetics, etc.), while purchase criteria can be influenced by consumer characteristics, including demographics, psychographics, etc. Specific evaluation methodologies vary by consumer, but can be broadly categorized as compensatory and non-compensatory. A compensatory decision rule involves the consumer "trading off" product attributes, while a non-compensatory decision rule involves a non-negotiable attribute (e.g., a consumer will only consider an all-wheel drive vehicle). In terms of the vehicle purchase decision context, key factors include attributes of vehicles available for purchase (e.g., vehicle body types available as BEVs) and aspects of the systems in which vehicles are used (e.g., abundance of charging infrastructure). The results of alternative evaluation are: an "evoked set" (i.e., the set of potential purchases); an "inept set" (i.e., the set of products that the consumer will not consider purchasing); and an "inert set" (i.e., the set of products that the consumer is indifferent toward). The vehicles in the evoked set are particularly acceptable to a consumer, while consumers are neutral toward the vehicles in the inert sets, deeming them acceptable in certain circumstances

but not as preferable as the options in the evoked set. The inert set of vehicles are unacceptable.

In *purchase*, the consumer decides to buy (or not buy) a specific product. This is influenced by a variety of factors, ranging from the internal (e.g., consumer beliefs, attitudes, and intentions) to the external (e.g., the quality of the retail experience, the availability of promotions, the offered terms and conditions for sale or lease, etc.). The product choice can change at the time of purchase for several reasons, including: product availability at the dealership; incentives for competing products; lack of necessary funds; and peer group opinions. During the purchase stage, consumers may even select a product from their inert set of options instead of one from their evoked set. Note that vehicle purchase decisions are made in the context of broader social systems (e.g., policy and market environments), which can contribute to final vehicle selection.

In *post-purchase behavior*, the consumer uses the product and evaluates, over time, the consumer's feelings about the purchase and whether it met pre-purchase expectations. Consumer satisfaction or dissatisfaction, particularly as it contrasts with expectations, shapes a consumer's heuristics about a product, helping the consumer to simplify future product information search and alternative evaluation (e.g., around a brand).

Key consumer characteristics of individuals and households include demographics (e.g., high income, high educational attainment), household characteristics (e.g., homeowner of a condo or a detached house) and vehicle usage characteristics (e.g., long commutes, a multicar household, etc.). In this report, we particularly consider consumer based on the following characteristics: household income; urban, suburban, or rural location of residence; gender; age; race/ethnicity; educational attainment; homeownership status; and housing type.

One of the key metrics we examine in this report is consumer consideration of BEVs. In the data sources we draw from – large sample-size surveys implemented by established industry players over many years, as described below – the term "consideration" can take one of several meanings, depending on the specific context and dataset. Some survey questions approach consumer consideration of a vehicle in a general or abstract sense, for example in questions like "would you consider a BEV for your next vehicle purchase?" or "do you consider BEVs to be as good as gasoline fueled vehicles"? Other survey questions approach consumer consideration of a vehicle in highly specific ways, for example, when asking a respondent to "please list the make and model of your second choice in your most recent vehicle purchase decision." In this latter instance, we refer to a "purchased vehicle" model and a "top alternatively considered" vehicle, which is a specific make/model listed by a survey respondent. We call these pairs of purchased and alternatively considered models a consumer's "consideration set," although it is technically a smaller set of products than the consumer might have initially considered in the search process, as described above. When discussing the level of BEV approval over time and across population subgroups, we try to be specific about whether we are referring to a consumer's general consideration of a potential future BEV purchase or a consumer's specific consideration of a second-choice vehicle model.

One of the characteristics that we examine is whether vehicle owners or shoppers live in urban, suburban, or rural areas. Just as there is no *single* formal definition of "rural" used across Federal statutes, the various datasets we analyze also have more than one way to define this term. Some of the data we analyze denotes "urban" versus "rural," while other data sets include an intermediate "suburban" category as well. In one case, "urban" areas are distinguished from "non-urban" areas. We try to stay true to the dataset definitions, when possible, although we also leverage U.S. Census data as appropriate. The U.S. Census defines an urban area as "a

densely settled core of census blocks that… encompass[es] at least 2,000 housing units or ha[s] a population of at least 5,000;" urban areas can be further categorized as "urbanized areas" with a population of 50,000 or more or "urban clusters" with fewer than 50,000 people (U.S. Census Bureau, 2022, 2024). These definitions anchor on "urban" for their etymology, with "rural" being whatever portion of the country remains that has not been categorized as a form of "urban."

In an attempt to simplify discussion of PEV adoption, approval, and consideration across consumers' location of residence, we adopt the term "urbanicity" to refer to a scale of how urban (or rural) a location is. In this, we follow the definition of urbanicity in (Vlahov & Galea, 2002), which "refers to the urban conditions at any given point in time rather than a 'process' of a city's changing characteristics," rather than the alternative definition of urbanicity sometimes seen, in which the term "refers to the impact of living in urban areas at a given time." In our usage, urbanicity refers to "the presence of conditions that are particular to urban areas or present to a much greater extent than in nonurban areas" (Vlahov & Galea, 2002). In the context of a developed country like the U.S., urbanicity reflects "the contrast between a city and the suburbs and rural areas around it" (Cyril et al., 2013).

2.2 Data Sources

We rely on several sources of information to discuss consumer preferences, demographic characteristics, and vehicle attributes over the past decade and more. We present new analyses of the following datasets: the highly detailed MaritzCX New Vehicle Customer Survey (NVCS) for the calendar years 2016-2020 (MaritzCX, 2020); the smaller but more recent J.D. Power U.S. Electric Vehicle Consideration Study (EVCS) and J.D. Power Electric Vehicle Ownership Study (EVOS) for MY2023 (J.D. Power, 2023a, 2023b); and the Alternative Fuels Data Center (AFDC) data on available PEV models (Alternative Fuels Data Center, 2024). Prior studies written by ourselves and others supplement these analyses, where appropriate. In particular, we draw from our own prior work with Strategic Vision's New Vehicle Experience Survey (NVES) for MY2014-2016 (Fujita et al., 2022; Strategic Vision, 2016).

We further describe the EVCS, EVOS, NVCS, NVES, and AFDC datasets below.

EVCS: J.D. Power conducts the EVCS with people who intend to purchase or lease a new vehicle in the coming year in order to understand how they are or are not considering EVs in the context of that pending purchase. The EVCS includes questions addressing: (1) reasons for vehicle purchase; (2) familiarity with and knowledge of BEVs; (3) likelihood of BEV purchase; (4) reasons for non-consideration of BEVs; and (5) respondent demographics. The EVCS asks respondents both about particular vehicle models that they own or would consider buying, as well as more general questions regarding their perceptions of BEVs. In particular, we explore the responses to the questions: "How likely are you to consider an EV for your next purchase or lease?", which is answered on a four-point scale ranging from "very unlikely" to "very likely," and "What physical access have you had to EVs?", which can include prior ownership, test drives, being a passenger, or no experience. We use the responses to these questions to explore general consideration of BEVs. The MY2023 version of the EVCS was collected online using a consumer panel between January and May of 2023, resulting in 8,136 responses. Data are weighted to reflect "the demographic profile (gender, age, household income) of the actual U.S. automotive shopper population."

EVOS: J.D. Power conducts the EVOS as an online survey of owners of MY2023-24 BEVs and PHEVs which is administered by sending a recruitment invitation to "members of PlugShare's

owner research panel and users of the PlugShare app." Survey returns – 4,650, representing 28 makes and 71 vehicle models – are weighted against "each model's sales availability (based on personal-use registrations for the time period as provided by IHS Automotive)." In the Wave 1 (Aug – Dec 2023) data we used for our analyses, the EVOS included questions addressing: (1) reasons for vehicle purchase; (2) reasons for specific model selection; (3) driving and charging habits; (4) assessment of the consumers experience with their PEV; and (4) respondent demographics. In particular, our analyses explore the responses to the question: "Why did you choose to purchase or lease your [PEV make/model]?"

NVCS: MaritzCX, now a part of InMoment, conducts the NVCS as a nationally representative survey of new vehicle buyers. Sample size by year includes approximately 150,000 to 300,000 respondents. The NVCS covers a wide range of topics, including: (1) characteristics of new vehicle buyers (e.g., demographics, psychographics, household composition, preferences, hobbies); (2) common travel behaviors of new vehicle buyers (e.g., planned driving distances, common reasons for vehicle use); (3) the make and model of both the newly purchased vehicle and up to three other vehicles that the buyer considered, but did not ultimately purchase (i.e., alternatively considered vehicles);[6] (4) the new vehicle buyer's feelings about the newly purchased vehicle, which is relevant to the post-purchase behavior stage of the decision process articulated in Taylor and Fujita (2018) (e.g., assessment of vehicle performance with responses ranging from negative to positive); and (5) aspects of the vehicle buying experience (e.g., influence on search of information sources, number of dealership visits, etc.). We analyzed NVCS data from the calendar years 2016-20, as well as a limited number of variables from earlier versions of the survey (2009-15).

NVES: Strategic Vision conducts the NVES as a nationally representative survey of new vehicle buyers, with approximately 200,000 respondents annually. The NVES covers many topics about the vehicle buyer and their purchase process that are similar to those covered by the NVCS, including: (1) stages of the purchase process; (2) alternative vehicle models considered; and (3) vehicle buyer characteristics. We previously analyzed MY2014-16 NVES data in Fujita et al. (2022), a study which analyzed vehicle selection criteria across consumer groups and examined the alignment of preferences for fuel economy and environmental friendliness with the attributes of purchased vehicles (i.e., fuel economy and fuel type). We cite and reproduce some of the statistics and figures from Fujita et al. (2022) as a point of comparison with the more recent data from the NVCS and EVCS in order to consider how preferences may have changed with changing vehicle attributes.

AFDC: The U.S. Department of Energy's Alternative Fuels Data Center (AFDC) is an online information hub for transportation decision maker usage which provides wide-ranging data on alternative and renewable fuels, including PEVs and charging infrastructure. These data are available in many forms, including through interactive tools, calculators, and mapping applications. We collected PEV model data over time using AFDC's Alternative Fuel and Advanced Vehicle Search, which allowed us to track the number of BEV and PHEV models by broad vehicle body style.

[6] We use the NVCS alternatively considered vehicles to examine the consideration sets of new vehicle buyers (i.e., the vehicles they choose between), and to analyze the strength of consumer preferences for vehicle body style. "Consideration" is more tangible in the NVCS than in the EVCS, as a respondent must be interested enough in a particular PEV to list it as a strong contender.

2.3 Methods regarding vehicle decision-making criteria

2.3.1 Previous work

In Fujita et al. (2022) we investigated the distribution of vehicle shopping criteria rankings across the U.S. and how they differ between groups of consumers. To do this, we analyzed three years of NVES data (MY2014-16), with a combined sample size of 842,212 responses.

The portion of our analysis that we revisit in this report relied on responses to the survey question: "Why did you decide to purchase or lease the particular model you did rather than some other model? How important was each of the following in your decision?" Responses involved the rating of 80 aspects of vehicles in terms of a 1-to-5 scaling of their importance to the purchase decision, including the presence of vehicle features, assessment of the quality of features, vehicle attributes derived from features, financial aspects, other influences, and assessment of overall vehicle attributes (e.g., "overall value"). In the subsequent criteria ranking analysis, we focused on 10 of the overall attributes, based on a literature review, exploratory factor analysis, and our own research questions. These vehicle attributes were: safety, value, performance, durability, fuel economy, comfort, image, power, design, and environment (see Table 1).

Table 1: NVES vehicle attribute criteria categories constructed for Fujita et al. (2022)

Category	Includes survey item "Overall importance of…"
Safety	Safety of the vehicle
Value	Value for the money
Performance	Driving performance
Durability	Impressions of durability/reliability
Fuel economy	Fuel economy/mileage
Comfort	Seat comfort
Image	Vehicle image; brand image
Power	Power and pickup
Design	Interior design; interior styling; interior workmanship; exterior workmanship; exterior styling
Environment	Environmental friendliness

In Fujita et al. (2022), we applied the analytical hierarchy process (AHP) to assess how consumers ascribed the relative importance of each of these criteria. AHP is described in greater detail in that paper and references therein, but in brief, it is a method used to determine which criteria rank of lesser or greater importance to each consumer (or group of consumers) and to construct relative overall importance degrees for each criterion, which we referred to as "criteria weights." Since we compared the relative weights of 10 criteria, a criteria weight of 0.1 (1/10) is a useful reference point; if all 10 criteria had a weighting of 0.1, it would mean that a consumer applies equal importance to all 10 criteria. If a particular criterion has a weight lower than 0.1, it can be understood as relatively less important; if higher than 0.1, it is relatively more important.

2.3.2 Current data

While not identical to the NVES questions in structure, several questions in the 2023 EVCS and EVOS are similar enough for us to investigate contemporary vehicle attribute criteria in a somewhat comparative fashion to Fujita et al. (2022). The EVCS surveys new vehicle shoppers and asks them "CV4. Why are you shopping for a new vehicle? Mark all that apply." This question provides the closest link to the way the NVES surveys the overall car-buying population, as it asks about the generic new car buyer and their reasons to purchase any vehicle. The EVCS also asks "EV3. How likely are you to consider an EV for your next purchase or lease?" and provides four possible responses: (1) very likely; (2); somewhat likely; (3) somewhat unlikely; and (4) very unlikely. Throughout this report, we refer to the set of respondents who choose option (1) or (2) as "BEV-considerers" (i.e., the BEV-interested) and the set of respondents who choose option (3) or (4) as "BEV-rejecters." In the EVCS, both the BEV-considerers and BEV-rejecters are asked follow-ups to this question. The BEV-rejecters are asked "EV13. What factors contribute to your low consideration of EVs? Mark all that apply." The BEV-considerers, meanwhile, are asked to name a BEV they might be interested in and then provide reasons for their choice in a "mark all that apply" format. In this report, we generally do not highlight the responses to this question, as we have data from a parallel question in the EVOS which is more consistent with how the NVES asks PEV buyers about their motivations for purchase, which we explored in Fujita et al. (2022). The EVOS asks people who decided to actually purchase a PEV "EV06_MULTI. Why did you choose to purchase or lease your [S2_Make] [S2_Model]? Mark all that apply."[7]

It is important to note that the EVCS and EVOS respondents are directed in these questions to "mark all that apply" rather than to use a 1-to-5 ranking. This construction unfortunately excludes analysis using the AHP and criteria weights, the way we did in Fujita et al. (2022). Instead, we are only able to identify how frequently a given shopping reason is selected by a set of respondents, either from the overall population or a segment thereof (e.g., 20% of respondents list reason A, only 5% of respondents list reason B). We sometimes refer to this as "commonality"; while it does not necessarily reflect priority (e.g., many people may care about vehicle image, but not strongly so), we find it a useful point of comparison when discussing the criteria and contexts that influence vehicle buyers' decisions.

2.3.3 Criteria categories

In order to be able to discuss our observations across the related NVES, EVCS, and EVOS questions described above, we needed to recode the detailed EVCS and EVOS response options to better align with the ten criteria categories we used when analyzing NVES data in Fujita et al. (2022). We anchored on NVES categories as a starting place, and grouped EVCS and EVOS response options into these as appropriate. Note that our NVES categories, and the more detailed survey responses they were constructed from, all pertain to attributes of the vehicle and the buyer's perceptions of it. While EVCS and EVOS include many reasons for a

[7] The EVCS and EVOS do not have a full overlap of consumer demographic characteristics. One characteristic we are interested in is race/ethnicity, which the EVCS includes but the EVOS does not. As a result, for this one demographic characteristic, we refer to an EVCS question as a substitute for EV06_MULTI so we can explore the criteria consumers employ when considering a PEV for purchase. That question, which was posed to those respondents who stated they are "very" or "somewhat" likely to consider a future BEV purchase and then what their top choice BEV model would be, is: "EV6. Why is the [Insert EV5 response] your top choice? Mark all that apply." While this does not show the reasons for selecting a BEV in general, it does allow us a glimpse at the priorities at play when comparing one BEV against another.

buyer to purchase, likely purchase, or reject a PEV which relate to vehicle attributes, none correspond well to the NVES-based categories of "safety," "comfort," or "power." Additionally, EVCS and EVOS include a number of response options that pertain not to attributes of a vehicle, but to stages of the vehicle purchase process (i.e., problem definition, search, purchase) or to the external systems in which vehicle purchase and use take place (i.e., infrastructure, policy). Table 2 provides examples of the response items from EVCS and EVOS, as sorted into categories by members of the project team first independently, and then through concordance discussions about the few attributes for which there was interrater disagreement. Table 2 also includes the definitions we used to construct categories of responses not related to vehicle attributes, along with examples of response items in each category.[8]

Table 2: Criteria categories that coordinate across NVES, EVCS, and EVOS data

Category *Aligned with Fujita et al. 2022*	**Includes EVCS/EVOS survey responses relating to…**
Safety	*N/A*
Value	*Example(s): "Purchase price / lease offer," "Cost of ownership"*
Performance	*Example(s): "Driving performance," "Battery/driving range"*
Durability	*Example(s): "Expected quality/reliability," "Inadequate reliability"*
Fuel economy	*Example(s): "Better fuel economy," "Lower carbon footprint"*
Comfort	*N/A*
Image	*Example(s): "Better styling/image," "Inadequate styling/image"*
Power	*N/A*
Design	*Example(s): "Need bigger vehicle," "Model design and styling"*
Design - Technology[9]	Special case of design. *Example(s): "Innovative product features"*
Environment	*Example(s): "Better environmental/"green" credentials"*

Category *External contexts*	**Definition and examples**
Problem definition	First step in the purchase decision process in which the shopper identifies a gap between their current situation and their needs/desires. *Example(s): "Lease is up," "Current vehicle is no longer operational"*
Search	Second step in the purchase decision process in which the shopper seeks and integrates internal and external information to generate a vehicle consideration set. *Example(s): "Prior experience with brand," "Critical input from family or friends"*
Purchase	Fourth step in the purchase decision process in which the shopper makes the decision to buy or not buy an option from their consideration set (e.g., the point of sale). *Example(s): "Lack of inventory"*

[8] For additional discussion of the steps of the vehicle purchase decision process (i.e., problem recognition, search, alternative evaluation, purchase, post-purchase), see Taylor and Fujita (2018) and citations therein.
[9] "Design" is in Fujita et al. (2022) but "Design – Technology" is not. We consider the latter category to be complementary to Design but a more accurate description of EVCS and EVOS survey data.

Infrastructure	Infrastructure refers to the availability of charging and other required equipment and services for the maintenance of PEVs. *Example(s): "Number of available charging stations…"*
Policy	Policy refers to both specific policies and programs, and/or broader policy issues. *Example(s): "Carpool/HOV lane access"*

Note that the EVCS and EVOS response options allowed us to create a distinct criteria sub-category for this report of "design-technology," which reflects shopper preferences for innovative features and "high tech" aspects of vehicles. Although this is a well-known characteristic of the EV driver archetype, it represents an advance for us in this report; we were unable to make a similar criteria construction in Fujita et al. (2022).

3. RESULTS

In the introduction to this report, we described how the PEV offerings for sale in the U.S. have changed over the past decade, including through increased diversity of body styles, range per charge, and price improvements. This results section focuses on how the vehicle shopper relates to the changing supply of EVs. It has several subsections. In subsection 3.1, we begin with a reflection on what it means for someone to "own" a PEV over the last decade. We particularly consider trends in consumers having access to multiple vehicles, a situation sometimes described as a "vehicle portfolio." Section 3.2 considers the preferences of all U.S. new vehicle shoppers during the MY2014-23 period, first in terms of body style – in keeping with Figure 1 – and then in terms of purchase criteria based on other vehicle and non-vehicle attributes. Section 3.3 explores the changing landscape of U.S. new vehicle shopper purchase criteria as they relate to PEVs. First, we explore the overall populations of (1) PEV owners; (2) BEV considerers, who are new vehicle shoppers who are "very" or "somewhat" likely to consider a BEV for their next purchase or lease; and (3) BEV rejecters, who are new vehicle shoppers wo are "very" or "somewhat" unlikely to consider a BEV for their next purchase or lease. We then move on to demographic cross-cuts of PEV owners, BEV considerers (i.e., BEV-interested), and BEV rejecters, using MY2023 data. The demographic characteristics which inform these cross-cuts include those of direct relevance to the EV driver archetype – income, degree of urbanicity, gender, age, race/ethnicity, education, and homeownership – as well as housing type, which is particularly relevant to electric vehicle charging equipment. As mentioned above, the approach of this report is to let the data on each demographic speak for itself so the reader can appreciate the evolution of each of the many facets of the EV driver archetype and the existence of any oppositional dichotomies. The Appendix provides general statistics and distributions, including of demographics, for the two sources of MY2023 data we analyze here, namely the EVCS and the EVOS.[10]

3.1 Reflections on vehicle ownership

What does it mean to be a "PEV owner" as compared to a "non-PEV owner?" Vehicle portfolios (e.g., the number of owned vehicles of potentially different brands, body styles, sizes,

[10] As a reminder, in the EVCS, data are weighted to reflect "the demographic profile (gender, age, household income) of the actual U.S. automotive shopper population," while in the EVOS, data are weighted against "each model's sales availability (based on personal-use registrations for the time period as provided by IHS Automotive)."

capabilities, etc.) for more than 50% of U.S. households consist of two or more vehicles, with about 15% including three or more vehicles (J.D. Power, 2023a). As illustrated in Figure 2, there are a variety of household fleet compositions that could lead to an individual being considered a "PEV owner" or a "non-PEV owner," in some cases, both at the same time.

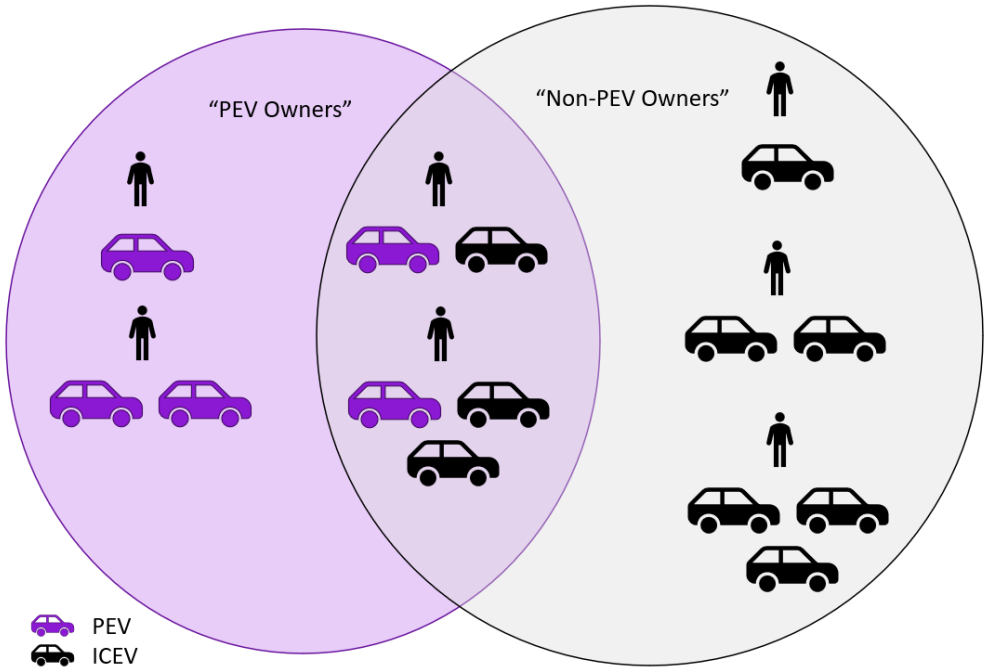


Figure 2: Illustrating that PEV ownership is not necessarily a binary variable

The attributes of a vehicle – including its status as an ICE or PEV – that draw a consumer to a particular model are influenced by the current household vehicle portfolio. Analyzing data from the 2017 National Household Travel Survey, Davis (2023) found that 89% of BEV owners also owned a non-BEV, primarily gasoline-fueled; only 10% of BEV-owning households have a single vehicle. Moreover, 60% of households with a PEV also had a non-electrified SUV, pickup truck, or minivan. This is a long-standing pattern and aligns with Axsen and Kurani's (2013) finding that more than 90% of PEV owners were members of multi-car households.

The alignment, or lack thereof, between purchased PEV models and consumer preferences regarding vehicle attributes plays out on a daily basis after purchase, as members of a household select which vehicle from amongst their household portfolio to drive, based on the specific conditions of the excursion (e.g., commuting, hauling, shopping).

3.2 Prospective purchaser preferences for all types of new vehicle

3.2.1 Vehicle body styles

Figure 3 depicts the purchased vehicles by U.S. automotive shoppers in the 2009-20 NVCS, as broken down by body style, irrespective of fuel type. As the NVCS is nationally representative on the basis of vehicle sales, Figure 3 presents a consistent illustration of consumer vehicle demand by body style. We see a shift from a strong and approximately equal demand for SUVs and sedans in 2009 to a strong preference for SUVs by 2020, representing about 50% of all purchased vehicles. Over this same period, demand for pickup trucks approximately doubled, and demand for hatchbacks, which was slight to begin with, approximately halved.

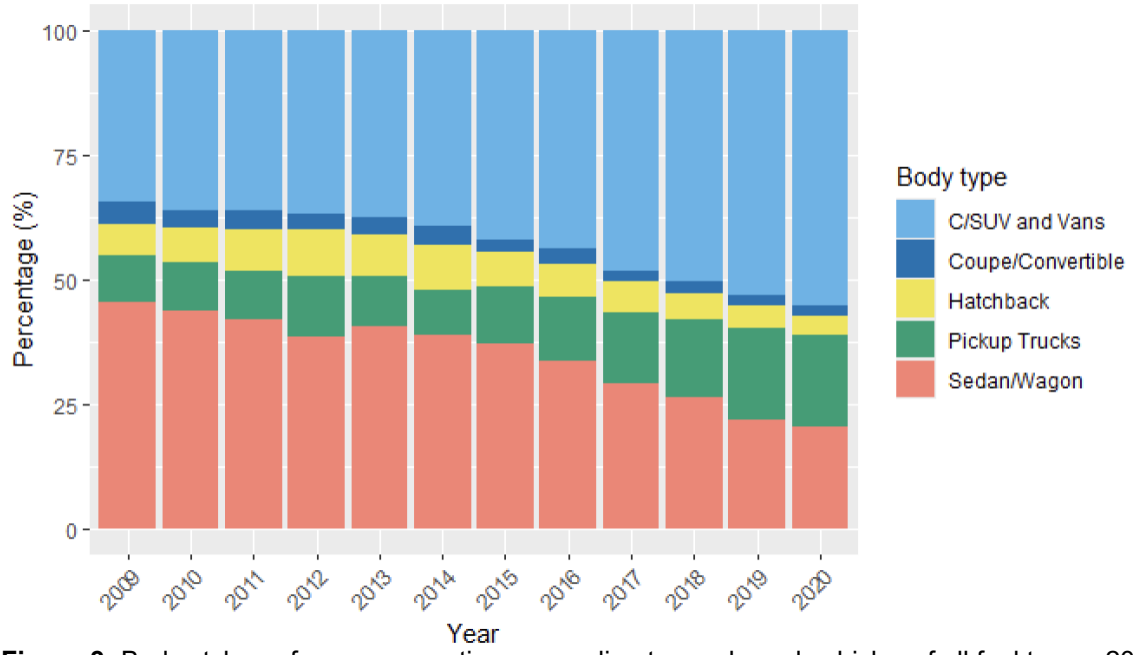


Figure 3: Body style preferences over time, according to purchased vehicles of all fuel types, 2009-2020. **Source:** NVCS

As of 2023, interest in the SUV body style remains high. Amongst those who are very or somewhat likely to consider in purchasing a BEV for their next vehicle purchase or lease, as identified in the EVCS, nearly 60% named a preferred model that falls within the SUV category (Figure 4). Tracking with general demand and recent availability of BEV pickup trucks (Figure 1, above), we see that nearly 14% express interest in potentially purchasing a BEV pickup truck.

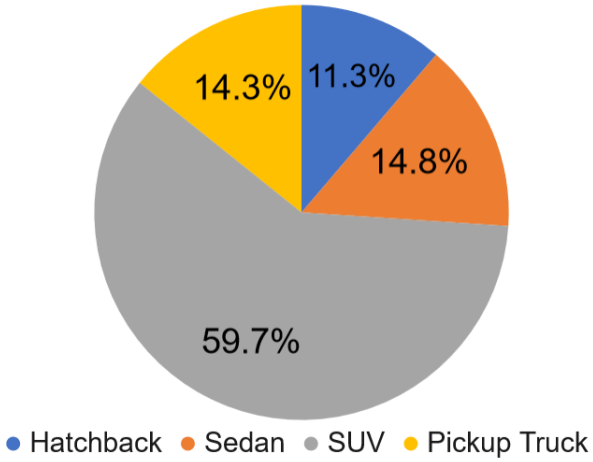


Figure 4: Body style of preferred BEV models in 2023. **Source:** EVCS

Prior research suggests that, for a given vehicle buyer, body style is a largely non-compensatory purchase criterion. Table 3 illustrates this to good effect by drawing from both the MY 2014-16 NVES data analyzed in Fujita et al. (2022) (upper panel) and the NVCS data for MY2020 (lower panel). It presents the body style of the vehicle a consumer purchased along the rows and the body style of the consumer's top alternatively considered vehicle model (i.e., the model that the survey respondent provided as their second choice) along the columns. We find that in the majority of cases, the body style of the purchased vehicle matches that of the top alternatively considered vehicle (e.g., 80% of respondents who purchased SUVs also listed an

SUV as their top alternative). There is a particularly strong inclination for shoppers who buy SUVs and pickup trucks to only consider other SUVs and pickup trucks. The only body style in which the buyer of a vehicle did not alternatively consider a vehicle of the same body style at a rate of >50% is hatchback vehicles. In the MY2020 NVCS data, the most commonly considered alternatives to hatchback models were sedans or SUVs, and hatchbacks were rare among alternatively considered models across all purchased body styles.

Table 3: Comparison of body styles between purchased and alternatively considered vehicles

Analysis of NVES data (2014-2016)							
	Body style of top alternatively considered vehicle model (%)						
		2-door car	4-door car	Convertible	Minivan	SUV	Pickup Truck
Body style of purchased vehicle	2-door car	**56.3**	30.7	4.2	0.1	6.2	2.5
	4-door car	7.2	**78.7**	0.6	0.4	11.5	1.6
	Convertible	16.5	11.0	**67.1**	0.1	4.9	0.5
	Minivan	0.4	5.0	0.1	**67.8**	25.0	1.7
	SUV	1.3	14.4	0.2	1.1	**80.1**	2.9
	Pickup Truck	1.0	2.5	0.2	0.1	5.3	**90.1**

Analysis of NVCS data (2020)						
	Body style of top alternatively considered vehicle model (%)					
		Hatchback	Coupe / Convertible	Sedan/Wagon	C/SUV & Van	Pickup Truck
Body style of purchased vehicle	Hatchback	29.2	4.0	**31.5**	**32.6**	2.7
	Coupe / Convertible	2.7	**60.0**	21.8	10.4	5.1
	Sedan/Wagon	5.7	4.3	**60.6**	25.3	4.2
	C/SUV & Van	1.8	0.6	7.1	**85.8**	4.7
	Pickup Truck	0.1	0.3	0.9	6.1	**92.6**

These data on body style preferences of all new vehicle shoppers in the large NVES and NVCS datasets have important implications for PEV adoption since 2014. As discussed in the Introduction and illustrated in Figure 1, in MY 2016 and before, the majority of BEV offerings of any type were “hatchback” forms of sedans/wagons, while BEV vans and pickup trucks did not exist. By MY2023: (1) SUVs were the main BEV body style offered for sale in the U.S.; (2) the number of sedan/wagon offerings had declined to their lowest level since 2017, with a diminished percentage of hatchbacks; and (3) there were a limited number of BEV pickup trucks on the market. Thus, the PEV offerings for sale today have become better positioned to appeal to a large segment of the population than they were when early PEVs were dominated by hatchback models.

Note that consumer preferences for vehicle attributes can vary across locations, based on terrain, common driving conditions, primary occupations, population density, culture, and a variety of other factors. For example, preferences for vehicle body styles differ by urbanicity, with ownership of sedans and hatchbacks more common in urban, rather than non-urban, areas (Figure 5). Conversely, non-urban areas have substantially higher rates of ownership for pickup trucks, nearly double that observed in urban areas. Pre-existing preferences for body styles and other attributes (e.g., all-wheel drive, towing capacity, etc.) are likely to influence PEV acceptance across urbanicity levels. For additional explorations of the body style preferences of urban, suburban, and rural prospective purchasers of PEVs, see Section 3.3.3 below.

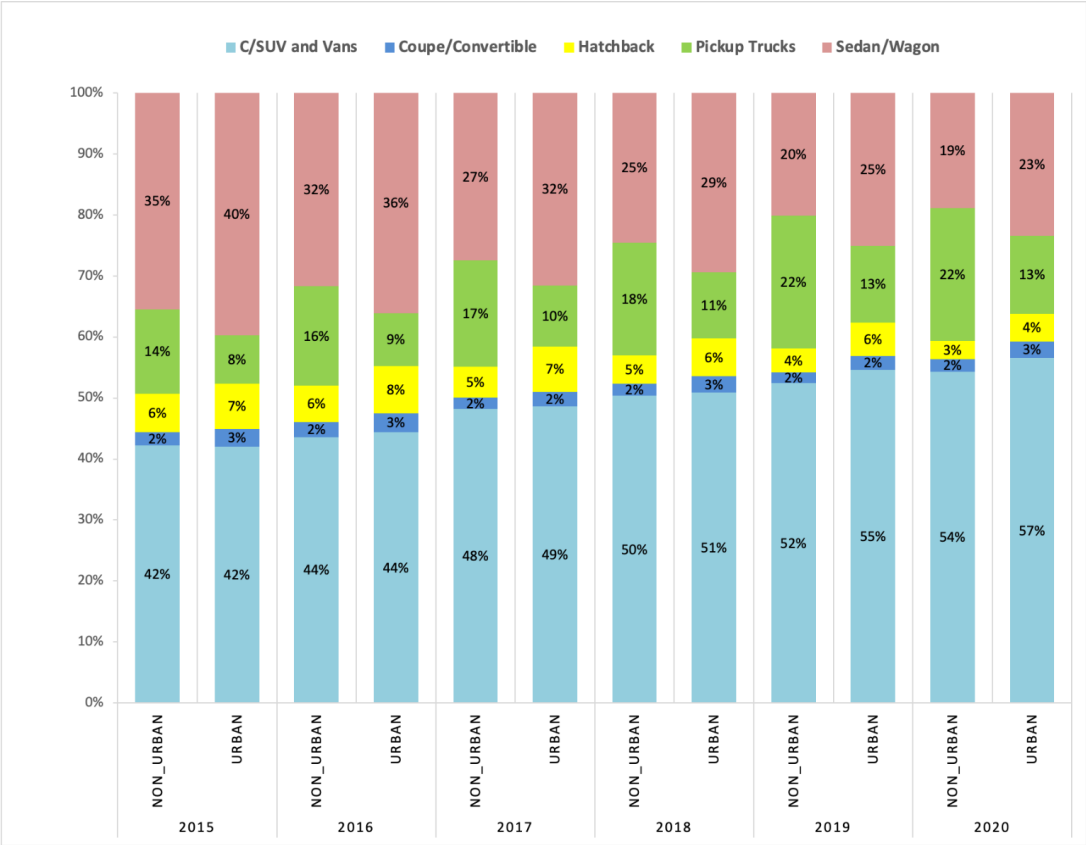


Figure 5: Body style of purchased vehicle by urban, non-urban. **Source:** NVCS

3.2.2 Other shopping and rejection criteria

There are many purchase criteria other than vehicle body style which consumers wrestle with in compensatory and non-compensatory ways. In this section we examine the relative importance and commonality of many of these purchase criteria and preferences over time for buyers of vehicles in general, not restricted to PEVs. We begin by looking at relative criteria weights which we developed in Fujita et al. (2022) on NVES MY2014-16 data, then turn to MY2023 EVCS data on the commonality of shopping reasons for new vehicles of any type, as coded to align with Fujita et al. (2022) in the process described above in Section 2.3. We discuss results across the full sample, as well as grouped by income, gender, and urbanicity.

Previous work (NVES 2014-2016)

For the buyers of all U.S. passenger vehicles, we found in Fujita et al. (2022) that safety, value, performance and durability were the top ranked criteria (in order of greatest to least importance), with all of them exceeding the 0.1 reference point which would be the expected value if consumers weighted all criteria equally (Figure 6). By contrast, the environment, vehicle design, power, and image were the least important criteria (in order of least to most importance), with all of these criteria falling below the 0.1 reference point. Fuel economy – which is tied to the value of a vehicle in terms of the overall cost of ownership – and comfort are criteria that achieve weightings at about the 0.1 reference point.

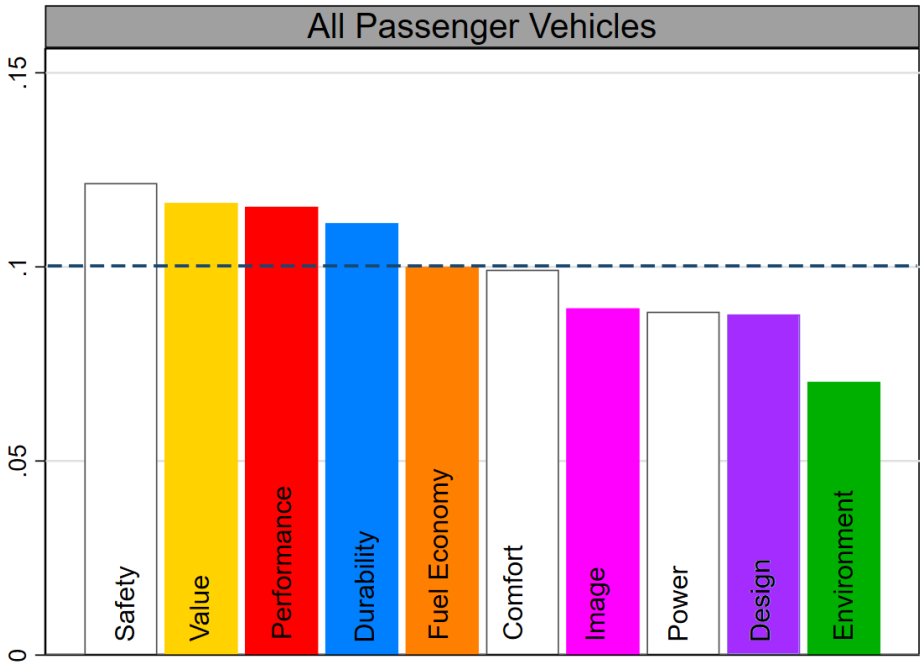


Figure 6: Overall general vehicle purchase criteria weights. **Source:** Fujita et al. 2022, NVES

Note that the distribution in Figure 6 serves as a touchstone throughout our discussion of data on vehicle purchase, consideration, and rejection criteria, allowing us to better understand any changes over time or differences between subgroups. As mentioned above, there is no ready concordance between the NVES criteria categories of safety, comfort, or power, which we constructed for Fujita et al. (2022), and the MY2023 data we draw from (EVCS and EVOS) to understand consumer criteria today. For this reason, in Figure 6 and other figures based on the MY2014-16 NVES data, we use the neutral color of white to portray these criteria, as we did above in Table 1 and Table 2. We also use the Table 1 and Table 2 color scheme more broadly throughout our exploration of vehicle purchase, consideration, and rejection criteria, with non-grey colors to represent the vehicle attributes that align between NVES and EVCS/EVOS, namely: value (gold), performance (red), durability (blue), fuel economy (orange), image (pink), design (purple), and environment (green). Note that Table 2 highlights two additional criteria which are present in MY2023 data but not in the earlier NVES data. These criteria are therefore highlighted in upcoming figures in this section with the following distinctive colors: the new technology aspect of design ("design-technology," salmon); and non-vehicle attributes (shades of grey).

Figure 7, which is based on MY2014-16 data in Fujita et al. (2022), considers how consumers at different income levels weigh the criteria from Figure 6. Here we find that low-to-moderate income consumers (<$35k and $35-75k) weigh fuel economy and environmental criteria more highly than consumers with incomes above $150k. In fact, low-to-moderate income consumers (<$35k and $35-75k) weigh fuel economy above the 0.1 reference point, while upper income consumers (above $150k) weigh it below the 0.1 reference point. We note that fuel economy and environment align well with PEV attributes.

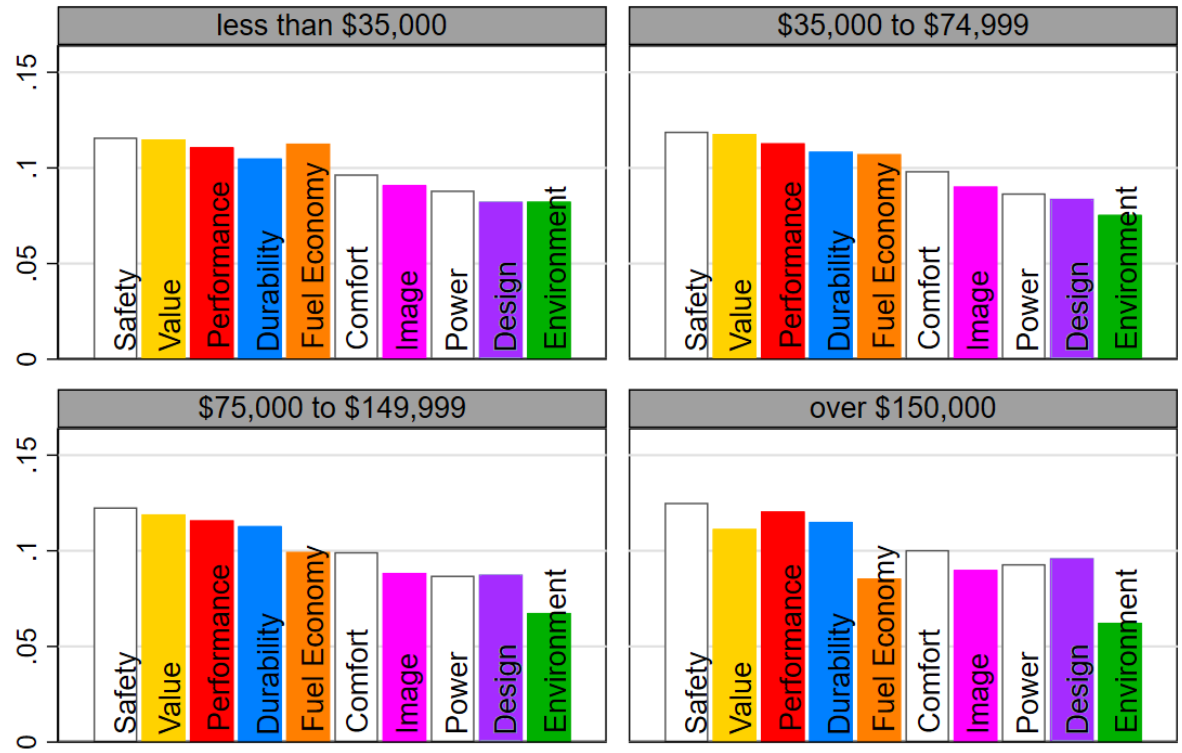


Figure 7: Overall general vehicle purchase criteria weights across income groups. **Source:** Fujita et al. 2022, NVES

Figure 8, which is based on MY2014-16 data in Fujita et al. (2022), considers how consumers of different genders weigh the criteria from Figure 6. Here we see only slight differences in the criteria weightings of female and male NVES respondents. Both groups placed the highest importance on safety, with value and performance coming next. Of note, females placed a higher importance on fuel economy than males, ranking it of fifth-highest importance rather than sixth. Also, while environment ranked last for both groups, women ascribed a somewhat higher weight to it than men.

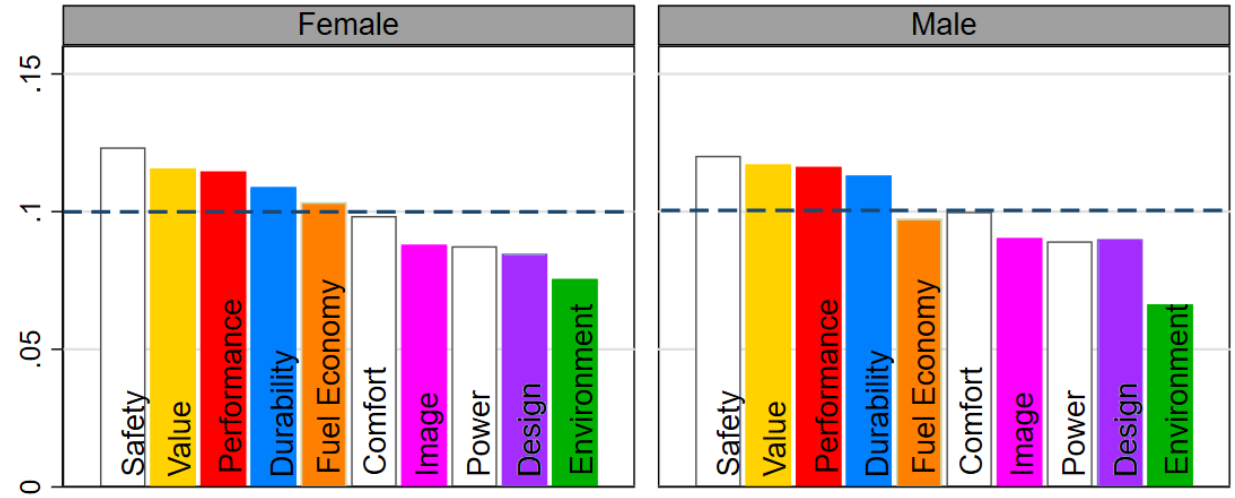


Figure 8: Overall general vehicle purchase criteria weights by gender. Source: Fujita et al. 2022, NVES

Today's prospective purchasers: Overall population (EVCS 2023)

We next turn to the EVCS to investigate the reasons why contemporary prospective vehicle purchasers shop for new vehicles, across all types of vehicles (i.e., not limited to any specific fuel type or body style). In Figure 9, as well as in later figures which draw on the EVCS and EVOS, we present responses using the color scheme in Table 2 but in the order of Figure 6, as this visual approach assists in comparisons. Note that there is no option provided to EVCS respondents in response to the question of why they are shopping for a new vehicle that could be reasonably coded as an environmental reason. We do not "white-out" environment from Figure 6, Figure 7, or Figure 8 to reflect this, however, as environmental response categories do appear in other parts of the EVCS, i.e., as reasons why a BEV-interested shopper might purchase a specific model of BEV and why a BEV rejecter might not be interested in purchasing a BEV.

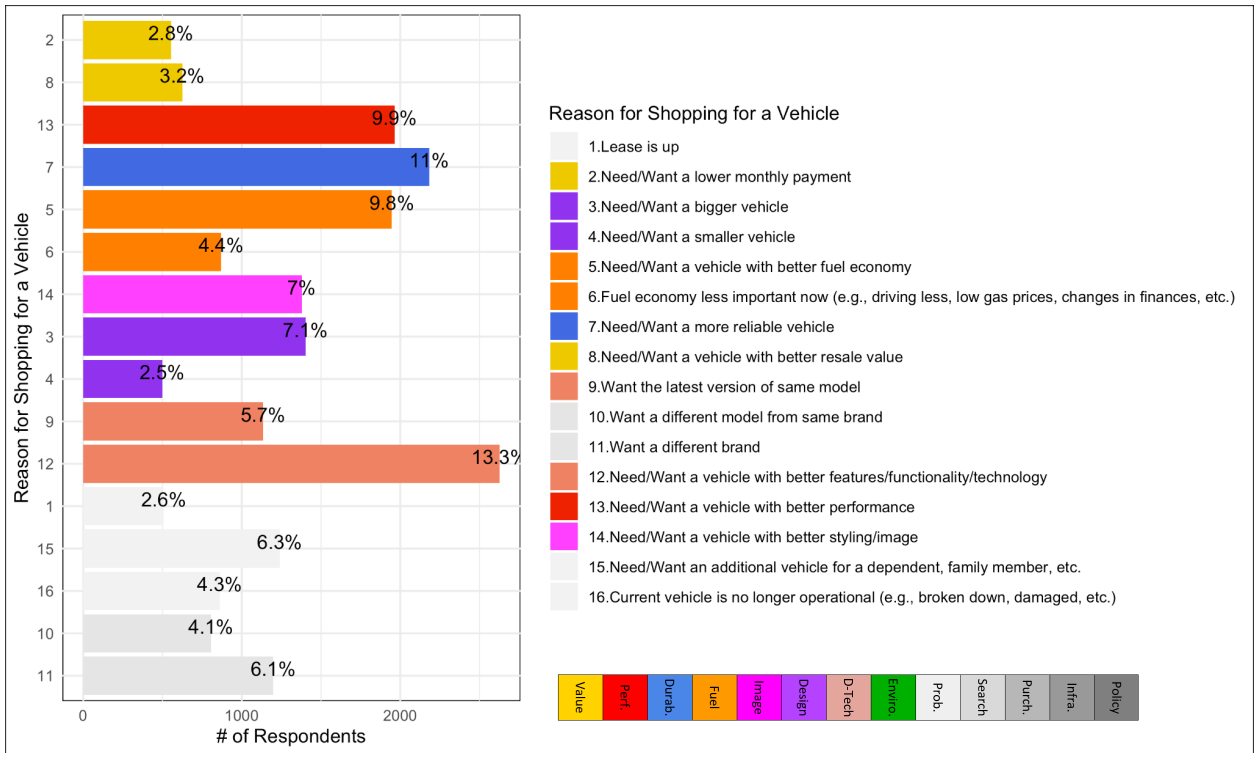


Figure 9: Commonality of general vehicle purchase reasons across all shoppers. **Source:** EVCS

We note that "better features/functionality/technology" – what we label "design-technology" – is the most commonly listed response for why prospective new vehicle purchasers are shopping for a vehicle. Unfortunately, we do not know from the EVCS response write-up what the purpose of "better features/functionality/technology" might be to a given consumer; the list could include new technology to promote safety, better communications, or many other things that are subject to the interpretation of the respondent.

The next highest proportion of shoppers for new vehicles, regardless of fuel type, commonly list durability and performance as reasons to shop for a new vehicle. We note that these two categories overlap with two of the high criteria weight categories in Figure 6. We also see moderate commonality for shopping reasons relating to fuel economy. Note that "value" is a relatively uncommon category for respondents to cite as a reason to shop for a new vehicle, unlike the decision to purchase a specific vehicle, which we showed in Fujita et al. (2022) to have a very high criteria weight.

Today's prospective purchasers: Income (EVCS 2023)

When we examine the commonality across income groups of the reasons consumers give for why they are shopping for a new vehicle in 2023, we find a substantial degree of similarity, even between shoppers in the highest and lowest income groups (Figure 10). As in Figure 9, which does not distinguish by income, Figure 10 shows that people of all incomes commonly report vehicle attributes of design-technology, performance, and durability as reasons to shop for a new vehicle. However, we do see a difference in emphasis on each of these attributes when moving from lower to higher income groups. Durability is a more commonly cited reason for vehicle purchase for low-income respondents, while performance is more common for higher income groups.

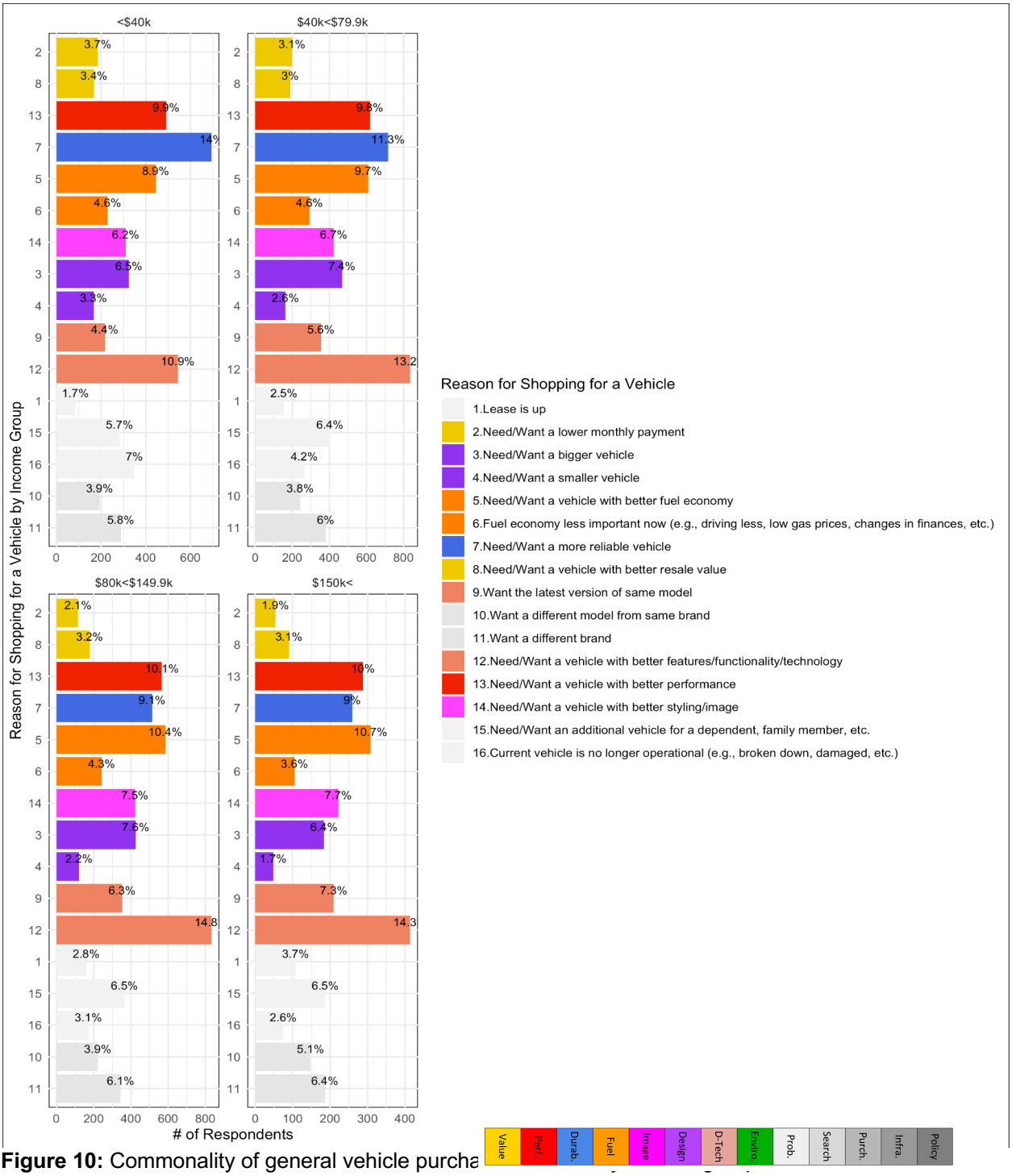


Figure 10: Commonality of general vehicle purcha

Today's prospective purchasers: Gender (EVCS 2023)

Comparing the reasons men and women state for shopping for a new vehicle, we again find broad commonality in citing design-technology, durability, performance, and better fuel economy most frequently (Figure 11). Men more commonly mention design-technology than women, however, as well as vehicle performance, better fuel economy, and image, while women more commonly mention general design aspects (e.g., a larger vehicle) and durability.

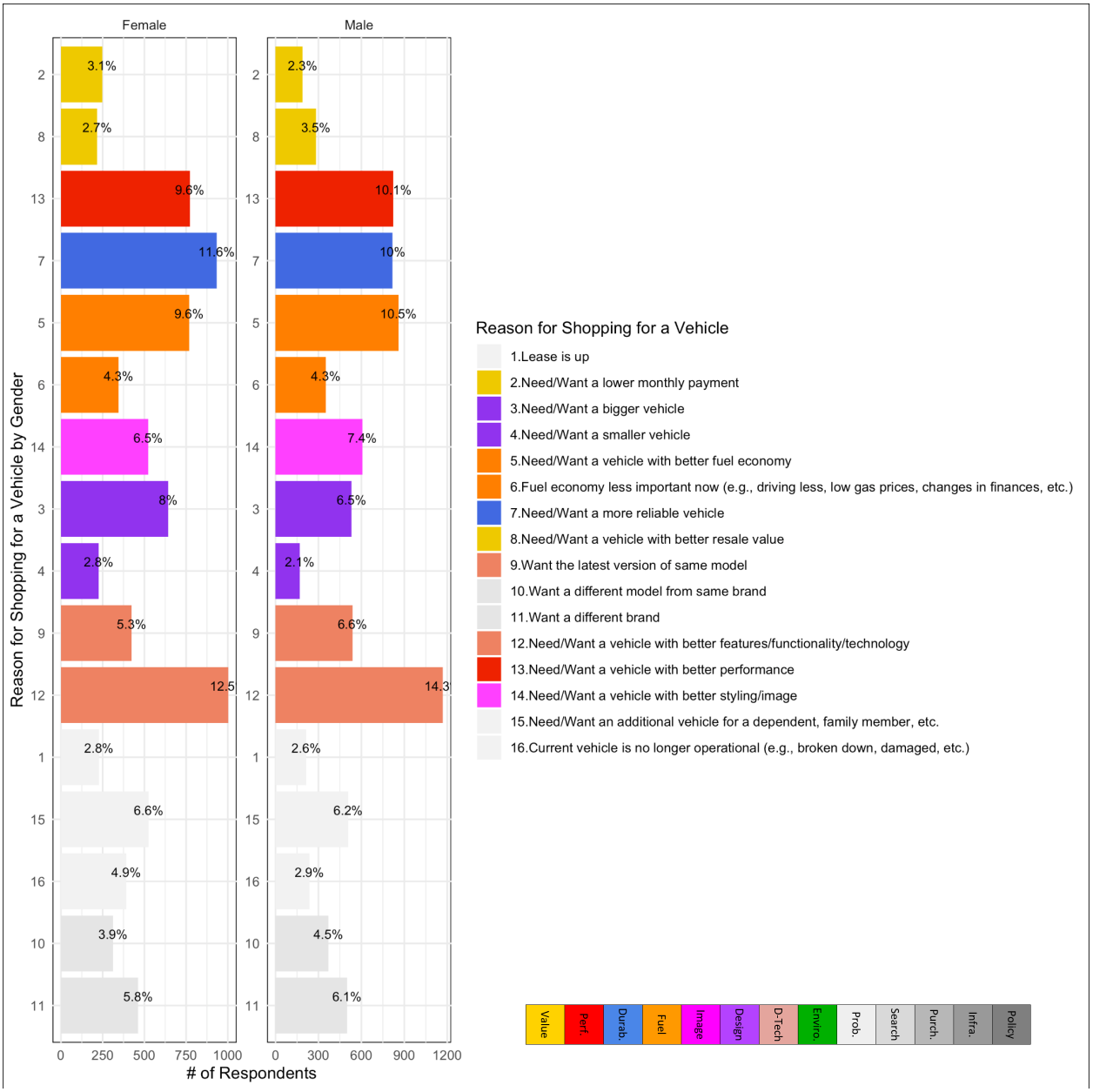


Figure 11: Commonality of general vehicle purchase reasons, by gender. **Source:** EVCS

Today's prospective purchasers: Urbanicity (EVCS 2023)

Figure 12 disaggregates the reasons for shopping for a new vehicle in the EVCS according to prospective purchasers who live in urban, suburban, and rural areas. As in the previous figures, the top reasons are design-technology, performance, durability, and fuel economy, but the relative strength of these criteria varies by urbanicity level. Suburban respondents are most likely to list design-technology as a reason to shop, while rural respondents are the least likely (design-technology is still the highest rated reason to shop for rural residents, although it ties durability for prevalence). Durability is most commonly cited by rural respondents (tied with design-technology), less so for suburban respondents (for whom it is second to design-technology), and least for urban respondents (for whom it is third, to design-technology and performance). Although less prevalent than these four criteria, two other reasons to shop for a new vehicle exhibit an interesting variation by urbanicity: an interest in better styling and an

interest in a larger vehicle design. Better styling is most commonly cited by urban, then suburban, then rural respondents, while larger vehicle size is most commonly cited by rural, then suburban, then urban respondents.

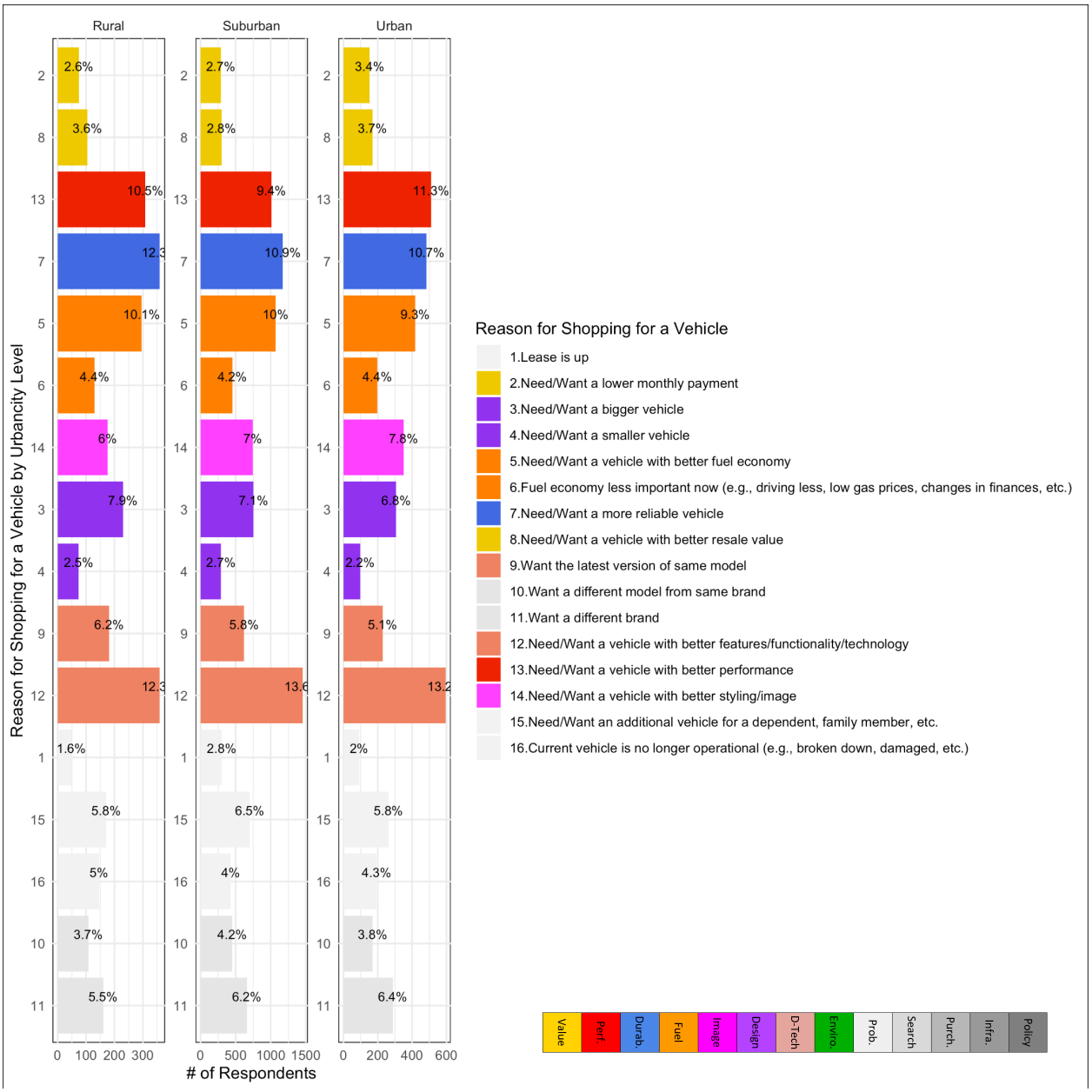


Figure 12: Commonality of general vehicle purchase reasons, by urban, suburban, and rural prospective purchasers. **Source:** EVCS

Today's prospective purchasers: Housing type (EVCS 2023)

Figure 13 compares the commonality of reasons consumers shop for new vehicles between respondents who live in single family homes and respondents who live in apartments, duplexes, or condominiums. The commonality of these criteria patterns do not cleanly align with the patterns in Figure 10, which clusters responses by the consumer's income, as might be expected due to a tendency for higher income individuals to be more likely to reside in single family homes. Design-technology and durability are the most and second-most common

reasons, respectively, for both residents of single family homes and apartments, duplexes, and condominiums to shop for a new vehicle. The third most commonly-cited reason for residents of single family homes to shop for a new vehicle is fuel economy, followed by performance (4th). By contrast, the third most commonly-cited reason for residents of apartments, duplexes, and condominiums to shop for a new vehicle is performance, followed by fuel economy. Note that residents of single family homes cite design-technology exactly as commonly as suburban residents.

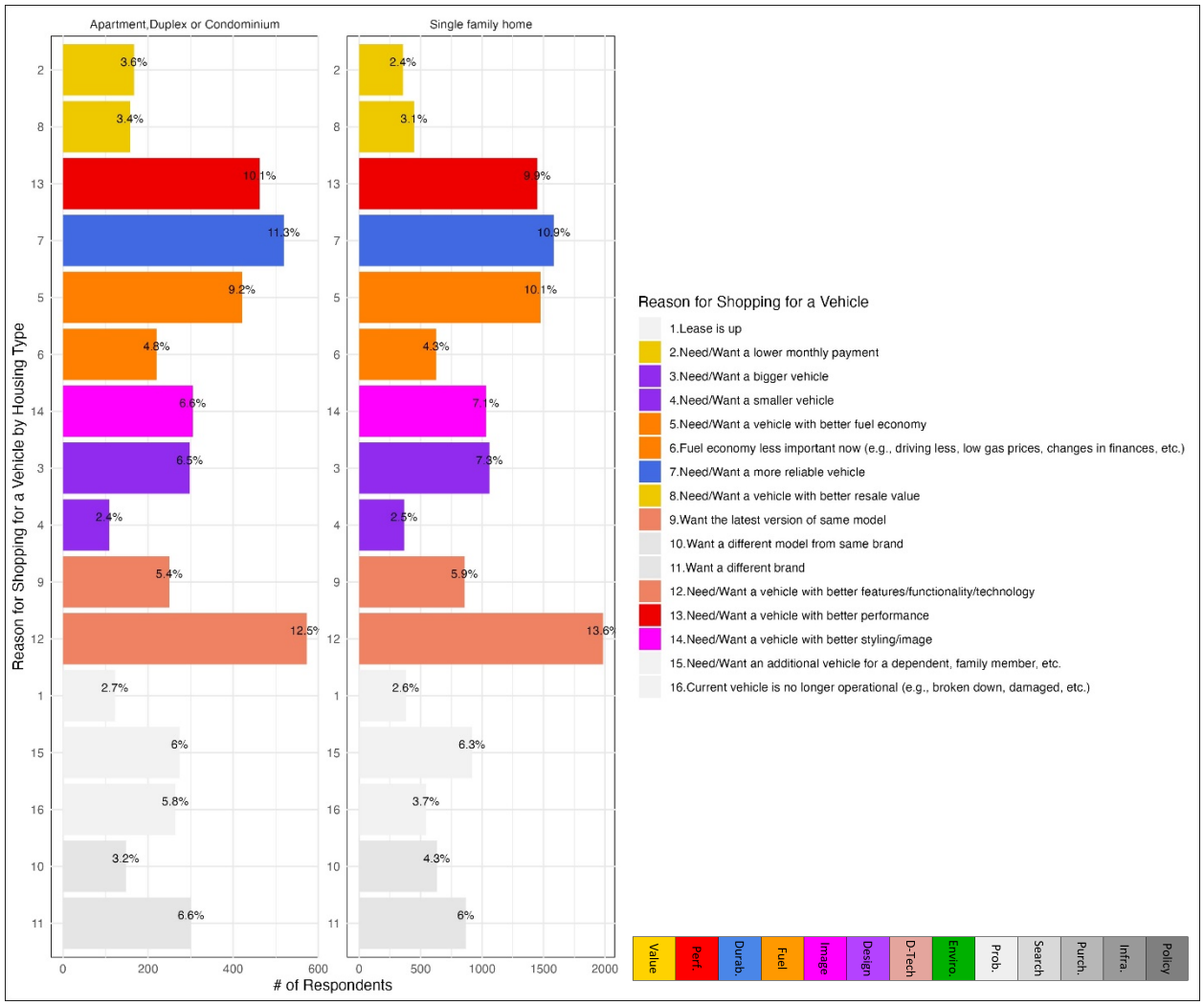


Figure 13: Commonality of general vehicle purchase reasons, by housing type. **Source:** EVCS

3.3 Prospective purchaser preferences for PEVs

3.3.1 Overall population

PEV buyers in the past

Figure 14 presents the vehicle shopping criteria weightings of NVES MY2014-16 respondents who purchased BEVs and those who purchased one of a category of vehicle we have not yet introduced to the body of this report, “hybrid electric vehicles” (HEVs). As used in Fujita et al. (2022), HEVs include both PHEVs and the more conventional hybrid vehicles which lack external charging capability (e.g., the original Toyota Prius). Compared to the general vehicle

shopping criteria weightings of NVES respondents, as portrayed in Figure 6, the shopping criteria weightings of NVES respondents who purchased BEVs and HEVs differed both from buyers of other fuel types and from each other in notable ways. Both BEV and HEV buyers placed the highest weight on fuel economy (higher for HEV buyers than BEV buyers) and a moderate value on the environment; both groups rate these two criteria at or above the 0.1 reference point, unlike all vehicle buyers. Safety is a strong criterion for all vehicle buyers, as well as for BEV and HEV buyers. HEV buyers rank value and durability relatively higher than BEV buyers, but both rank it above the reference point for equal weightings across criteria. BEV buyers rank performance higher than HEV buyers, but both rank it above the reference point.

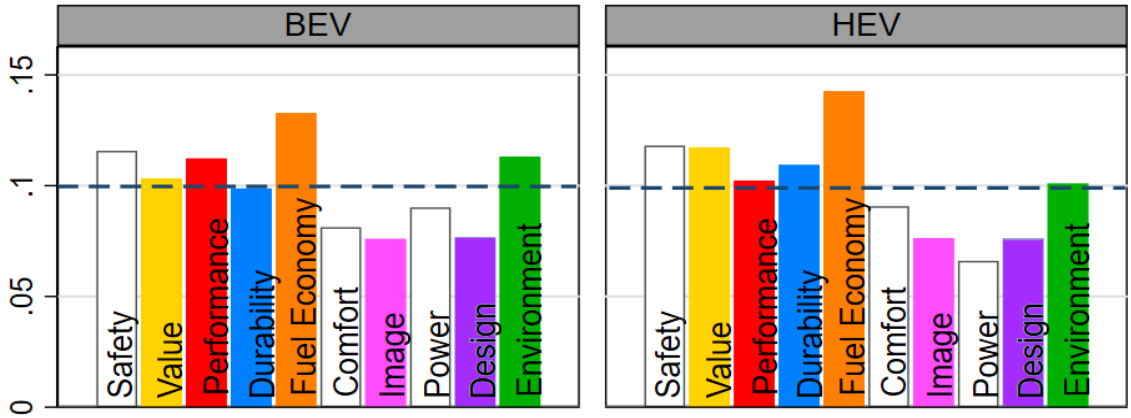


Figure 14: Vehicle purchase criteria weights, BEV and HEV (hybrid & PHEV) buyers. **Source:** NVES, Fujita et al. 2022

BEV-interested shoppers in the present (EVCS 2023)

Here we evaluate the reasons a prospective vehicle buyer today gives in the EVCS for shopping for a new vehicle, predicated on being “very” or “somewhat” likely to consider a BEV purchase or lease for the next vehicle purchase. In Figure 15, we see that design-technology is most commonly given by BEV considerers as a reason to shop for a new vehicle, just as it was for all vehicle buyers. Note that for BEV-interested vehicle shoppers, better fuel economy is more commonly cited as a reason to shop for a new vehicle than performance or durability. This represents a departure from the reasoning of the full sample of U.S. automotive shoppers (see Figure 9). Performance and image are more commonly cited by BEV interested shoppers today than the general shopping population, while an interest in a larger vehicle is less commonly cited by the BEV interested.

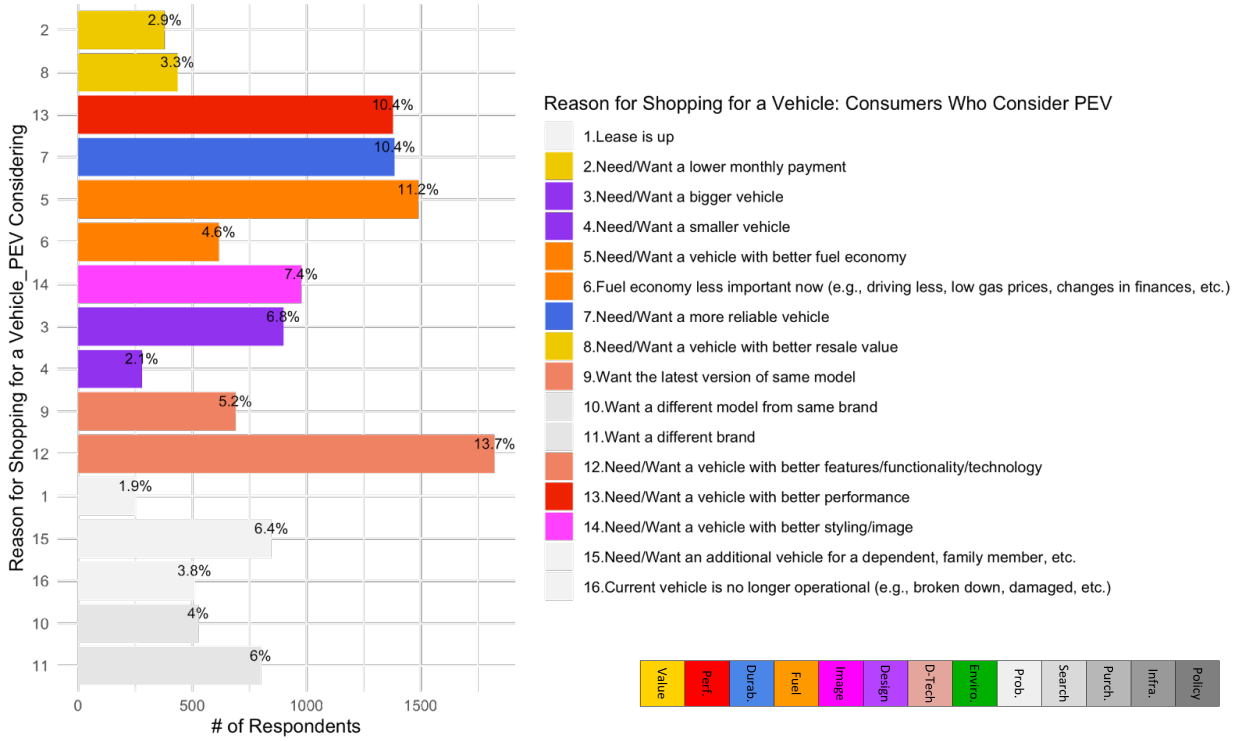


Figure 15: Commonality of general vehicle shopping reasons across BEV-interested shoppers. **Source:** EVCS

PEV buyers in the present (EVOS 2023)

Figure 16 depicts the reasons that BEV and PHEV buyers stated in the MY 2023 EVOS for selecting their specific model of PEV, as coded in alignment with MY 2014-16 NVES and MY 2023 EVCS criteria categorizations, to the extent possible. Unfortunately, the list of potential purchase reasons included in the EVOS does not include fuel economy; the closest analogous category is “running costs.” Environment does occur as a purchase reason for an EV in the EVOS, unlike in the EVCS, where it does not appear as a general shopping reason for new vehicles.

In the MY2014-16 NVES data, we found that those who purchased PEVs strongly weighted the criterion of fuel economy. In the MY2023 EVOS data, we find that buyers of BEVs are more likely than PHEV buyers to list running costs as a purchase reason. This resonates with the fact that U.S. charging rates tend to be significantly less expensive than gasoline prices for the same overall driving range, and BEVs are solely fueled by charging while PHEVs only have low levels of electric driving range (see Figure 1).

Other observations about the reasons consumers of all types listed for purchasing a specific PEV include: (1) design-technology is much less common, relatively speaking, for a PEV owner to list in the context of the purchase of a specific vehicle model than it was as a general reason to shop for a new vehicle; (2) performance and durability are about as commonly listed reasons to purchase a specific PEV as they were for reasons to shop for a new vehicle; (3) model design and styling is the most commonly cited reason for purchase, where it was much less common as a reason to shop for a new vehicle; (4) value is much more commonly given as a reason to purchase a specific PEV than to shop for a new vehicle, in general; and (5) BEV buyers are

somewhat more likely than PHEV buyers to list environmental friendliness as a reason for purchase. This last finding mirrors Figure 14 with respect to BEV and HEV buyers.

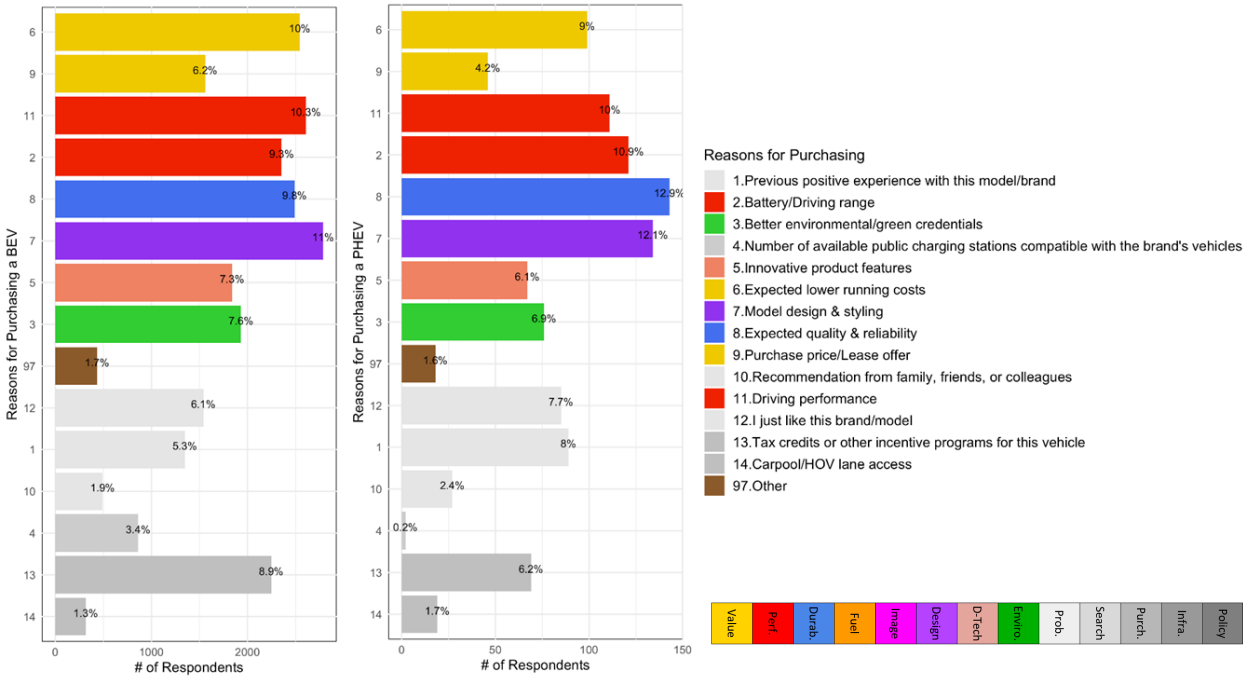


Figure 16: Commonality of vehicle purchase reasons, PEV buyers. **Source:** EVOS

BEV rejection in the present (EVCS)

As mentioned above in 2.3.2, in this report we refer to respondents who are “very” or “somewhat” unlikely to consider a BEV for their next vehicle purchase or lease as “BEV rejecters.” In this section, we review the factors which BEV rejecters list as contributing to their low consideration of BEVs to see which are more and less commonly listed. As we do elsewhere, we attempt to code the response options in alignment with the color schemes established in Table 1 and Table 2 and in the order presented in Figure 6, which lists purchase criteria weightings of all vehicle buyers in MY2014-16 NVES against a backdrop of a 0.1 reference point that would be expected if all 10 criteria in Figure 6 were weighted equally.

Figure 17 highlights that the non-vehicle attributes defined in Table 2 – the grey-shaded purchase process steps of problem definition, search, and purchase; infrastructure; and policy – are strongly represented in the response options provided to BEV rejecters. The most frequently cited factor for BEV rejecters to not consider purchasing or leasing a BEV is one of these non-vehicle attributes, namely the consumer’s perception of a lack of charging station availability.

With respect to vehicle attributes, Figure 17 shows that BEV rejecters are very unlikely to cite technology limitations (design-technology) as a reason not to consider VEVs. This is noteworthy given that a desire for better technological features is the most commonly cited reason why prospective car buyers shop for a new vehicle. By contrast, purchase price (value) is the most commonly cited vehicle attribute given for not considering a BEV purchase, with limited driving distance per charge (performance) the next most commonly cited vehicle attribute.

Figure 17: Commonality of BEV non-consideration reasons. **Source:** EVCS

3.3.2 High versus low-income households

In this section, we focus on the demographic characteristic of income as it relates to PEV consideration, purchase, and rejection. We begin with a short reflection on PEV prices, which are the vehicle attribute most directly tied to a prospective buyer's income characteristic. Price

premiums for PEVs, when compared to comparable ICEVs are an oft-cited barrier to PEV purchase by low-income households.

Mass market BEV price trends

Using data collected from (Kelley Blue Book, 2024), a common source of vehicle pricing and rating information, we evaluated trends in the manufacturer's suggested retail prices (MSRPs) of several mass-market BEV models that have been available for much of the MY2016-23 period, namely: the Nissan Leaf, the Hyundai Kona Electric, and the Kia Niro. While it is offered at a substantially higher price point, we also include the Tesla 3 in our trend assessment of "indicator" vehicles, as this is one of the top-selling, moderately-priced BEV models.

Figure 18 presents the results. Note that since most vehicle models are offered in several trim levels which incorporate distinctive feature sets, we track both the minimum and maximum price of indicator BEV models over time. To evaluate the original MSRP in terms of today's dollars, we use the *urban all items consumer price index* (U.S. Bureau of Labor Statistics, 2024). In Figure 18, we see that all of the indicator BEV models have experienced a drop in their purchase price between 2016 and today, in some cases on the order of $10,000 or more.

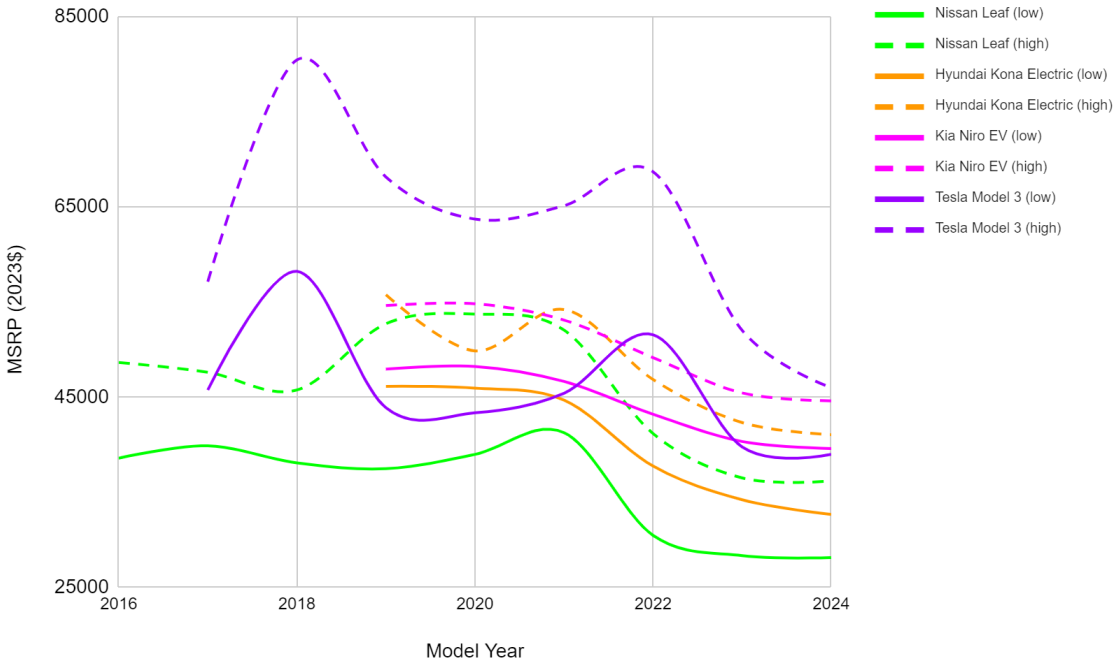


Figure 18: Price of new mass market BEVs over time (MSRP in 2023$). **Source:** kbb.com

It is also pertinent to recall that many people, particularly in lower-income groups, buy their vehicles from the used car market, rather than the new car market. While there have been perturbations in the used car market in general (e.g., increase in demand during and following the height of the Covid 19 pandemic), examination of Kelley Blue Book's "KBB Fair Purchase Price" for these same four BEV models reveals that as of today, there are many model year 2016-2022 EVs likely to be priced on the order of $20,000 or less. See Figure 19 (Kelley Blue Book, 2024).

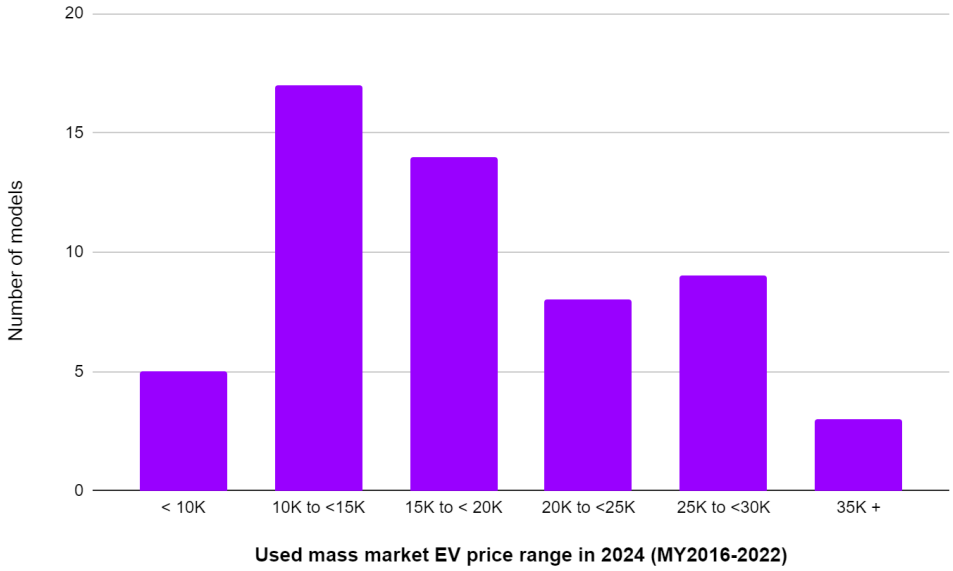


Figure 19: Price range of used mass market BEVs. **Source:** kbb.com

PEV acceptance over time

High income households, particularly those with annual incomes over $100k, dominated the early demand for PEVs; households earning less than $70k per year accounted for less than 5% of early EV adoption (Axsen & Kurani, 2013). Similarly, Singer (2017) found that those with household incomes over $100k were approximately 10 percentage points more likely to state that they expected to consider buying a PEV for their next vehicle, as compared to those with income below $50k.

Analysis of MY2016-20 NVCS data broadly agrees with these earlier findings, but also demonstrates an important trend. In Figure 20, we observe an increase in the shares of PEVs purchased between 2016 and 2020 by buyers from all income groups (note that the y-axis is truncated in Figure 20 and Figure 21 to focus on non-gasoline fueled vehicle trends). While overall purchase levels are lowest for income groups under $30k, this trend becomes more noticeable for income groups starting at $50-55k per year and strongest for those above $150k annual household income (Figure 20, Figure 21). It is interesting to note that Figure 21 shows that it is worth filtering out PEVs according to BEVs and PHEVs, since they exhibit very different trends. BEV adoption is what primarily accounts for the increased adoption of PEVs in Figure 20, while PHEV adoption stayed relatively flat over the MY2016-20 period.

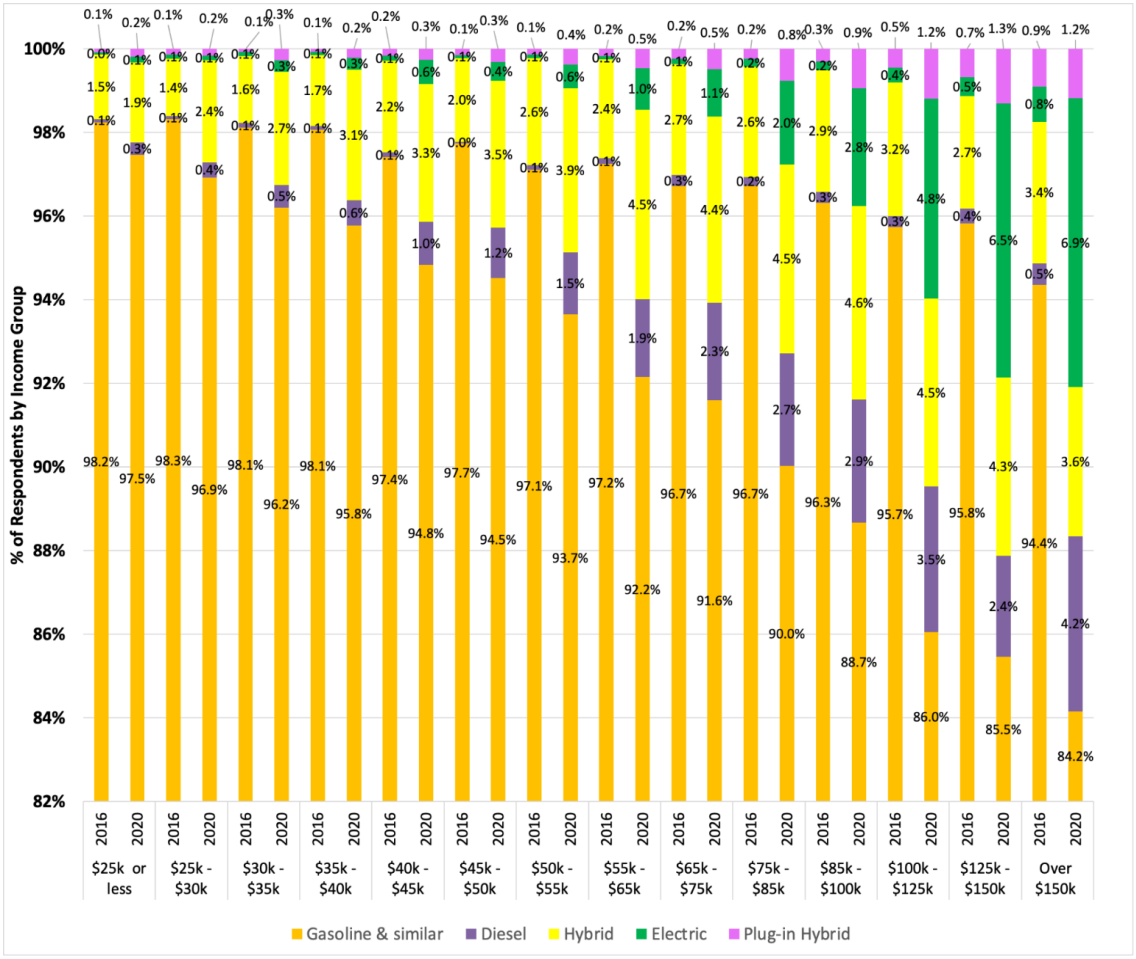


Figure 20: Fuel type of purchased vehicle by income group. **Source:** NVCS

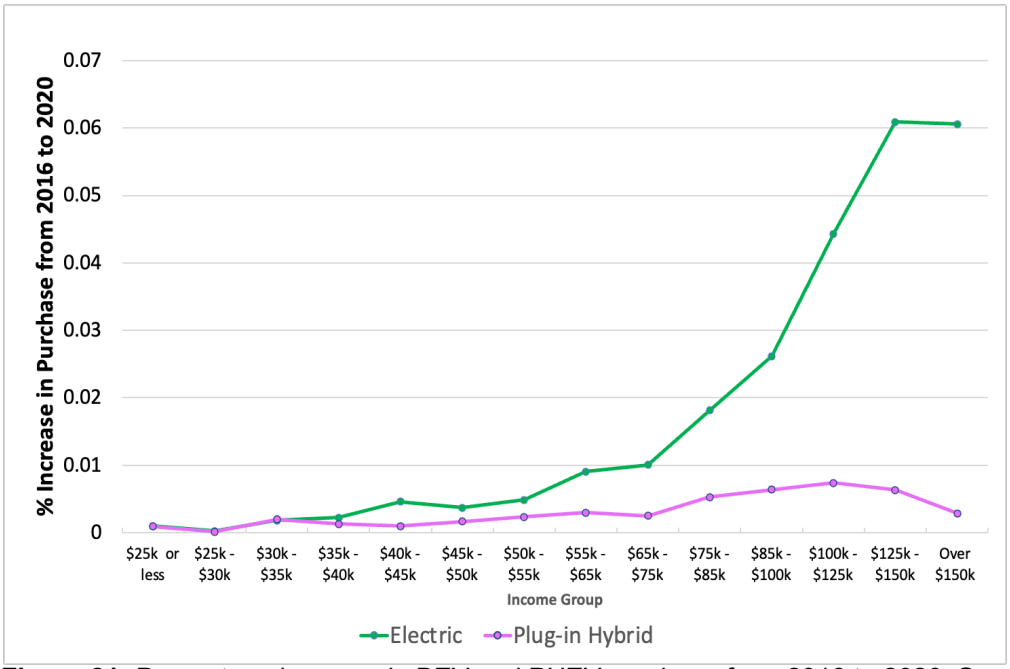


Figure 21: Percentage increase in BEV and PHEV purchase from 2016 to 2020. **Source:** NVCS

To gain insight into the potential future of PEV acceptance, we are interested in trends in consumer approval of PEVs, rather than simply past adoption trends. Singer (2017) found that while lower income people were less likely to have near term plans to purchase a BEV, lower income people were substantially more likely than those with household incomes above $50k to state that they believed BEVs were at least as good as ICE vehicles. EVCS data from 2023 on those vehicle shoppers who are “very likely” or “somewhat likely” to consider a BEV for a future vehicle purchase show something similar. Although there appears to be a general correlation between income level and BEV purchase consideration, it nevertheless holds that more than 50% of respondents in *all* income ranges are interested in BEVs for their next purchase. Once income levels reach $50,000 per year, BEV consideration likelihood generally exceeds 60% (Figure 22).

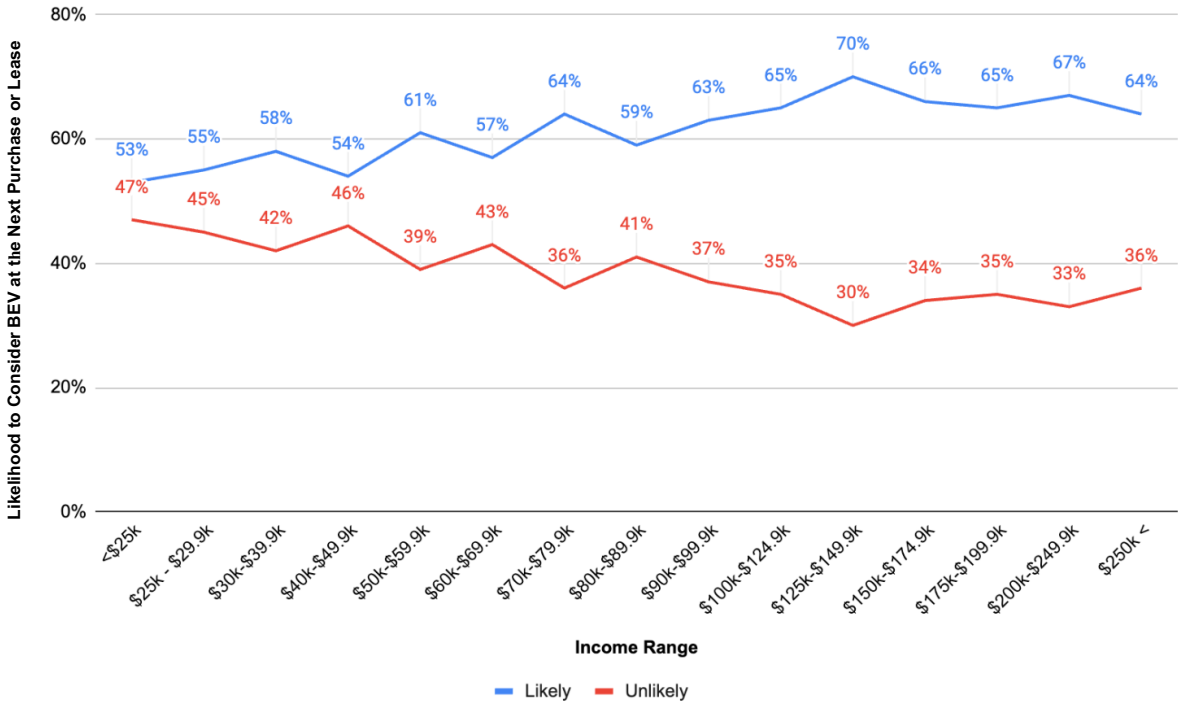


Figure 22: Likelihood of BEV consideration at next purchase across income groups, in 2023. **Source:** EVCS

PEV purchase and BEV rejection reasons today

Figure 23 groups EVOS respondents in segments that are as closely aligned as possible to those used in Fujita et al. (2022). One thing this immediately shows is the smaller number of EVOS respondents in the lowest and second-lowest income groups, as opposed to the two higher-income segments (see Appendix A for the full distributions on this and other variables covered in this report). In Figure 23, we find several differences of note between income groups with respect to the reasons a consumer provides for why they purchased the PEV they bought. While all groups commonly cite value – “lower running costs” in particular – as a reason the consumer purchased their chosen PEV, it is most commonly cited by those in the lowest income group, and falls in commonality of citing as income increases. This aligns with the high criteria weights given to value and fuel economy in the MY2014-16 NVES analysis conducted for Fujita et al. (2022) for the overall population of new car buyers, as well as for lower-income respondents (see Figure 7).

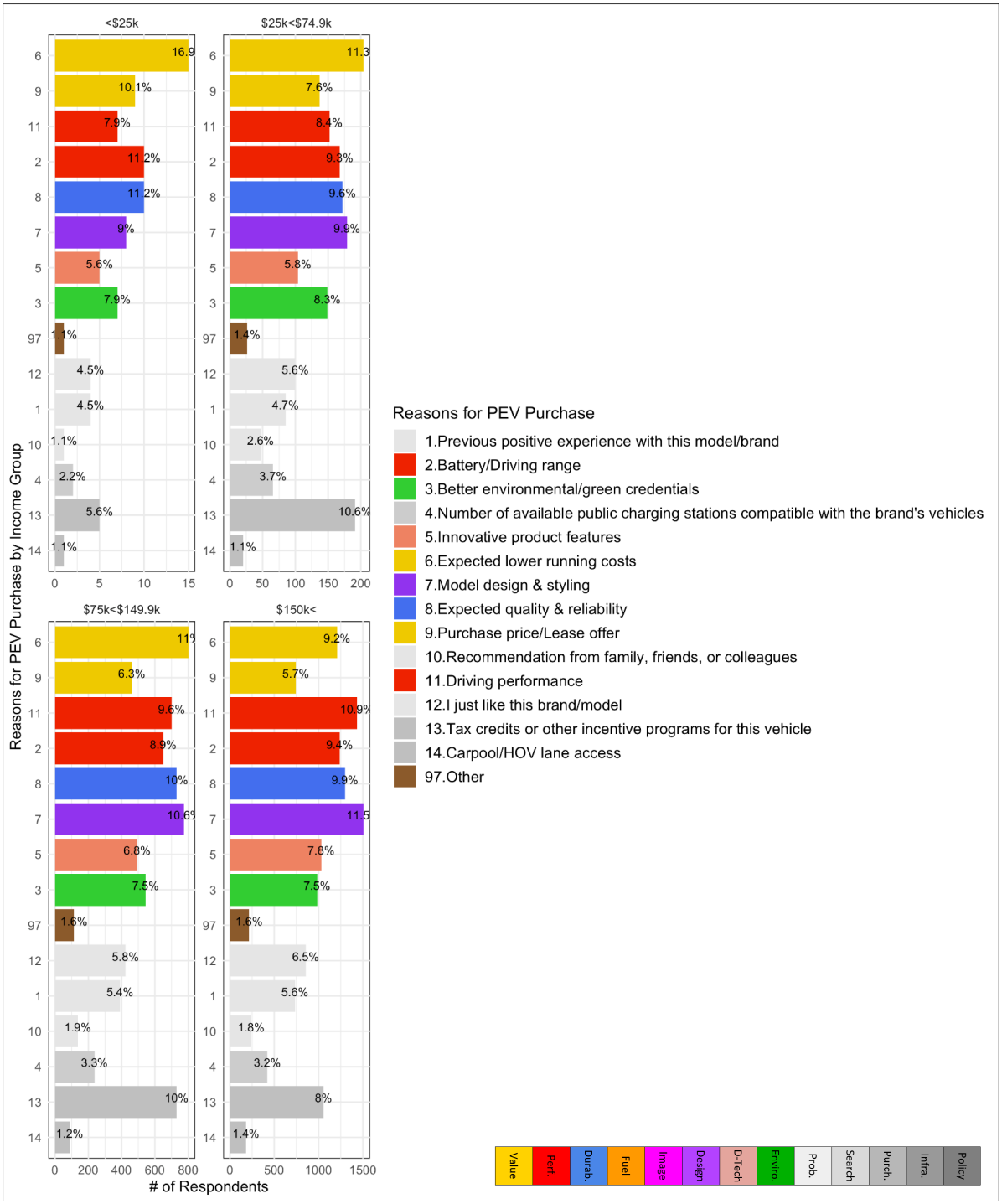


Figure 23: Commonality of PEV purchase reasons by income group. **Source:** EVOS

In Figure 23, we see that higher income respondents are more likely than lower income respondents to cite model design and styling as a purchase reason, as well as innovative product features (the latter somewhat less commonly than the former). Interestingly, one of the biggest differences between the lowest-income households and the other segments in Figure 23 is how much less frequently they cite tax credits and other incentives as a reason for selecting the PEV they purchased. It is difficult to speculate on the reason for this, particularly given the small number of EVOS respondents in this lowest-income segment. One possible explanation

for this might be derived from the fact that these respondents also cite “purchase price/lease offer” at double the rate they cite tax credits as a reason for purchase, unlike any other segment. Given the relatively lower taxes paid by this income segment, there is a relatively higher chance that the incentives this group might see would be “on the hood” in the form of rebates, etc. This group might therefore see these incentives more as part of the purchase price/lease offer than as a separate policy instrument.

Figure 24 groups BEV rejecter respondents by income in slightly different ways than the PEV buyers in Figure 23, due to differences between the EVCS (Figure 24) and the EVOS (Figure 23). In Figure 24, lack of charging station availability is the most frequently cited factor for BEV rejection by all income groups except for the lowest. For the two lowest income groups of BEV rejecters, purchase price (a factor associated with value) is either the most or second-most commonly listed factor in their low consideration of BEVs. By contrast, the two highest income groups of BEV rejecters list limited driving distance per charge (a factor associated with performance) second only to lack of charging station availability in terms of a commonly cited factor in their low consideration of BEVs.

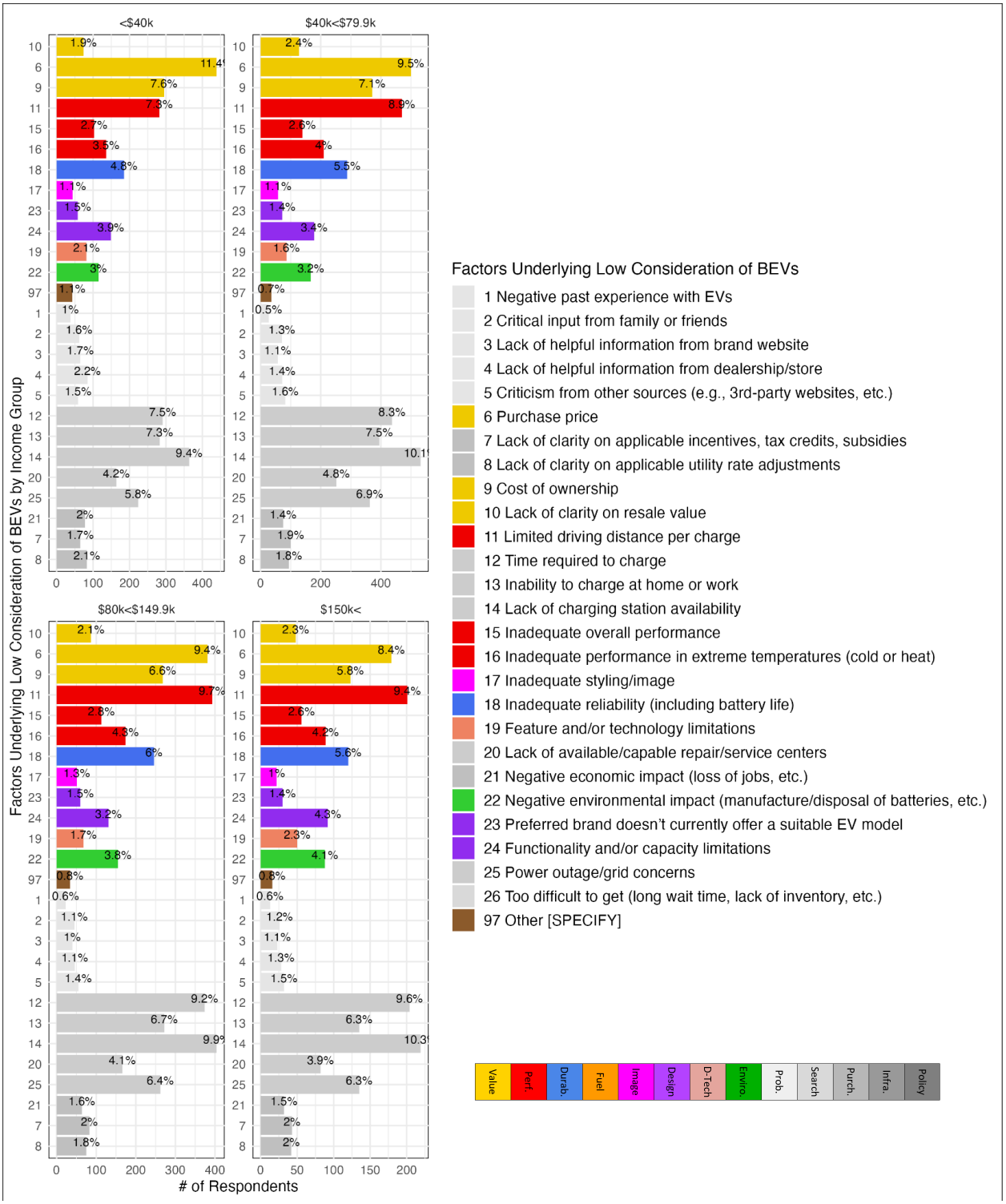


Figure 24: Commonality of BEV rejection reasons by income group. **Source:** EVCS

3.3.3 Urban versus rural populations

PEV acceptance over time

The earliest PEV adoptions clustered in urban areas. Reviewing trends in recent data, we see that PEV adoption and interest remain lower in rural compared to urban areas. A study of U.S.

light-duty vehicle sales between 2014 and 2020 reveals that of the counties with very low BEV market share, the majority are rural (Gillingham et al., 2023). The authors suggest that supply constraints are an important determinant of the low rural PEV market share, including the higher cost of shipping to rural dealerships.

Analysis of NVCS purchased vehicle data between 2015 and 2020 (Figure 25, top panel) similarly shows that PEVs represent a greater share of annual new vehicles bought by respondents in urban areas, in contrast with non-urban areas. In most years, the contrast is on the order of two to three times more PEV purchase in urban rather than non-urban areas. While those in urban areas were also more likely to list a PEV as their second-choice (alternatively-considered vehicle, see bottom panel of Figure 25) model, the gap between urban and non-urban is smaller for the alternatively-considered vehicle than for the purchased vehicle. This means that even in the 2015-202 period, PEVs were an element of the vehicle consideration sets of a number of rural vehicle buyers.

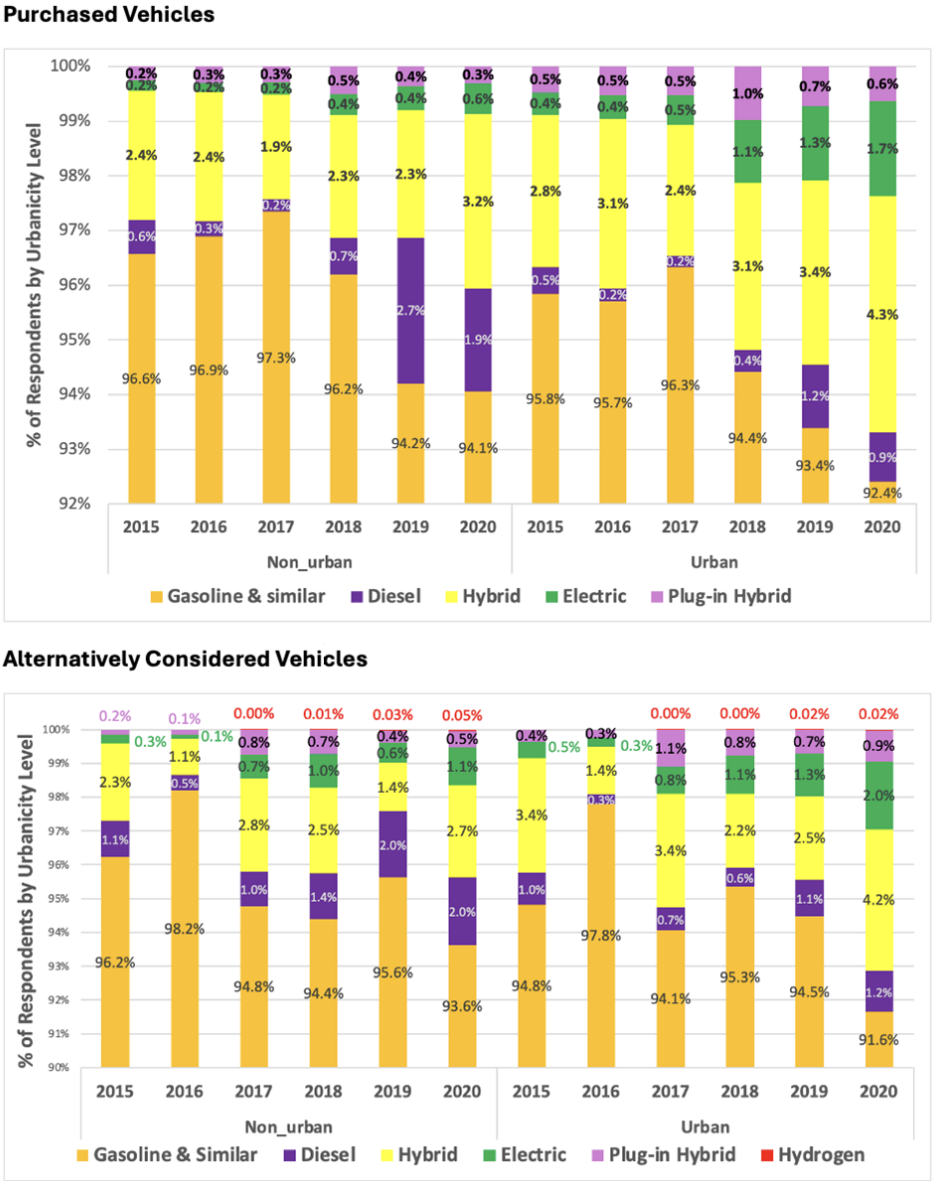


Figure 25: Fuel type of purchased and considered vehicles by urban, non-urban consumers. **Source:** NVCS

Figure 26 shows the breakdown of urban, suburban, and rural respondents to the 2023 EVCS with respect to whether they are very likely, somewhat likely, somewhat unlikely, or very unlikely to consider purchasing or leasing a BEV for their next vehicle purchase. We see that respondents from urban areas state that they are likely to consider purchasing a BEV at greater rates than those in suburban and particularly rural areas. However, it should be noted that more than 50% of respondents from rural areas express that they are "very likely" or "somewhat likely" to consider a BEV for a future vehicle purchase. This represents a substantial increase from the 21% of respondents who expressed willingness to consider a BEV purchase in Singer (2017).

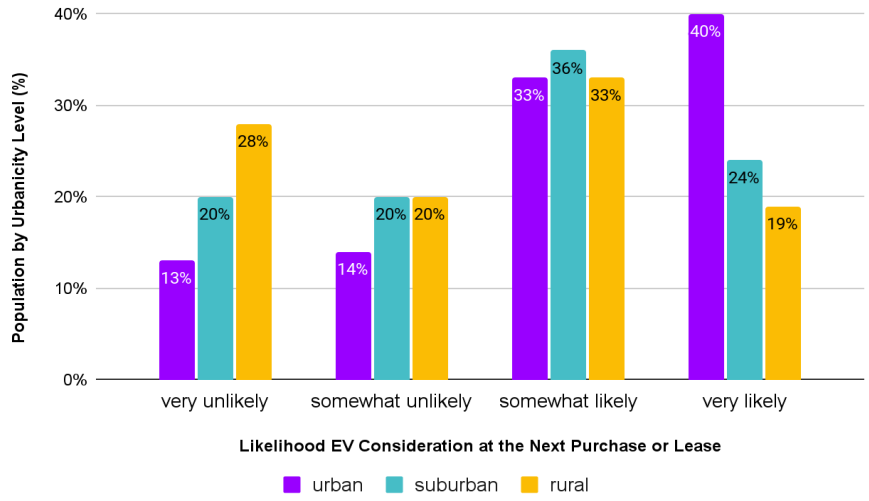


Figure 26: Likelihood of BEV consideration by urbanicity, in 2023. **Source:** EVCS

Figure 27 depicts the physical experience with BEVs of urban, suburban, and rural respondents to the 2023 EVCS. Here we see that rural residents are nearly twice as likely to have never been in a BEV compared to the residents of urban areas. Given this context, and the connection between familiarity with BEVs and approval of BEVs (Jackman et al., 2023), the pattern revealed in Figure 26 appears unsurprising.

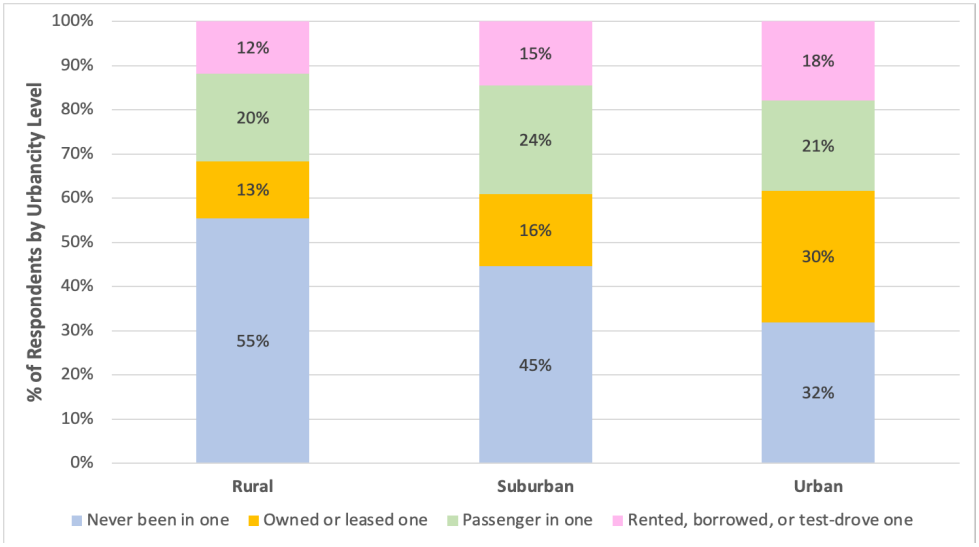
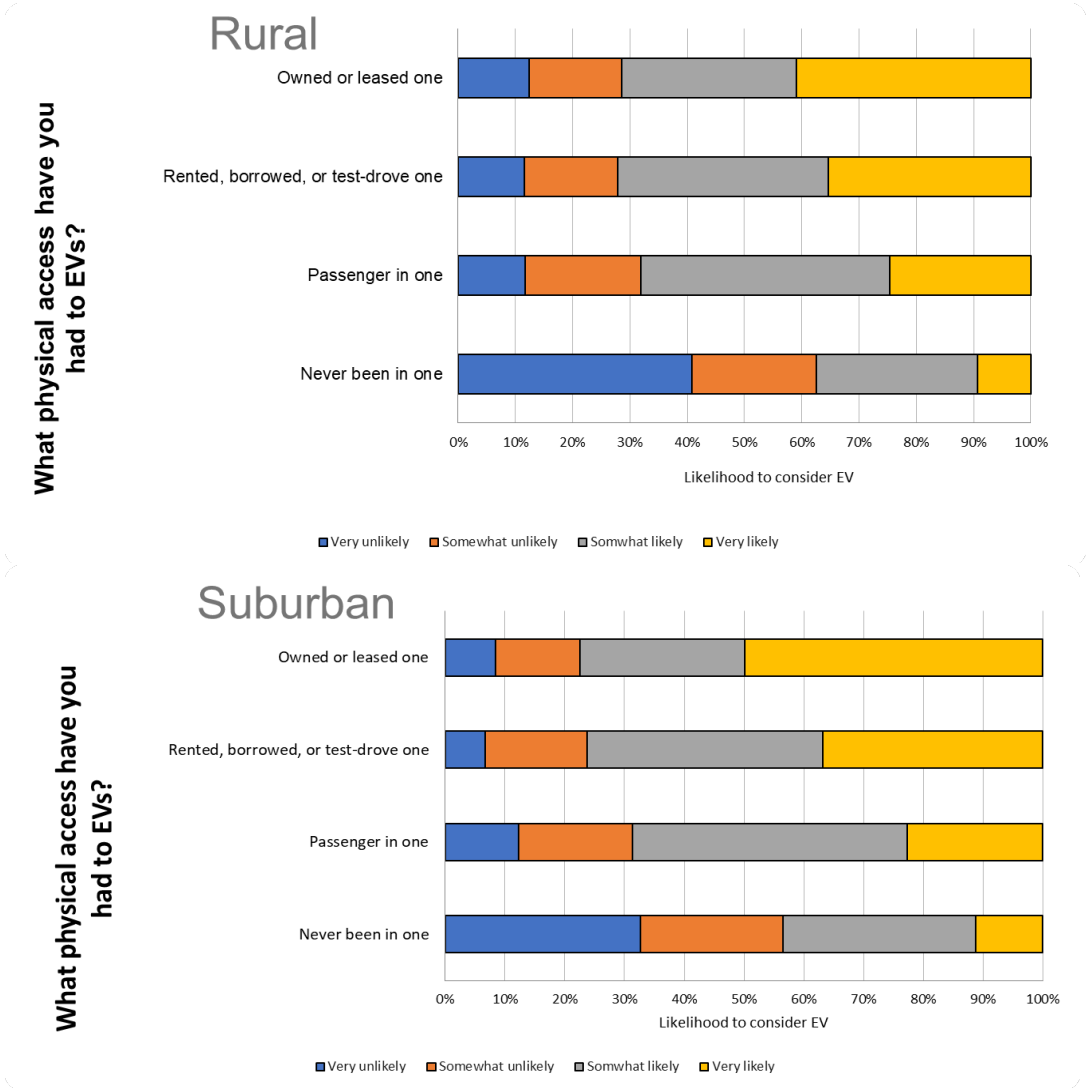


Figure 27: Physical experience with BEVs by urbanicity, in 2023. **Source:** EVCS

Figure 28 compares urban, suburban, and rural respondents to the 2023 EVCS 2023 with respect to their physical experience of BEVs and their likelihood of BEV purchase consideration. In Figure 28, the four available response options regarding degree of physical experience are sorted from highest to lowest as follows: (1) highest is “owned or leased” a BEV; (2) second-highest is “rented, borrowed, or test-drove” a BEV; (3) third-highest is “passenger in” a BEV; and (4) lowest is “never been in” a BEV. Across urbanicity levels, Figure 28 shows that “very likely” BEV consideration increases linearly with higher degrees of physical experience, although the slopes of these positive lines differ slightly for urban, suburban, and rural respondents. This positive, linear association between degree of physical experience and likeliness to consider a BEV does not hold for any other BEV consideration likeliness level, with the single exception of suburban respondents who are “somewhat unlikely” to consider a BEV for their next purchase or lease.



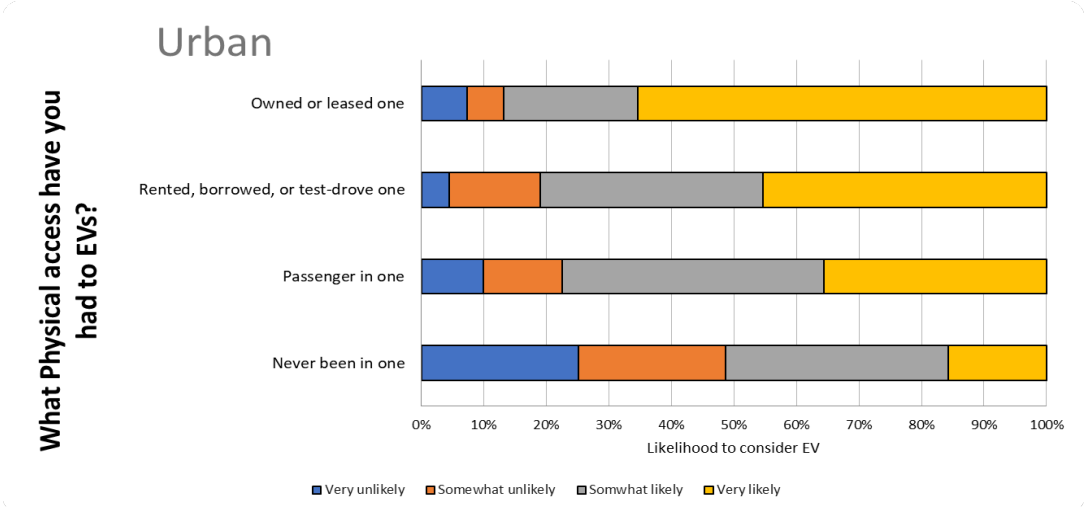


Figure 28: Likelihood to consider BEV for next purchase by urbanicity, in 2023. **Source:** EVCS

Figure 28 also allows for a comparison between urban, suburban, and rural new vehicle shoppers on the relationship between the lowest two levels of physical experience and the likelihood of rejecting a BEV (i.e., being very or somewhat unlikely to consider a BEV for the next vehicle purchase or lease). In Figure 28, BEV rejection declines dramatically for each urbanicity group when BEV physical experience increases from none to a background as a passenger. Never having been in a BEV is tied to BEV rejection for rural respondents at a rate of over 60%, suburban respondents at over 50%, and urban respondents at under 50%. Meanwhile, an experience as a passenger in a BEV is tied to BEV rejection for respondents at a rate of just over 30% for both rural and suburban respondents and at just over 20% for urban respondents. These findings suggest the potential importance of experiential programs like “ride and drives” in increasing BEV consideration by U.S. consumers.

Figure 29 looks at urban, suburban, and rural respondents to the 2023 EVCS who are “very” or “somewhat” likely to purchase or lease a BEV for their next vehicle (BEV considerers) and displays expectations of when they might have a fully electrified household vehicle portfolio. Interestingly, no group of BEV considerers, distinguished by urbanicity, states that they will “never” or will “in more than ten years” have a fully electrified household vehicle portfolio at above a 6% rate. The perspective that full household vehicle portfolio electrification will happen in 5-10 years is shared by a fairly tight range (23-28%) of urban, rural, and suburban prospective buyers. The most differentiation occurs at the 0-4 year level, with urban BEV considerers foreseeing that early day arriving at a rate of 61%, a view shared by rural BEV considerers at a rate of 52% and suburban BEV considerers at a rate of 49%.

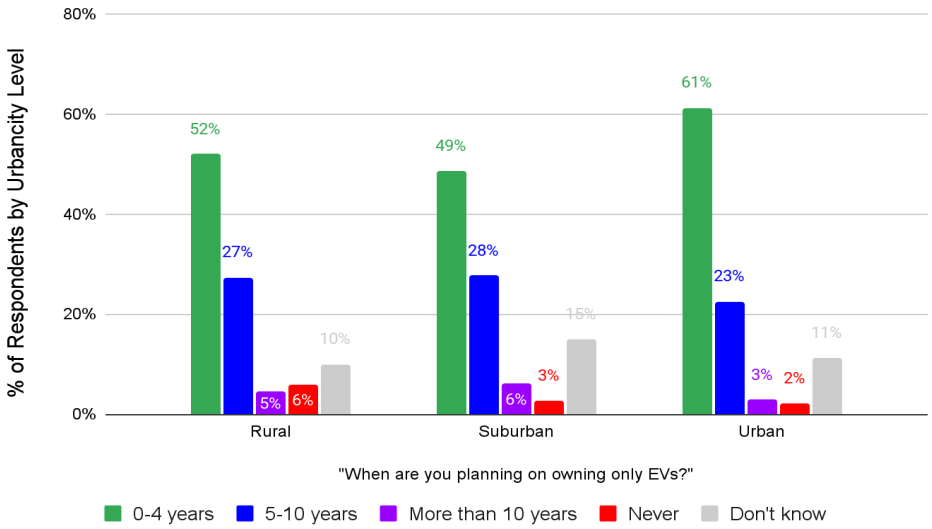


Figure 29: Expected timeframe of fully electrified household vehicle portfolio by level of urbanicity.
Source: EVCS January 2024

In section 3.2, we considered the vehicle preferences or urban and non-urban prospective buyers in the NVES and NVCS with respect to body style (see Table 3). In Table 4, below, we consider the body style preferences of urban, suburban, and rural respondents to the 2023 EVCS as they relate to their first choice of possible BEV model. SUVs emerge as the most preferred body type of BEV considerers, garnering 59% of rural respondent interest, 59.1% of suburban interest, and 60.2% of urban interest. While sedans are the second-most-favored body style of the top model for BEV considers who live in urban and suburban areas (18.3% and 14.2%, respectively), pickup trucks hold that position for those residing in rural locales (22.4%).

Table 4: Body style of first choice BEV model by urbanicity level

	Hatchback	Sedan	SUV	Truck
Rural	9.7%	8.9%	59.0%	22.4%
Suburban	12.6%	14.2%	59.1%	13.0%
Urban	9.9%	18.3%	60.2%	11.6%

On a related note, we close this section with a brief discussion of “gasoline superusers.” Some policy advocates have proposed that targeting PEV purchase and usage incentives toward gasoline superusers –defined as the top decile of U.S. drivers in terms of fuel use – would be a particularly effective way to quickly reduce transportation consumption of gasoline, with its negative environmental impacts. Figure 30 replicates a figure from (Coltura, 2021) on the urbanicity of gasoline superusers, versus other gasoline users. It shows that gasoline superusers are geographically distributed in the following ways: rural resident (33% of superusers, as opposed to 26% of other users); small town resident (24% of superusers, the same as for other users); second city resident (16% of superusers, as opposed to 18% of other users); suburban resident (20% of superusers, as opposed to 22% of other users); and urban resident (7% of superusers versus 10% of other users). Given the slightly higher representation (by 7 percentage points) of superusers in rural areas, there is likely a good case to be made for

policies to continue to close the gap between rural and urban PEV consideration. That said, across many measures, rural prospective shoppers are relatively far along on the path toward PEV acceptance (e.g., the 51% of rural vehicle shoppers who express likelihood of future BEV purchase in Figure 26 above).

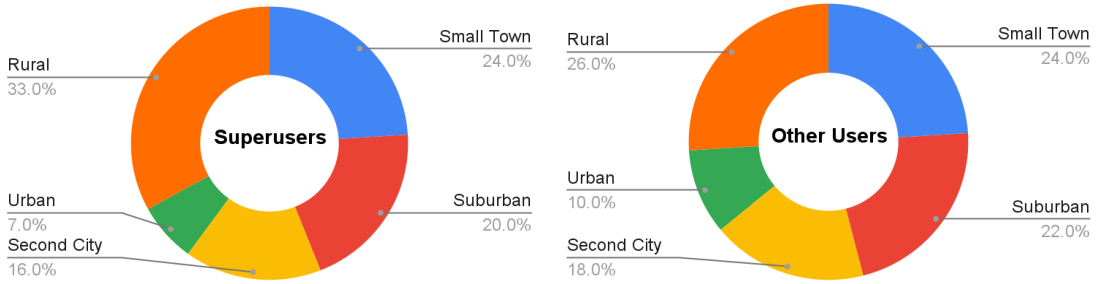


Figure 30: Urbanicity of gasoline superusers and others. **Source:** (Coltura, 2021)

PEV purchase and BEV rejection reasons today

Figure 31, which pulls from the 2023 EVOS, shows that PEV buyers today share a number of similarities across urbanicity levels. Urban, suburban, and rural buyers of PEVs respond to the 2023 EVOS with generally consistently high reference to the following vehicle attributes as relevant to their choice of PEV: (1) model design and styling (design, at a range of 10.1-11.3%); (2) expected quality and durability (durability, 9.8-10.4%); (3) driving performance and battery range (performance, at ranges of 9.8-10.3% and 9.2-10.2%, respectively); and (4) expected purchase price/lease offer (value, at a range of 8.8-10.7%). The non-vehicle attribute of tax credits or other purchase incentives for this vehicle is the only non-vehicle attribute of a similarly high degree of commonality (at a range of 8-9.2%). Note that innovative product features (design – technology) is a very similarly prominent reason for urban, suburban, and rural PEV buyers to purchase their chosen PEV model (7-7.4%). There is a wider range with respect to "better environmental/green credentials," from 7.2-8.4%; it is urban drivers who express the highest common sentiment in that range toward the positive environmental qualities of PEVs, while rural drivers express the lowest common sentiment in that range.

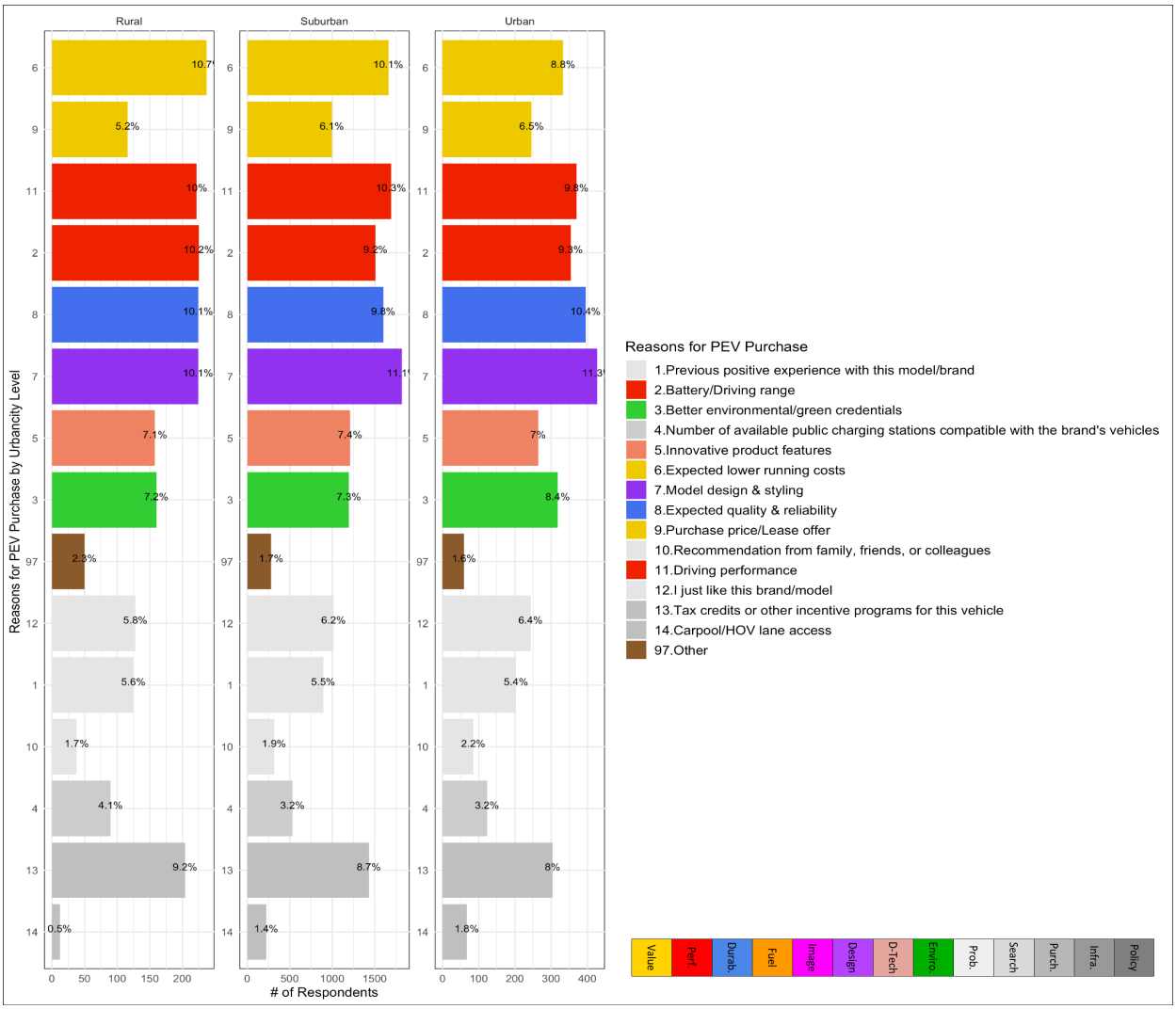


Figure 31: Commonality of PEV purchase reasons by urbanicity level. **Source:** EVOS

Figure 32 considers the responses of urban, suburban, and rural prospective purchasers of new vehicles who are “very” or “somewhat” unlikely to consider a BEV for their next vehicle purchase, according to the 2023 EVCS. Across all urbanicity levels, BEV rejecters most commonly listed the non-vehicle attribute of lack of charging infrastructure (infrastructure, 9.5-10%) as a factor underlying their low consideration of BEVs. The next most common factor listed by urban, suburban, and rural BEV rejecters is purchase price (value, 9.6-9.9%). The third most common factor listed across urbanicity levels is limited driving distance per charge (performance, 7.8-8.8%). Other factors also do not seem to vary overmuch between urban, suburban, and rural BEV rejecters.

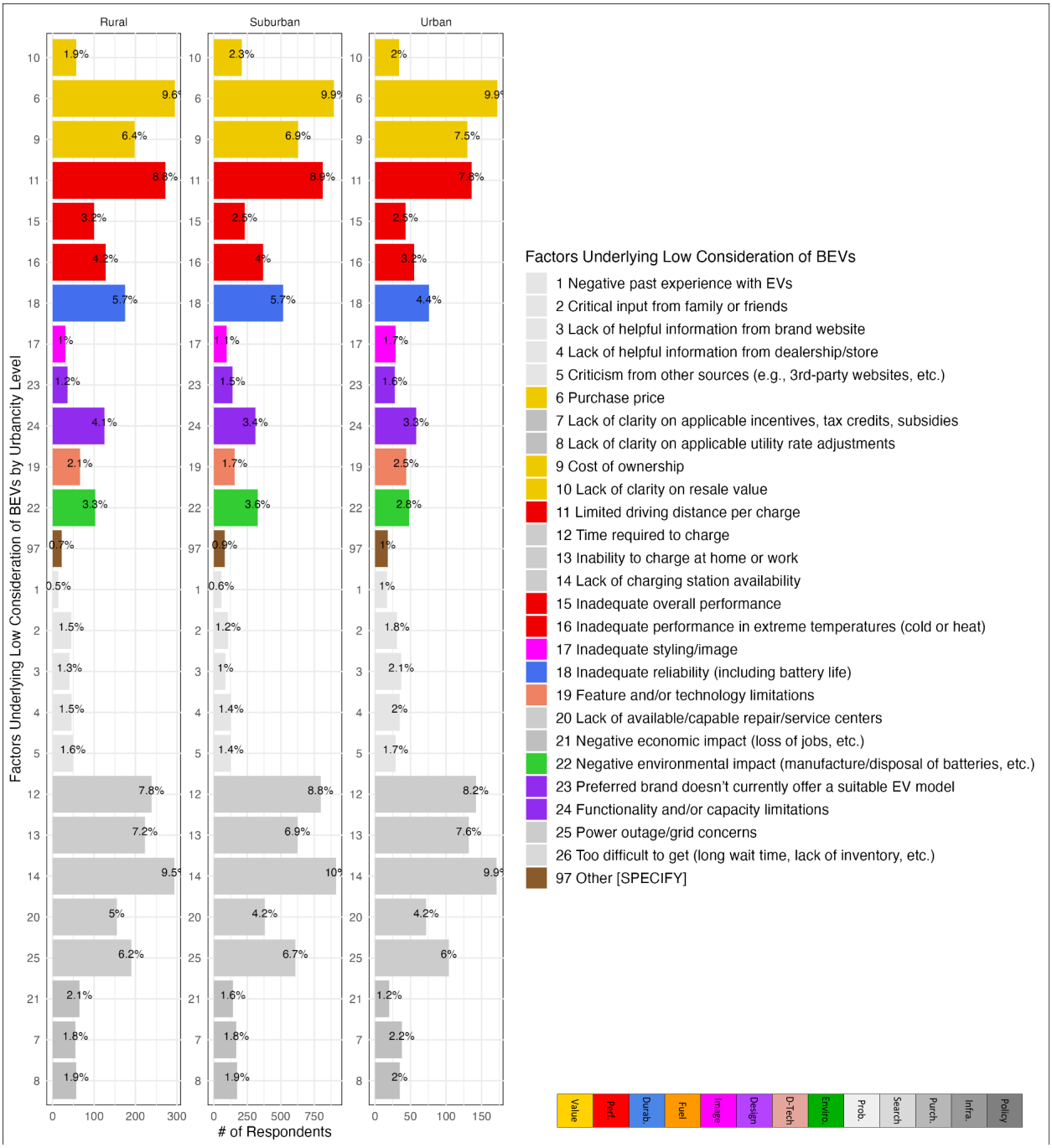


Figure 32: Commonality of BEV rejection reasons by urbanicity level. **Source:** EVCS

3.3.4 Male versus female consumers

PEV acceptance over time

The archetypal PEV driver has long been cast as male, rather than female.[11] Examining the SF Bay Area WholeTraveler survey data collected in 2018, described in Spurlock et al. (2019), we

[11] We acknowledge that gender is a nuanced topic, with identities beyond the binary. However, the data sets we analyze in this report either only code responses as "male" or "female", or only allow for representative samples of "male" and "female," with very few respondents selecting another gender identifier.

found that 63.5% of men and 48.8% of women expressed interest in owning a PEV in the future. As this survey was conducted in the San Francisco Bay Area of California, a location that tends to be relatively receptive to new technologies, these values are likely to be higher than the U.S. national averages at that time.

In our later study, (Fujita et al., 2022), we explored the vehicle purchase criteria weights of male versus female respondents to the MY2014-16 NVES. Women were found to have a slightly higher valuation of environmental friendliness and fuel economy than men, but otherwise had broadly similar criteria weights (see Figure 8, above).

Figure 33 shows how male and female respondents to the 2023 EVCS are distributed across the options of "very likely," "somewhat likely," "somewhat unlikely," or "very unlikely" to consider a BEV for their next vehicle purchase or lease. This figure shows a fairly dramatic discrepancy between women and men with respect to being "very likely" to consider a BEV, with only 20% of women and 30% of men expressing this sentiment. Women are slightly over-represented across all the other three categories, with 36% of women somewhat likely to consider a BEV (as opposed to 34% of men), 21% of women somewhat unlikely to consider a BEV (as opposed to 18% of men), and 23% of women very unlikely to consider a BEV (as opposed to 18% of men). The combination of very and somewhat likely consideration of BEVs is now 64% of women and 56% of men; this 8 percentage point gap is smaller than the one observed in the WholeTraveler survey referenced above, which was about a 15 percentage point gap.

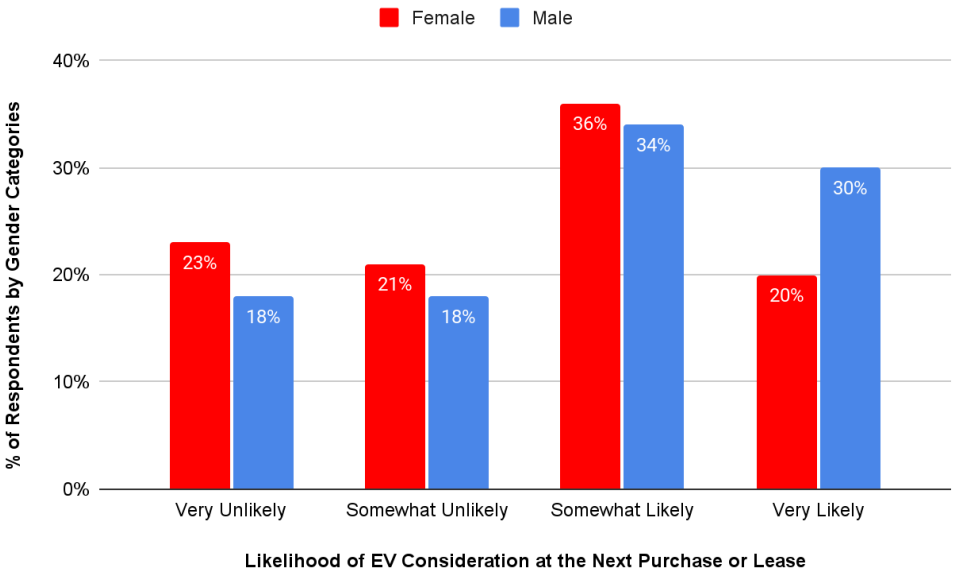


Figure 33: Likelihood of future BEV consideration by gender, in 2023. **Source:** EVCS

PEV purchase and BEV rejection reasons today

Figure 34 presents data on the reasons that male and female respondents to the 2023 EVOS give for selecting the PEV they purchased. Model design and styling (design, 11%), driving performance (performance, 10.6%), and expected lower running costs (value, 9.9%) were the three most common reasons provided by male respondents. Model design and styling (design, 11.4%), expected quality and reliability (durability, 11.3%), and expected lower running costs (value, 10%) were the three most common reasons provided by female respondents.

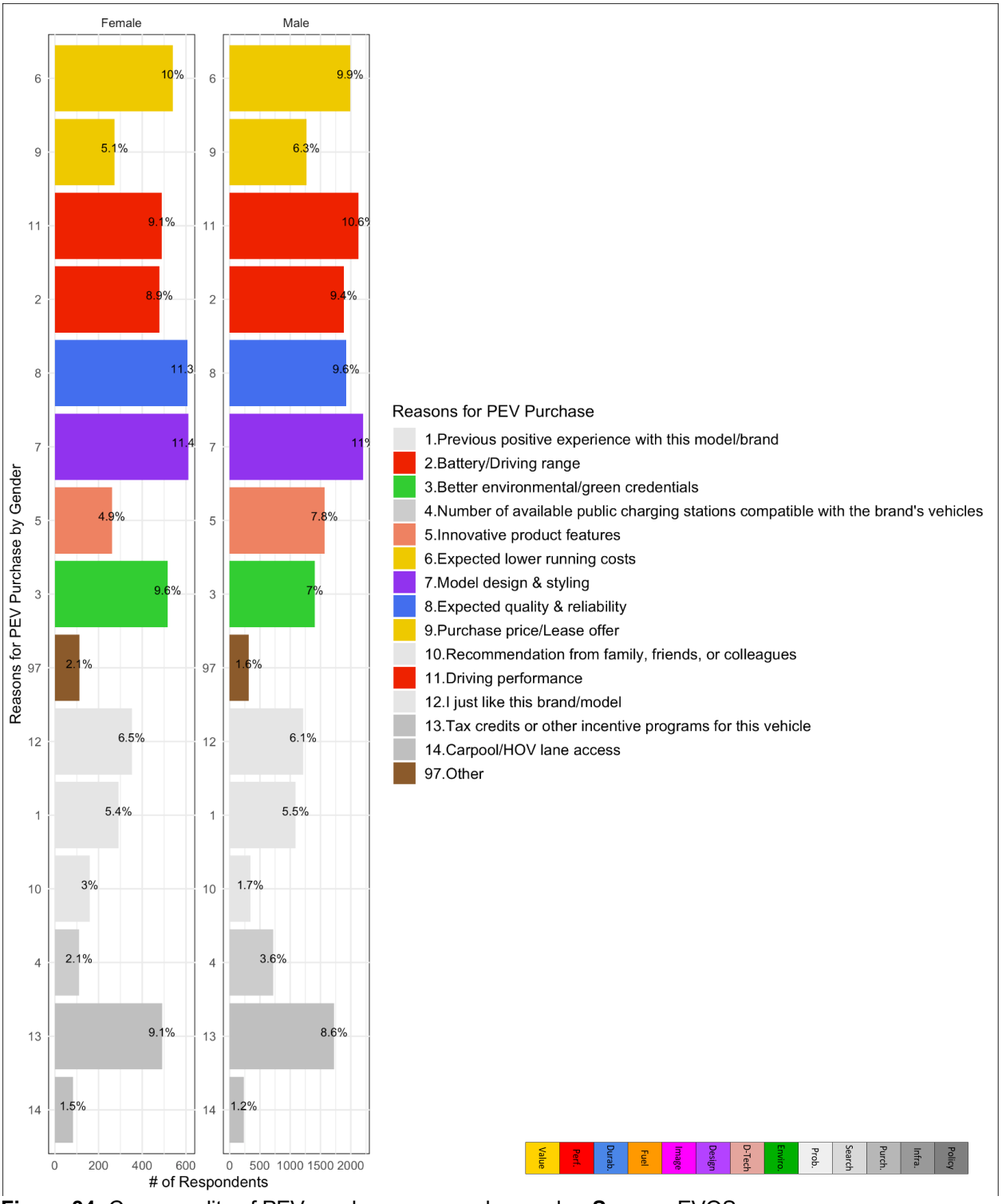


Figure 34: Commonality of PEV purchase reasons by gender. **Source:** EVOS

Figure 35 presents data on the male and female respondents to the 2023 EVCS who say they are “very unlikely” or “somewhat unlikely” to consider a BEV for their next purchase or lease. For both men and women, the non-vehicle attribute of lack of charging station availability is the most commonly cited factor underlying their low consideration of BEVs (infrastructure, with 9.9% of both men and women citing it as a factor). Male respondents cite two other factors at the

same or similar rate to charging station availability as reasons for their low consideration of BEVs, namely limited driving distance per charge (9.9%) and purchase price (9.8%). Women cite purchase price as their second-most common factor underlying non-consideration of BEVs (9.5%), but the non-vehicle attribute of time to charge is their third-most common factor (8.4%).

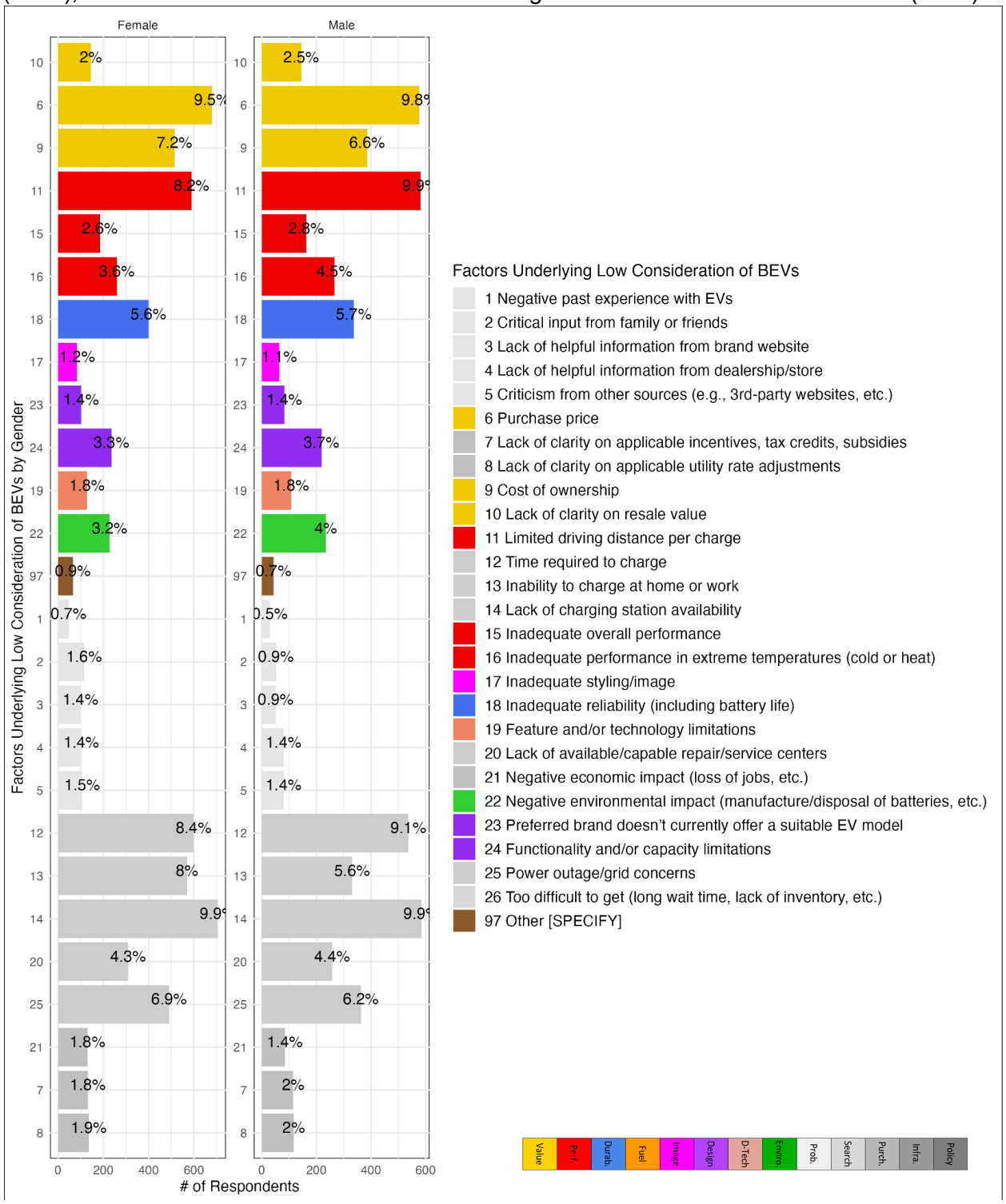


Figure 35: Commonality of BEV rejection reasons by gender. **Source:** EVCS

3.3.5 Younger versus older consumers

PEV acceptance over time

The initial cohort of PEV adopters tended to be middle aged or older (i.e., 50 years old or older), with fewer than 20% of early PEV adopters under 40 years of age (Axsen and Kurani 2013). Given that an individual's highest earnings are often attained in middle age, or at the transition from middle to retirement age, the tendency of this age group to adopt PEVs appears to align with findings related to income. The average new vehicle buyer in 2015 was in the late 40s (Kurz et al., 2016). This implies that the EV driver archetype characteristic of middle-aged may stem more from the relative proportion of middle-aged vehicle buyers than from a strong relative preference for PEVs amongst middle-aged Americans.

Looking at interest in PEVs rather than adoption of PEVs, we see a different pattern. Surveying prospective vehicle buyers in 2016 and 2017, Singer (2017) found that overall average willingness to consider PHEVs for the next vehicle purchase was 24%. By age group, younger vehicle buyers were nearly three times more likely to consider a PHEV than older buyers (i.e., 34% of those under 35 years of age compared to 12% of those over 55). Meanwhile, PHEV consideration by middle-aged respondents was slightly lower than younger buyers, at 26%. Expressed approval of PHEVs and BEVs was found to be highest amongst people aged under 35, with approximately 70% agreeing that PEVs are "as good or better than a gasoline vehicle;" these rates drop off to approximately 45% for middle aged and 30% for older age cohorts (Singer 2017).

Figure 36 shows PEV purchase by generational cohort of respondents to the MY2016 and MY2020 NVCS. It shows that PEV purchase was most common amongst members of Generations X and Y (i.e., those currently between 29 and 58 years of age); this represents a shift toward younger PEV buyers compared to the earlier findings of Axsen and Kurani (2013).

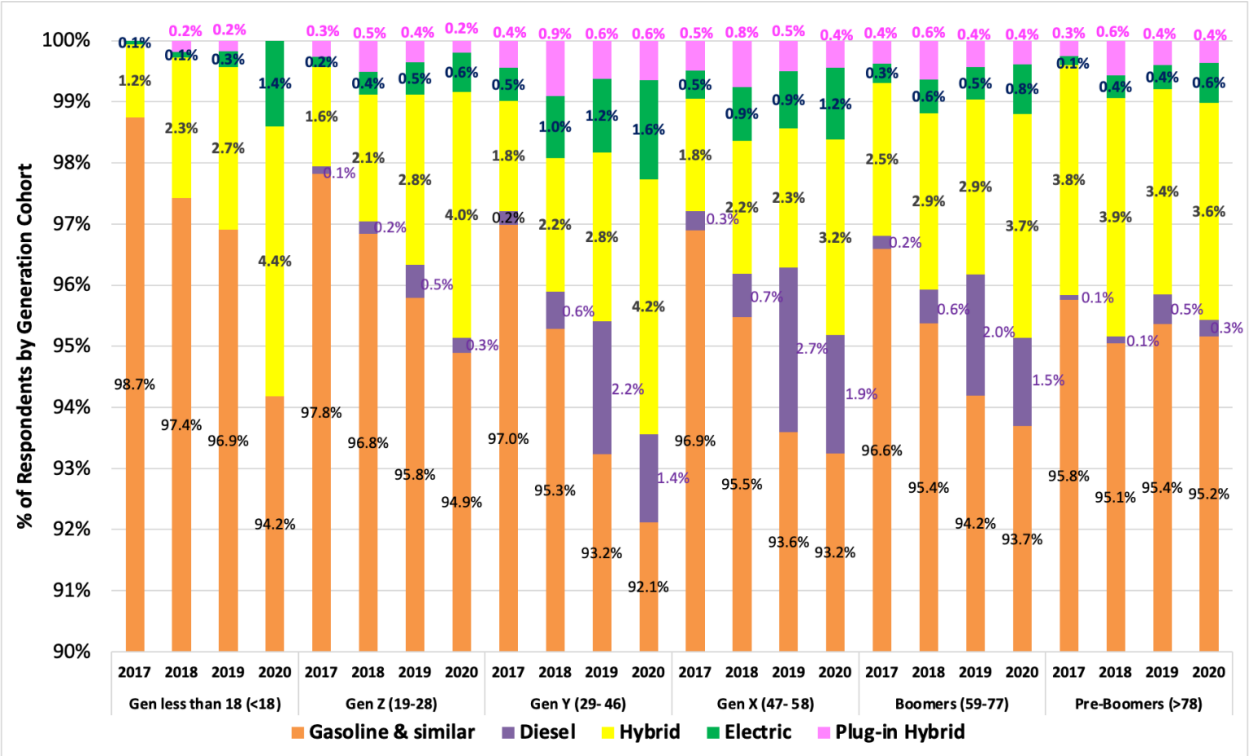


Figure 36: Fuel type of purchased vehicle by generation cohort. **Source:** NVCS

Figure 37 shows the proportion, by age group, of people who are “very” or “somewhat” likely (BEV considerers) and “very” or “somewhat” unlikely (BEV rejecters) to consider a BEV for their next vehicle purchase or lease, as reported in the MY 2023 EVCS. In general, BEV consideration and rejection appear to follow trends tied to age. Consideration drops from highs around 73% of all prospective purchasers aged 25 to 39 to lows of 37% of prospective purchasers aged 70+. Conversely, BEV rejection starts at lows of 26% of prospective purchasers aged 25-29, and peaks at a high of 63% of prospective purchasers aged 70+. The crossover point in the two trends appears to be for people aged 55-64.

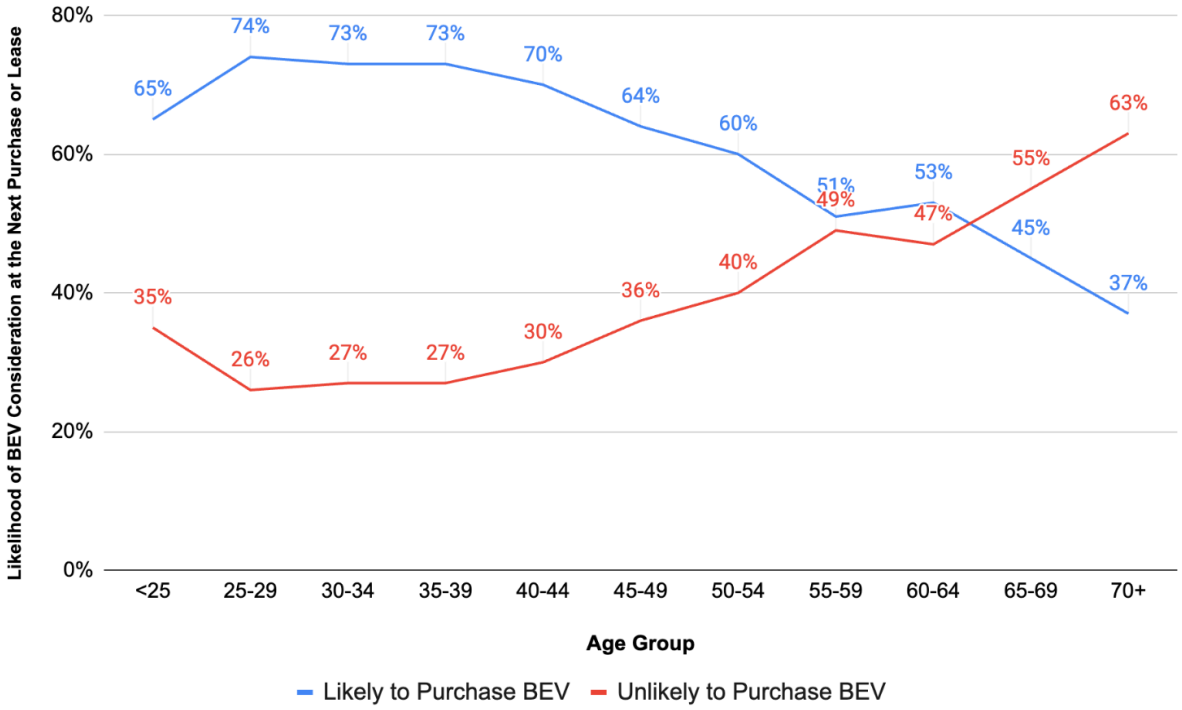


Figure 37: Likelihood of future BEV purchase by age group, in 2023. **Source:** EVCS

Figure 38 shows the likelihood of BEV consideration in the MY2023 EVCS by generation, rather than age. There is particularly strong interest amongst younger generations, with about 70% of both Gen Z and Gen Y prospective vehicle purchasers (people aged 24-44) stating they were somewhat or very likely to consider a BEV for their next vehicle purchase. BEV consideration drops somewhat for people in Gen X, of whom slightly more than 50% express a likelihood of BEV adoption. The eldest cohort of consumers is least likely to be BEV considerers, with only 33% of Pre-Boomers expressing interest.

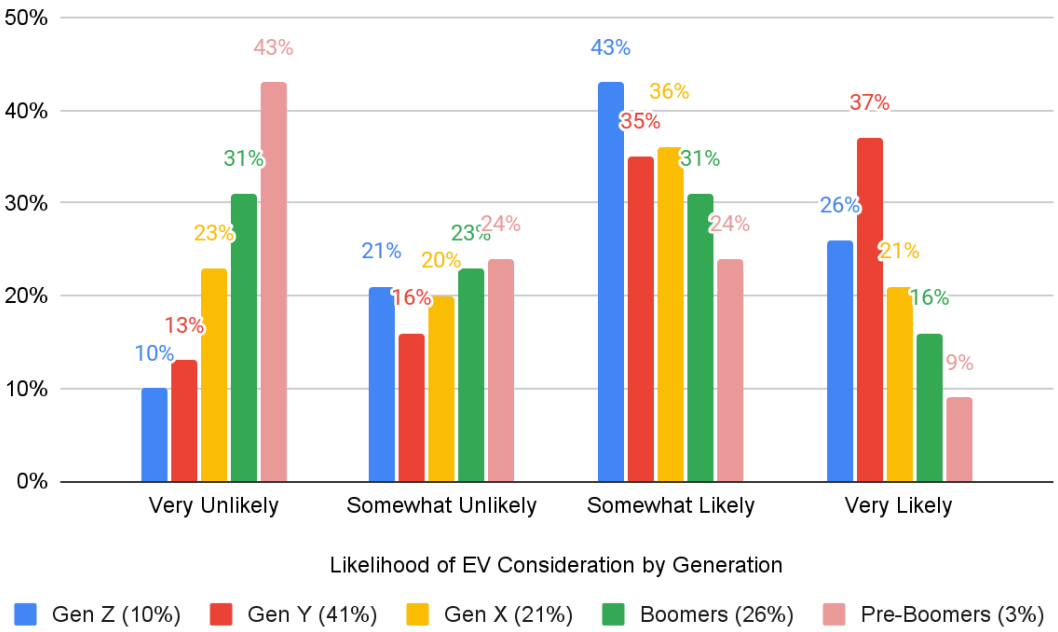


Figure 38: Likelihood of BEV consideration, by generation. Labels on the x-axis list EVCS representation of each group, overall. **Source:** EVCS

PEV purchase and BEV rejection reasons today

Figure 39 shows the reasons that respondents of different ages gave in the 2023 EVOS regarding why they selected the PEV they purchased. Model design and styling (design) was the most commonly cited reason for every age cohort except Pre-Boomers, for whom it was expected quality and reliability (durability), and Gen Z, for whom it was tax credits or other incentive programs for this vehicle (value). Driving performance (performance), was the second-most commonly cited vehicle purchase reason by Gen X, Gen Y and Gen Z (for Gen Z, there was a tie with the value criteria of expected lower operating costs). For Boomers, the second-most commonly cited criterion was expected quality and reliability (durability) and for Pre-Boomers, it was model design and styling (design). As in previous demographic cross-cuts, innovative product features (design – technology) and environmental credentials (environment) are modestly cited by each age cohort, with a range of 6.9-8.2% for innovative product features and 6.9-8.3% for environmental credentials. Expected lower operating costs was the third most commonly cited PEV purchase criterion for Gen X and Gen Y, while for Gen Z, as mentioned above, this criterion tied for second with driving performance. The third-most commonly cited PEV purchase criterion for Boomers was driving performance, while for Pre-Boomers, it was battery/driving range.

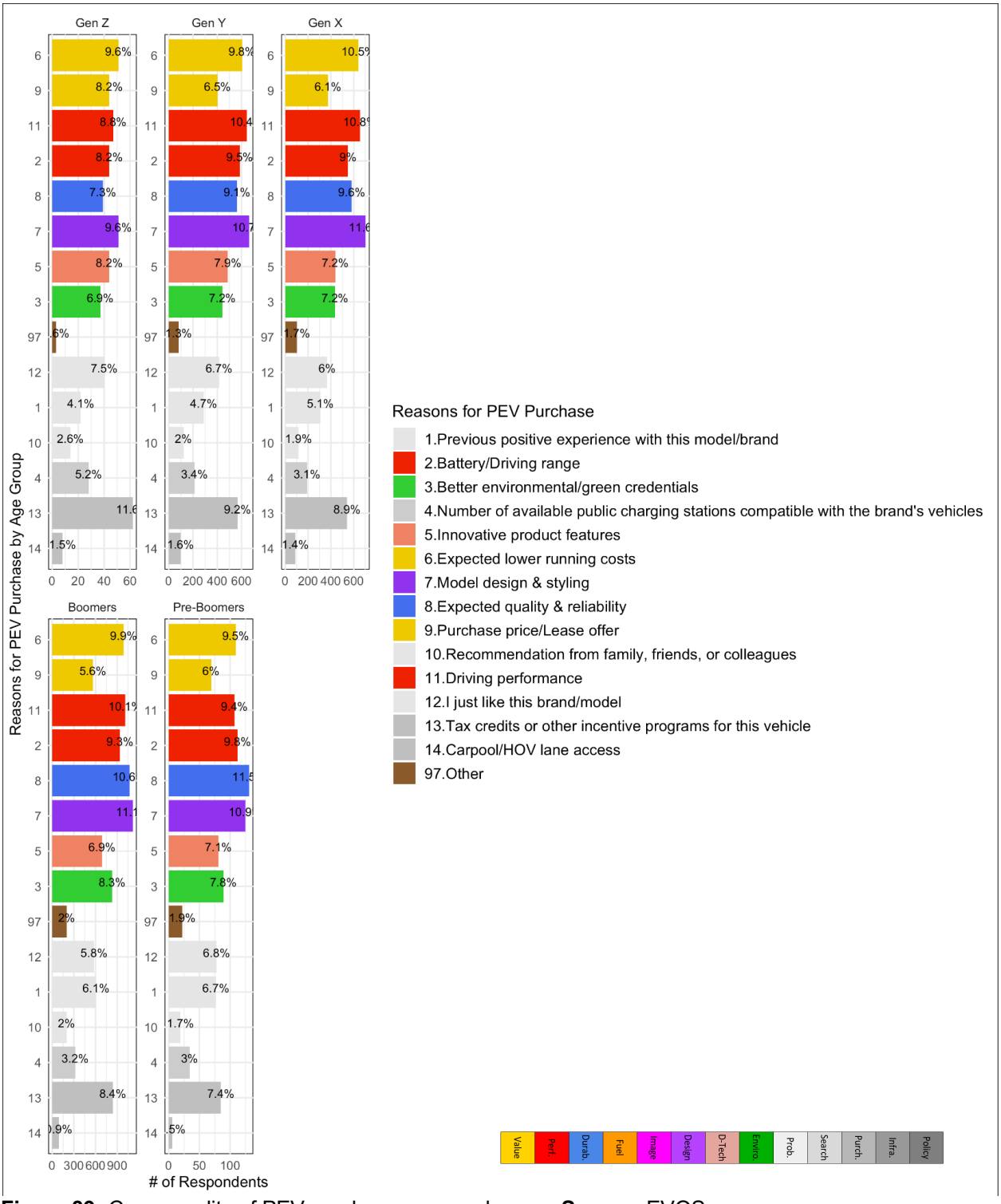


Figure 39: Commonality of PEV purchase reasons by age. **Source:** EVOS

Figure 40 shows how respondents of different ages who were BEV rejecters in the 2023 EVCS study (i.e., they say they are “very unlikely” or “somewhat unlikely” to consider a BEV for their next purchase or lease) report the factors underlying their low consideration of BEVs. While all age cohorts frequently cite a lack of charging station availability (infrastructure) as the most or second-most important factor underlying their BEV rejection, older groups are more likely to cite

infrastructure-related reasons for BEV rejection as compared to younger groups. Purchase price (value) is of similarly high concern to people from all age groups in Figure 40, and is the highest common concern of people in Gen Z and Gen Y.

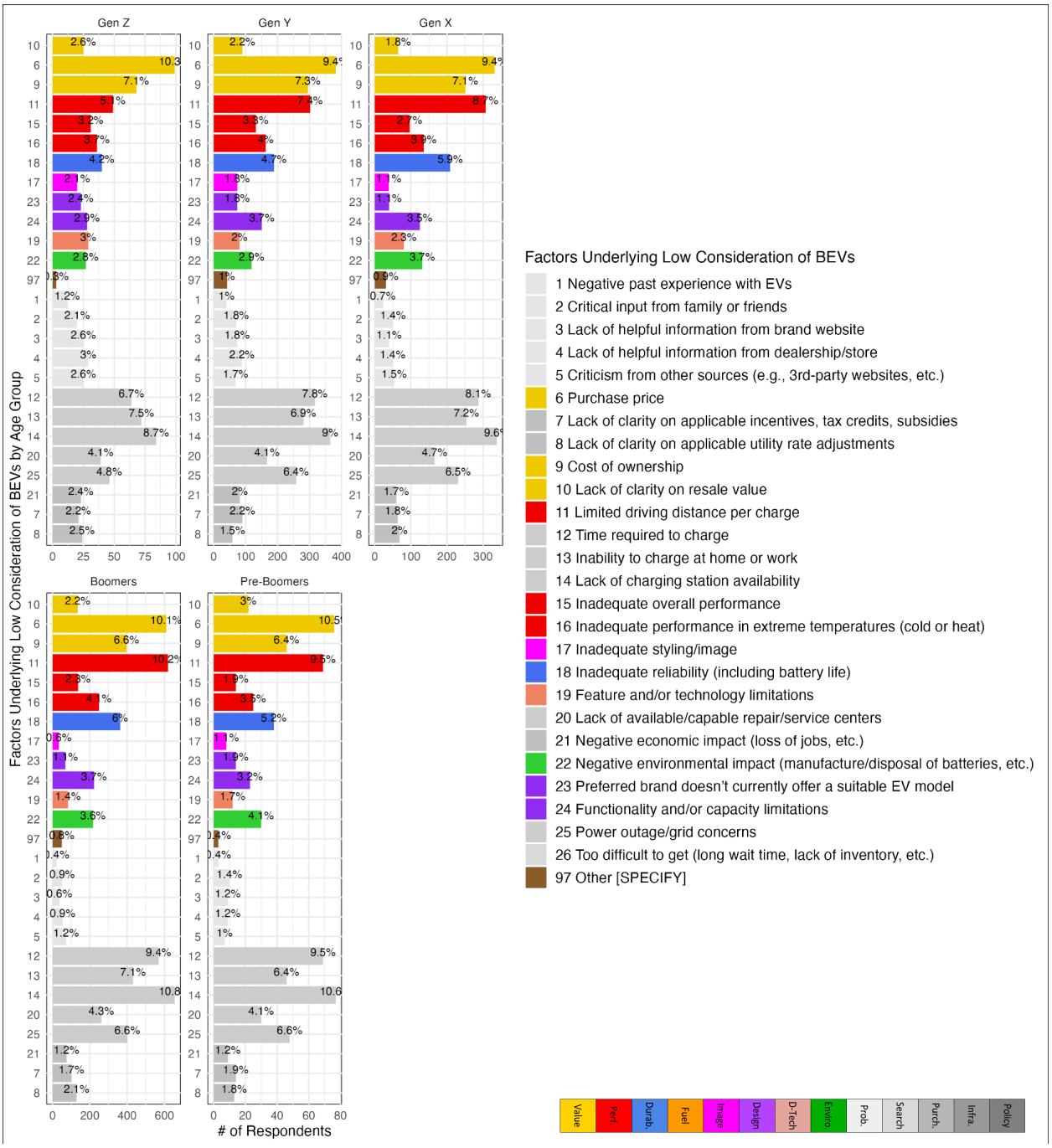


Figure 40: Commonality of BEV non-consideration reasons by age. **Source:** EVCS

3.3.6 Race and ethnicity

PEV acceptance over time

This section focuses on what is known about the racial and other ethnic demographic characteristics of BEV considerers, PEV owners, and BEV rejecters. Before proceeding to discuss how PEV acceptance has changed over time, with respect primarily to BEV consideration, we begin with a note on terminology and overall U.S. population statistics.

First, we recognize that the common names used for categories of race and ethnicity evolve over time, and that often, colloquial usage outpaces the terminology embedded in research instruments. In various data sources we use in our analyses, the terms Black and African American are used interchangeably. Similarly, White is sometimes termed Caucasian, and Hispanic may be termed Latino/a/e/x. While recognizing that racial and ethnic identity are complex topics, we rely on the following terms to describe different groups within the U.S. population: Black, White, Hispanic/Latino, and Asian American. Additionally, we realize that the U.S. has a complex and varied population with many people not personally ascribing to a particular racial/ethnic group and that there are many racial/ethnic groups not listed here. We select these four categories to highlight in this section because they are the most populous and consistently used in demographic studies. As of 2019, the U.S population identified itself as approximately 60% White; 18% Hispanic/Latino; 13% Black; and 6% Asian American (U.S. Census Bureau, 2019).

Figure 41 shows MY2017-2020 NVCS data on the purchased vehicles of survey respondents, as broken down by the four racial/ethnic categories described above and by five vehicle “fuel types” (i.e., gasoline and similar; diesel; traditional hybrid electric vehicle that cannot be plugged-in; BEV; and PHEV). Note that, as in Figure 20 and Figure 21, the y-axis is truncated so we can better observe trends with respect to non-gasoline fueled vehicles. Over these years, we see traditional hybrid electric vehicles becoming a more prominent share of the overall vehicle population, but particularly for Asian Americans. By MY2020, 7.7% of Asian American NVCS respondents reported purchasing a traditional hybrid electric vehicle, followed by 3.6% of Hispanic/Latino, 3.5% of White, and 2.5% of Black respondents. Fully electric BEVs were the next most prominently reported fuel type of new vehicle in MY2020, other than gasoline, with 4.9% of Asian American respondents reporting purchasing a BEV, followed by 1.7% of Black respondents and 1.5% of Hispanic/Latino and White respondents. In MY2020, PHEVs had achieved a slightly higher percentage of a singular racial/ethnic group’s responses with respect to the non-gasoline fuel type of a newly purchased vehicle than the next closest alternative, diesel. In MY2020, 2.4% of Asian Americans reported buying a PHEV, while 2.0% of White Americans reported buying a diesel. That said, diesel was a slightly more popular fuel choice than PHEVs for the other, non-leading racial/ethnic groups. Diesel was the choice of 1.4% of Hispanic/Latino respondents, 0.5% of Asian American respondents, and 0.4% of Black respondents, while PHEVs were the choice of 0.8% of Hispanic/Latino respondents, 0.7% of White respondents, and 0.6% of Black respondents. Together, respondents reported purchasing PEVs (BEVs+PHEVs) at the following rates, by racial/ethnic group: 7.3% of Asian American respondents; 2.3% of Black respondents; 2.3% of Hispanic/Latino respondents; and 2.2% of White respondents.

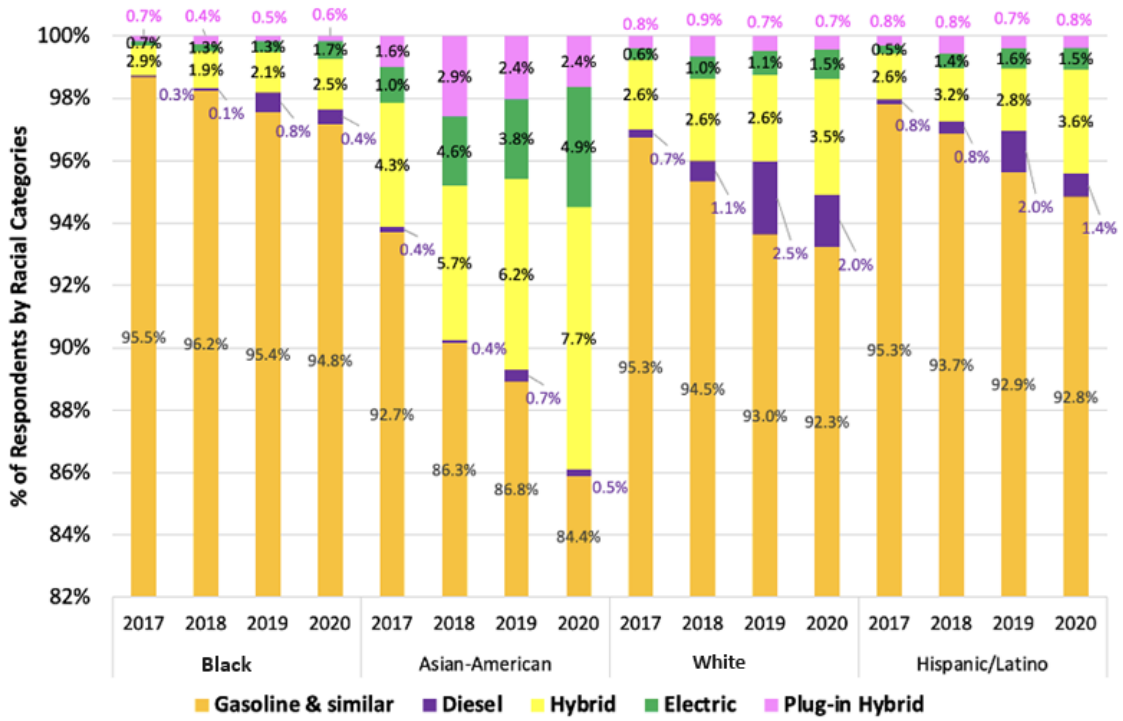


Figure 41: Fuel types of purchased vehicle models by race, in 2023. **Source:** NVCS

Figure 42 shows how respondents to the 2023 EVCS, as grouped by racial/ethnic category, are distributed across the options of “very likely,” “somewhat likely,” “somewhat unlikely,” or “very unlikely” to consider a BEV for their next vehicle purchase or lease. The highest percentage of EVCS respondents who are “very” or “somewhat” likely to consider a BEV, by racial/ethnic category, is Asian Americans, at 75%. This is followed by Black respondents (67%), Hispanic/Latino respondents (65%), and White respondents (59%). This indicates that the majority of vehicle buyers in the EVCS, regardless of racial/ethnic category, are willing to consider BEVs for their next purchase or lease.

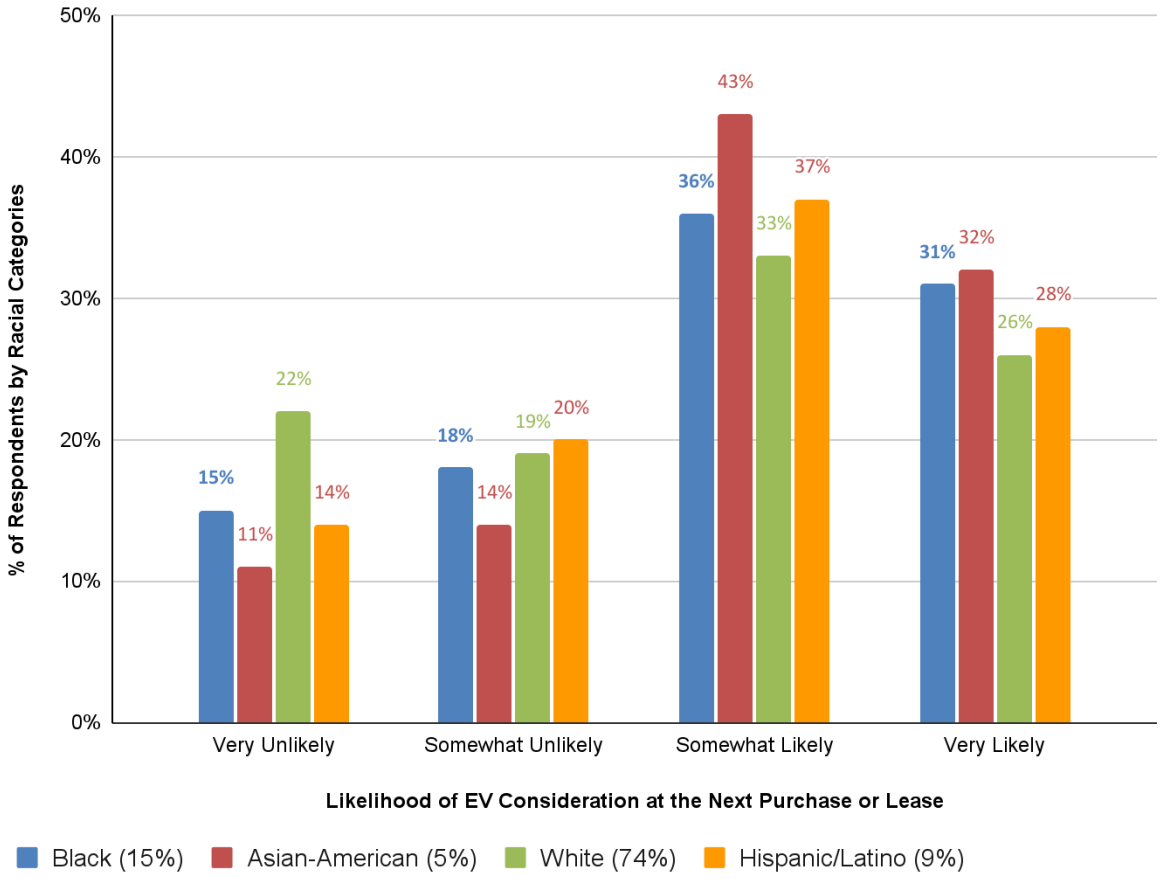


Figure 42: Likelihood of BEV consideration by race, in 2023. Labels on the x-axis list EVCS representation of each group, overall. **Source:** EVCS

PEV purchase and BEV rejection reasons today

As discussed in section 2.3.2, the EVCS and EVOS do not have a full overlap of consumer demographic characteristics. The EVCS includes information on a respondent's racial/ethnic group identification, but the EVOS does not. As a result, for this one demographic characteristic, we are not able to look at data on why a respondent with a given racial/ethnic identification chose the PEV they purchased. As a substitute for this question, here we consider an EVCS question posed to BEV considers who stated they are "very" or "somewhat" likely to consider a future BEV purchase. After asking these BEV considerers what their top choice BEV model would be, the question asks the respondent to mark every reason that applies to their reasoning for why that model would be their top choice.

Figure 43 shows how these 2023 EVCS BEV considerers, as differentiated by the four racial/ethnic group categories explored in this section, reported their reasons for choosing the BEV they identified. Note that the response categories here differ from those in other places in the report, although we coded them to the Table 2 code scheme and placed them in the order of Figure 6, as in other sections. As with BEV rejecters in the EVCS, there is not a clear fuel economy reason offered to respondents in the EVCS as a potential reason for considering a particular vehicle for purchase. There are also many reasons offered to respondents that do not relate directly to the vehicle itself as much as they do to the purchase process, policy, and charging infrastructure.

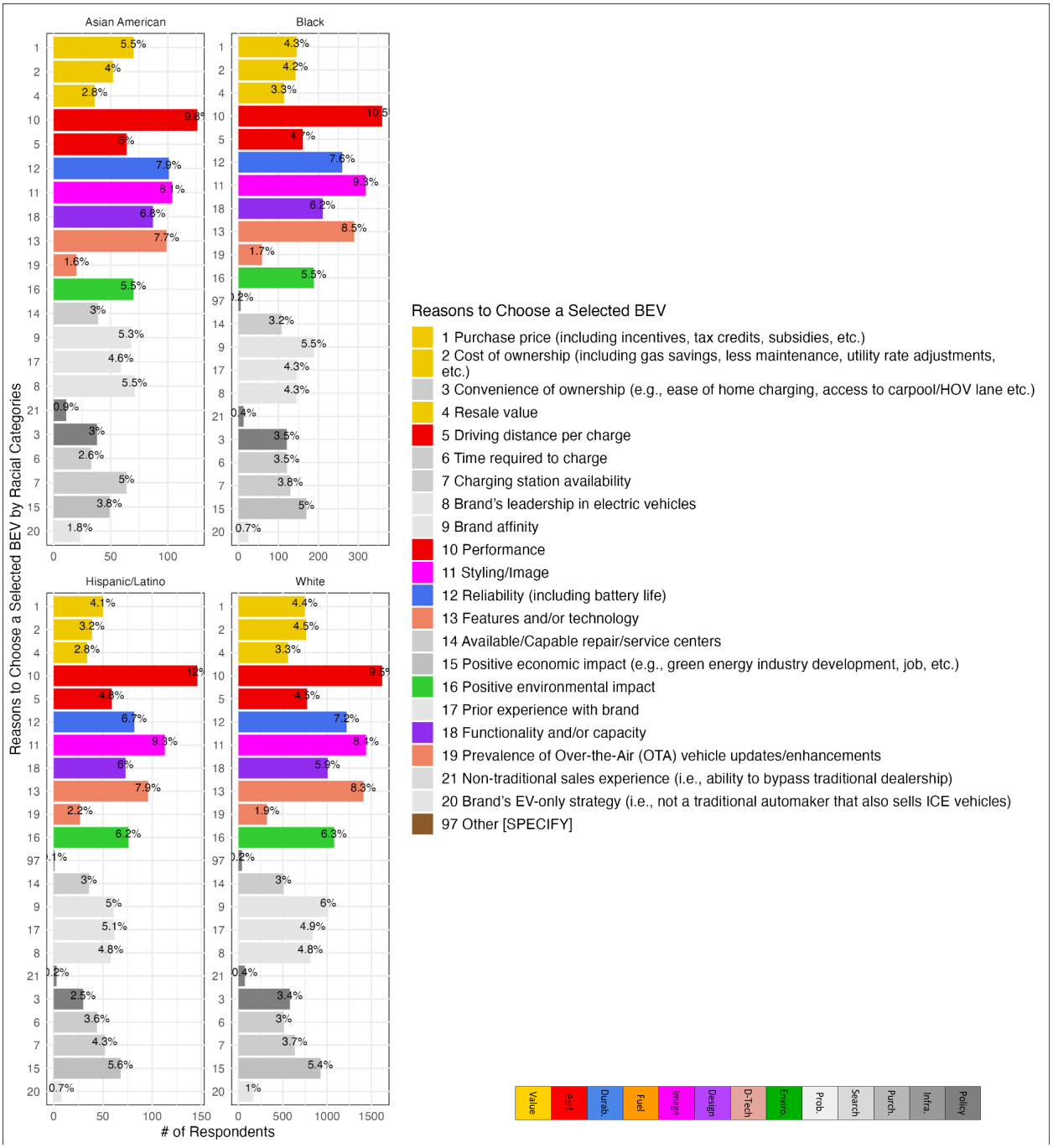


Figure 43: Commonality of BEV consideration reasons by racial/ethnic group. **Source:** EVCS

In Figure 43, the most commonly cited reason for every demographic group was "performance." This was highest for Hispanic/Latino respondents (12%), followed by Black (10.5%), Asian American (9.8%) and White respondents (9.5%). The second most commonly cited vehicle selection reason for all groups was "styling/image" (9.3% of Black and Hispanic/Latino respondents, 8.4% of White respondents, and 8.1% of Asian American respondents). The third most commonly cited vehicle selection reason for three of the four racial/ethnic groups was "features and/or technology" (8.5% of Black respondents, 8.3% of White respondents, and 7.9% of Hispanic respondents). For those same three groups, the fourth most commonly cited vehicle

selection reason was “reliability (including battery life).” By contrast, the third most commonly cited vehicle selection reason for Asian American respondents was “reliability (including battery life),” which 7.9% of Asian American respondents said was important to their selection, just edging out “features and/or technology” at 7.7%.

Two other observations of respondent reasoning regarding vehicle attributes, as presented in Figure 43, are worth noting here. First, “positive environmental impact” was moderately important across all four groups, with 6.3% of White respondents listing it, as well as 6.2% of Hispanic/Latino respondents, and 5.5% of both Black and Asian American respondents. Second, value criteria were much less prominent as a reported reason for vehicle selection in EVCS as opposed to vehicle purchase in the EVOS. “Purchase price (including incentives, tax credits, subsidies etc.)” was listed by all four groups in a range of 4.1-5.5%. “Cost of ownership (including gas savings, less maintenance, utility rate adjustments, etc.)” was listed at an even lower rate, in the range of 3.2-4.5% of respondents across the four racial/ethnic groups.

Non-vehicle reasons for vehicle selection were, on the whole, less frequently cited as reasons for a BEV model choice by BEV considerers in the EVCS, and there was more variation in the commonality of citation by different racial/ethnic groups than there was for vehicle attributes. The most frequently cited non-vehicle reason for vehicle selection was “brand affinity” for White and Black respondents (6% and 5.5% of these respondents listed this, respectively). The most frequently cited non-vehicle reason for vehicle selection by Asian American respondents, however, was “brand’s leadership in EVs,” at 5.5% of these respondents. The most frequently cited non-vehicle reason for vehicle selection by Hispanic/Latino respondent was “positive economic impact (e.g., green energy industry development, jobs, etc.),” at 5.6% of these respondents; this policy factor was also listed as the second most commonly cited non-vehicle rationale for vehicle selection by White and Black respondents (at 5.4% and 5% of these groups, respectively). The second most commonly cited non-vehicle reason for vehicle choice by Asian American respondents was “brand affinity,” with 5.3% of respondents in this group selecting it, while it was “prior experience with brand” for Hispanic/Latino respondents, with 5.1% of these respondents reporting it. Only two other non-vehicle attributes were listed as selection reasons by greater than or equal to 5% of the respondent members of one of the four racial/ethnic categories listed here: “charging station availability” (listed by 5% of Asian American respondents), and “brand affinity” (listed by 5% of Hispanic/Latino respondents).

Figure 44 differentiates respondents who were “very unlikely” or “somewhat unlikely” to consider a BEV for their next purchase or lease in the 2023 EVCS by the four racial/ethnic group categories explored in this section, then presents the factors each group reported as important to their low consideration of BEVs. The most frequently cited factor in low consideration of PEVs for each group except White respondents was “purchase price,” with 11.2% of Asian American respondents, 10.7% of Hispanic/Latino respondents, and 10.4% of Black respondents listing it as a factor. For White respondents, the most frequently cited factor was “lack of charging station availability,” which was listed by 10.1% of this demographic group. The second most commonly cited factor underlying low consideration of BEVs differed more across racial/ethnic groups: for Asian American BEV rejecters, “time required to charge” was listed by 9.6% of respondents from this group; “lack of charging station availability” was listed by 9.2% of Hispanic/Latino BEV rejecters and 9.1% of Black BEV rejecters; and “purchase price” was listed by 9.7% of White BEV rejecters. The third most common factor varied even more, across demographic groups: 9.1% of Asian American BEV rejecters listed “lack of charging station availability”; 7.6% of Black BEV rejecters listed “inability to charge at home or work”; 7.6% of Hispanic/Latino BEV rejecters listed “cost of ownership”; and 9.1% of White BEV rejecters listed “limited driving distance per charge.” We note that as in other cross-cuts of BEV rejecters, the factors that appear to more

commonly underly low consideration of BEVs, across groups, tend to be non-vehicle attributes. The main exception here is purchase price and limited driving distance per charge.

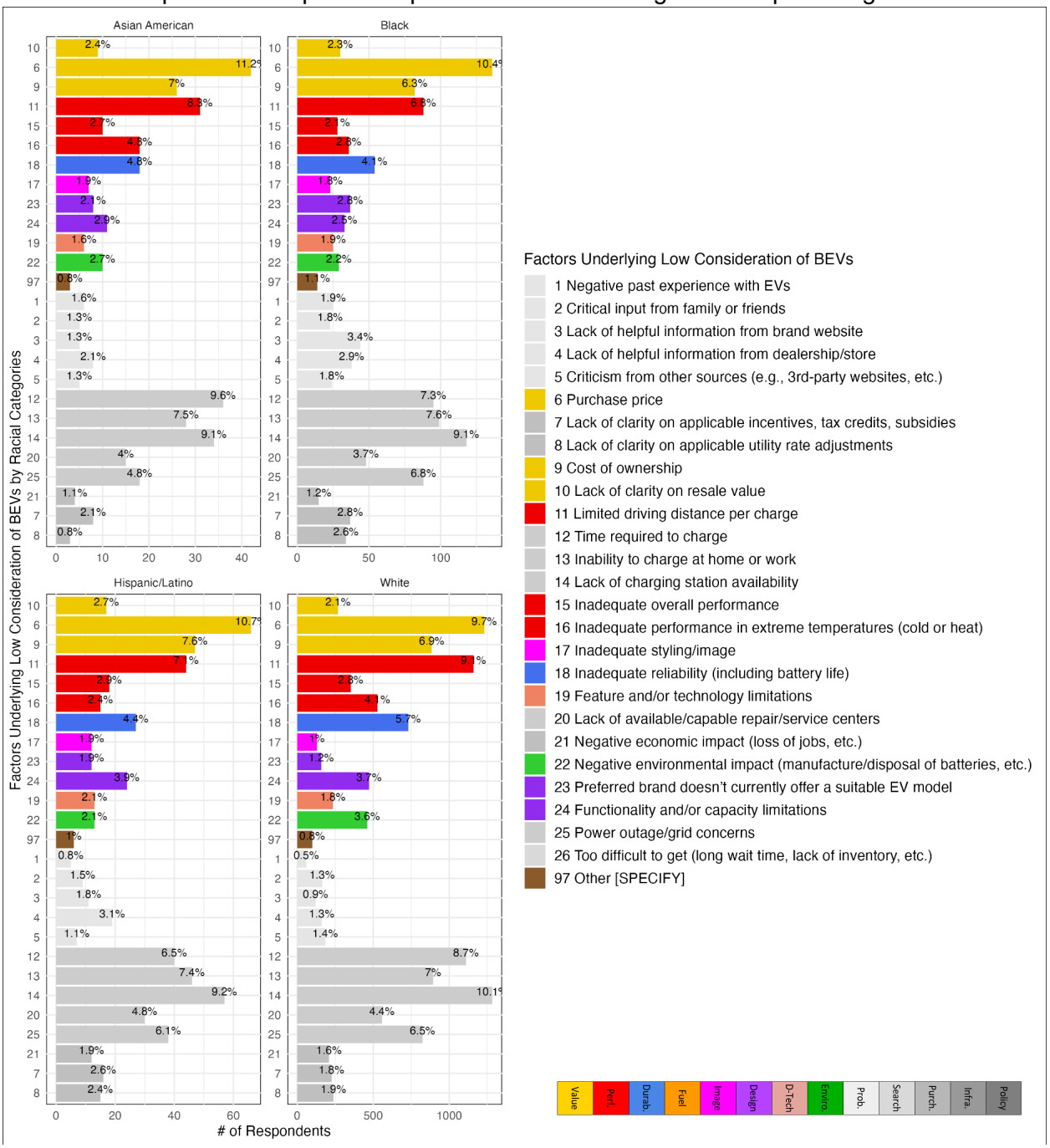


Figure 44: Commonality of BEV non-consideration reasons by racial/ethnic group. **Source:** EVCS

3.3.7 Other demographic characteristics

In this section, we briefly explore available information on the educational attainment, homeownership status, and housing type of BEV considerers, PEV purchasers, and BEV rejecters, as data allows. Note that less detailed data are available for these demographic characteristics than for the characteristics discussed above.

PEV acceptance over time: Education

Early PEV buyers were predominantly highly educated; in 2012, close to 90% of PEV owners had a bachelor's or advanced degree, far more than the U.S. average (Axsen and Kurani 2013). This tendency is also evident in more recent NVCS data.

Figure 45 shows MY2015-2020 NVCS data on the purchased vehicles of survey respondents, as broken down by five categories based on educational attainment level: some high school; high school; trade school/community college; bachelor's; and graduate. Note that a problem arose with the data for MY 2019 and 2019 such that we could not identify a bachelor's category in those years. The five vehicle "fuel types" in Figure 45 are gasoline and similar; diesel; traditional hybrid electric vehicle that cannot be plugged in; BEV; and PHEV). Note that, as in Figure 20, Figure 21, and Figure 41, the y-axis is truncated so we can better observe trends with respect to non-gasoline fueled vehicles. This is because gasoline and similar fuels represent the overwhelming majority of all vehicles purchased in this period. In MY2020, 95.7% of people with less than high school educations purchased gasoline vehicles, as did 94.3% of people with high school educations, 92.2% of people with trade school or community college educations, and 89.9% of people with graduate education. The most recent NVCS data we have on people with bachelor's education show 94.8% of them purchased gasoline vehicles in MY2018.

As mentioned previously, traditional hybrid electric vehicles that cannot be plugged in became a more prominent share of the overall vehicle population in the years covered in Figure 25. By MY2020, 6% of people with graduate education reported purchasing a traditional hybrid electric vehicle, followed by 4.2% of people with trade school or community college education, 2.9% of people with a high school education, and 1.8% of people with some high school. By MY2018, the last NVCS year available with information on bachelor's education, 2.9% of people with bachelor's education reported purchasing a traditional hybrid electric vehicle.

BEVs and PHEVs were less common. Together, respondents reported purchasing PEVs (BEVs+PHEVs) at the following rates in MY2020, by education level: 3.2% of people with graduate education; 2.3% of people with trade school or community college education; 0.7% of people with a high school education, and 0.6% of people with some high school. In MY2018, 2.1% of people with bachelor's education reported purchasing a PEV.

These traditional hybrid electric vehicle and PEV trends tend to show an association with education level, although it is worth noting that: (1) levels of adoption are low across all education levels; and (2) even in MY2020, people with every type of reported education level purchased PEVs.

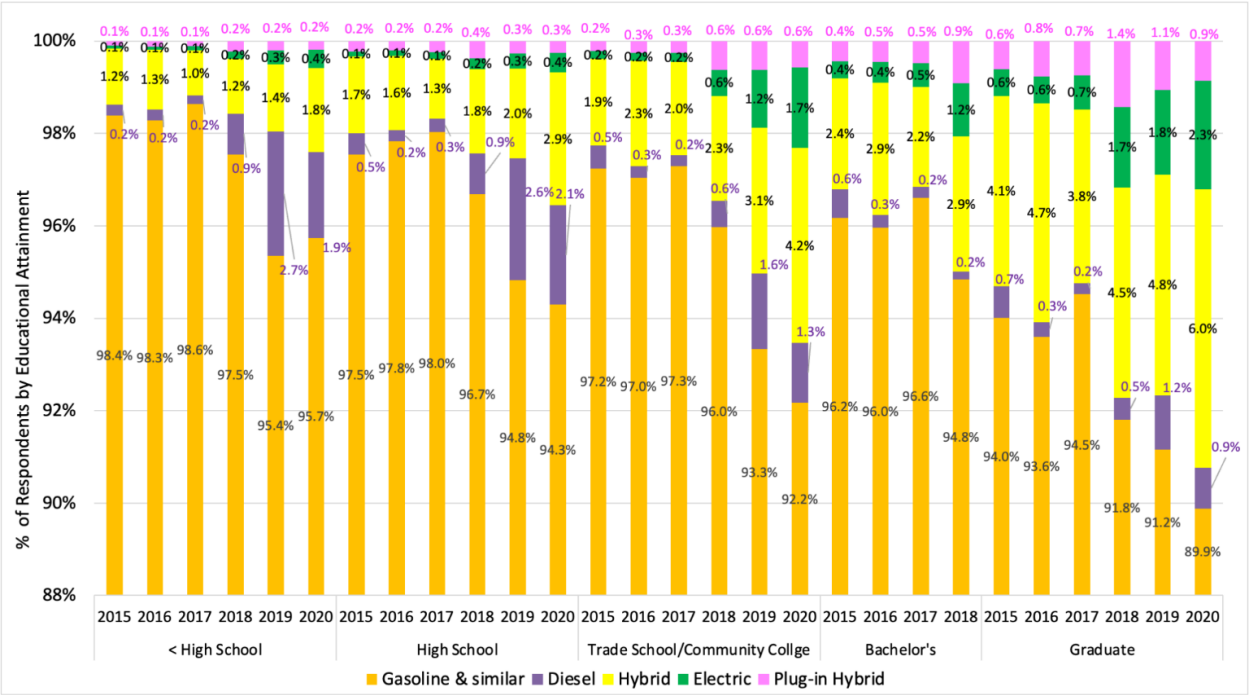


Figure 45: Fuel type of purchased vehicles by level of education. Respondent coding by bachelor's did not occur in the data we had available for MY 2019 and 2020. **Source:** NVCS

PEV purchase reasons today: Education

As discussed in section 2.3.2, the EVCS and EVOS do not have a full overlap of consumer demographic characteristics. The EVOS includes information on a respondent's level of educational attainment, but the EVCS does not. As a result, we are not able to use the EVCS to appreciate how likely a respondent with a given level of education is to consider a BEV for their next vehicle purchase or lease. This means that we are also unable to look at the data that builds from this information with respect to BEV considerers and BEV rejecters. Instead, we only have data available to analyze based on the educational attainment level of people who bought PEVs and responded to the MY 2023 EVOS.

Figure 46 shows how respondents of different education levels – as grouped by high school or less (i.e., "some high school"), some college or associate's degree (i.e., "some college"), bachelor's degree (i.e., "bachelor's), and graduate or professional degree (i.e., "graduate") – responded to the 2023 EVOS about why they chose the PEV they purchased. "Model design and styling" (design) was the most commonly cited reason for three of the educational cohorts in Figure 46, with 11.4% of respondents with some college listing it as one of their reasons for purchase, followed by 11% of both graduate and bachelor's education respondents citing it. "Expected lower running costs" (value) was, by contrast, the most frequently cited reason provided by people with some high school education, with 12.6% of these respondents citing it.

The rank of second most commonly cited reason varies more across education groups. For graduate and bachelor's degree respondents to the EVOS, "driving performance" (performance) was the second most commonly cited reason (given by 10.4% of bachelor's and 10.2% of graduate educated respondents. For people with some college education, "expected lower running costs" (value) was the second most commonly reported reason (10.5% of people with some college cited it). And for people with some high school education, "model design and

styling" (design) was the second most commonly cited reason for purchase (10.6% of those with some high school education cited it).

The third most commonly cited reason for PEV purchase was different for each education level. "Expected quality and reliability" (durability) was cited by 10.2% of those with graduate education, in a tie with "driving performance" (performance). "Expected lower running costs" (value) was cited by 10.2% of those with bachelor's level education. "Driving performance" (performance) was cited by 10.1% of those with some college. And "expected quality and reliability" (durability) was cited by those with some high school education, similar to those with graduate education.

Finally, we note that the most commonly cited non-vehicle reason for PEV purchase which people of all levels of education mentioned was "tax credits or other incentive programs for this vehicle" (value), at a range of 8.5%-9.6% of the respondent group.

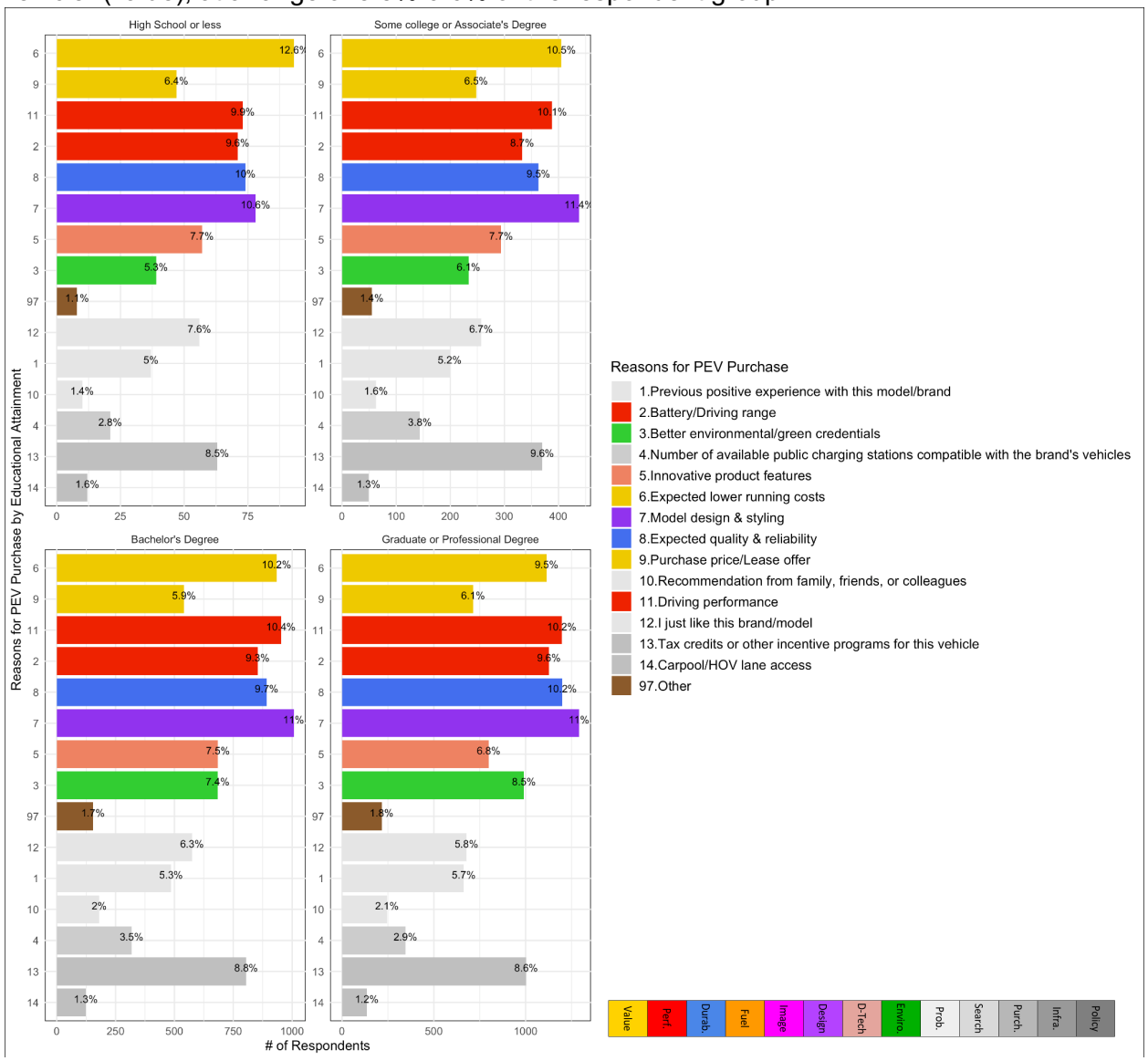


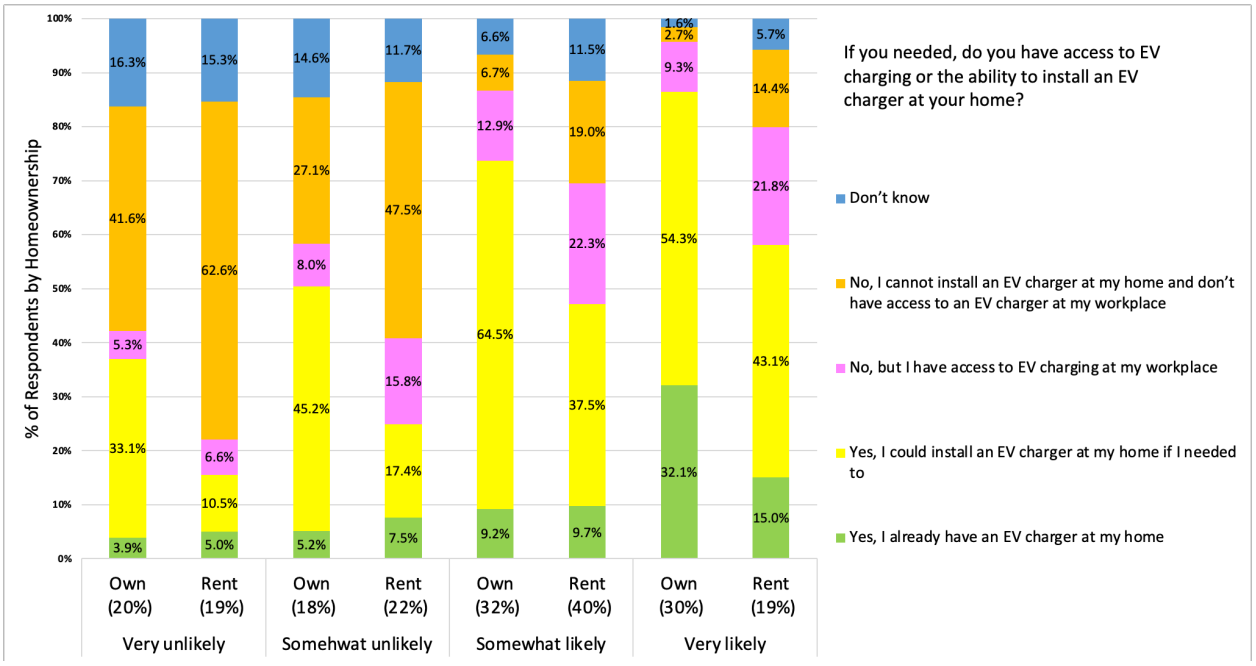
Figure 46: Commonality of PEV purchase reasons by education. **Source:** EVOS

PEV acceptance over time: Homeownership

Although the older primary data sources – NVES and NVCS – we use in other sections of this report did not have the appropriate data fields to allow us to assess PEV acceptance trends by homeowners and renters over time, we were able to get a broad sense of this topic by using Residential Energy Consumption Survey (RECS) data from 2020 and 2015 (U.S. Energy Information Administration, 2020). In the RECS data for 2015, although PEV adoption was still uncommon overall, homeowners in 2015 were about twice as likely to have an EV as were renters. By the time of the 2020 RECS, homeowners were more than three times as likely to have an EV as were renters.

These findings align with the prior work of other researchers. This body of work includes Ge et al. (2021), which showed that the majority of PEVs are owned by single-family homeowners, with multi-family dwelling residents and renters facing charging challenges. It also includes Lee et al. (2019), which finds from survey data that about 85% of California PEV adopters between 2012 and 2017 were homeowners. Similarly, Axsen and Kurani (2013) found that over 90% of PEV owners were homeowners.

Figure 47 groups respondents to the 2023 EVCS by (1) whether they own or rent their homes; (2) how owners and renters are distributed across the options of "very likely," "somewhat likely," "somewhat unlikely," or "very unlikely" to consider a BEV for their next vehicle purchase or lease;[12] and (3) how they respond to the question, "If needed, do you have access to EV charging or the ability to install an EV charger at your home?" Figure 47 normalizes the results on a percentage basis in order to illustrate the importance of charging options to owners and renters, as well as to BEV consideration and BEV rejection.



[12] 30% of owners are very likely to consider BEVs, 32% are somewhat likely, 18% are somewhat unlikely, and 20% are very unlikely. By contrast, 19% of renters are very likely to consider BEVs, 40% are somewhat likely, 22% are somewhat unlikely, and 19% are very unlikely.

Figure 47: Likelihood of BEV consideration by homeownership status and access to a home charger, 2023. **Source:** EVCS

Figure 47 has several takeaways. First, it indicates that most homeowners – with the exception of those who are "very unlikely" to consider a BEV for their next vehicle purchase – expressed that they either already have or could install an EV charger at home "if I needed to."

Second, it shows that the majority of people who consider themselves "very" or "somewhat" likely to purchase a BEV in the future – regardless of homeownership status – have some form of charging access, either at home or at work (the pink, yellow, and green bars in Figure 47). The converse generally holds true as well, with the majority of people who believe that they are "very" or "somewhat" unlikely to consider a BEV in the future (the BEV rejecters) either stating that "I cannot install an EV charger at my home and don't have access to an EV charger at my workplace" or that they don't know if they have access to charging or the ability to install a charger at home. The one exception to this characterization of BEV rejecters in Figure 47 is homeowners who are "somewhat unlikely" to consider a BEV for their next purchase. Just under 60% of these homeowners either already have a home EV charger and/or access to a charger at work, or could install a charger at home if necessary.

Third, Figure 47 shows that having access to EV charging at work appears to be a major factor in increasing the likelihood that a renter will consider purchasing a BEV. Renter access to workplace charging is associated with renter consideration and rejection of BEVs as follows: 21.8% of renters who are very likely BEV considerers have workplace charging; 22.3% of renters who are somewhat likely BEV considerers have workplace charging; 15.8% of renters who are somewhat unlikely to consider a BEV (i.e., mild BEV rejecters) have workplace charging; and 6.6% of renters who are very unlikely to consider a BEV (i.e., strong BEV rejecters) report having workplace charging.

PEV purchase and BEV rejection reasons today: Homeownership

Figure 48 shows how homeowners and renters responded to the 2023 EVOS about why they chose the PEV they purchased. The reasons that owners most commonly cited as reasons for their vehicle selection were: (1) "model design and styling" (design, at 11.1%); (2) "driving performance" (performance, at 10.3%); and (3) a tie (at 10%) between "expected lower running costs" (value) and "expected quality and reliability" (durability). The reasons that renters most commonly cited as reasons for their vehicle selection were: (1) "model design and styling" (design, at 10.2%); (2) "expected lower running costs" (value, at 9.7%); and (3) a tie (at 9.3%) between "driving performance" (performance) and "tax credits or other incentive programs for this vehicle" (a non-vehicle attribute of policy, in this case as associated with value).

This latter non-vehicle attribute is the most important of the non-vehicle attributes for both owners and renters. Owners cited it at a rate of 8.7%, at a ranking of sixth criteria overall.

Finally, as with other demographic cuts, we see that the values associated with the EV driver archetype, i.e., technology and environment, are cited at a modest frequency by both homeowners and renters. "Innovative product features" (design – technology) was cited by 7.1% of owners and 7.7% of renters, while "better environmental/green credentials" (environment) was cited by 7.6% of owners and 7.3% of renters.

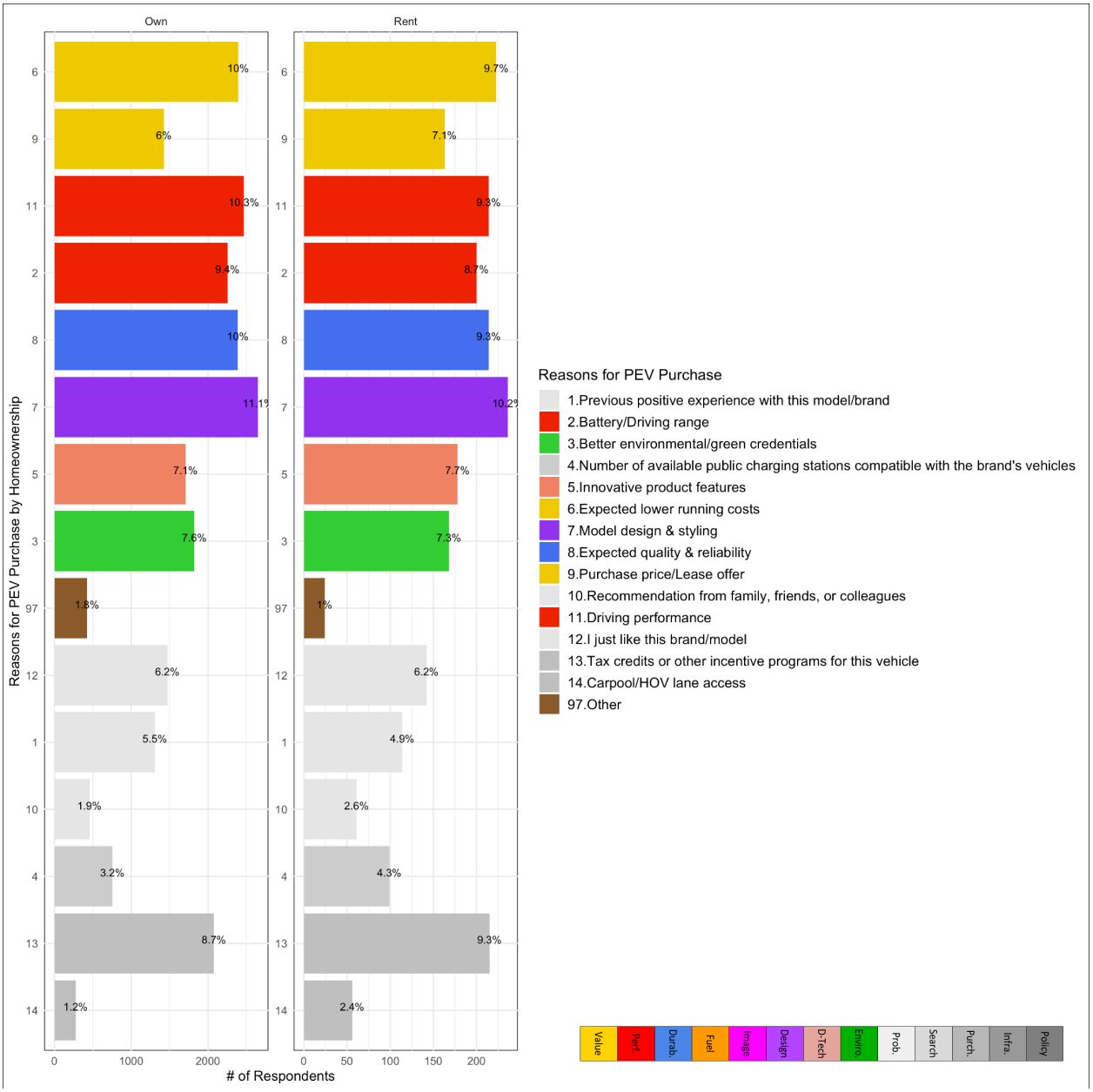


Figure 48: Commonality of PEV purchase reasons by homeownership. **Source:** EVOS

Figure 49 differentiates respondents who were "very unlikely" or "somewhat unlikely" to consider a BEV for their next purchase or lease in the 2023 EVCS – BEV rejecters – according to whether they own or rent their homes. Homeowners who are BEV rejecters cited the following factors most frequently as underlying their low consideration of BEVs: (1) "lack of charging station availability (a non-vehicle attribute tied to infrastructure, cited by 10% of homeowners); (2) "purchase price" (value, cited by 9.6%); (3) "limited driving distance per charge" (performance, cited by 9.4%); and (4) "time required to charge" (a non-vehicle attribute tied to infrastructure, cited by 9% of homeowners).

Renters who are BEV rejecters, by contrast, cite the following factors most frequently as underlying their low consideration of BEVs: (1) "purchase price" (value, cited by 10.3%); (2) "lack of charging station availability" (a non-vehicle attribute tied to infrastructure, cited by 9.9%);

(3) “inability to charge at home or work” (a non-vehicle attribute tied to infrastructure, cited by 8.2%); and (4) time required to charge (a non-vehicle attribute tied to infrastructure, cited by 7.5%).

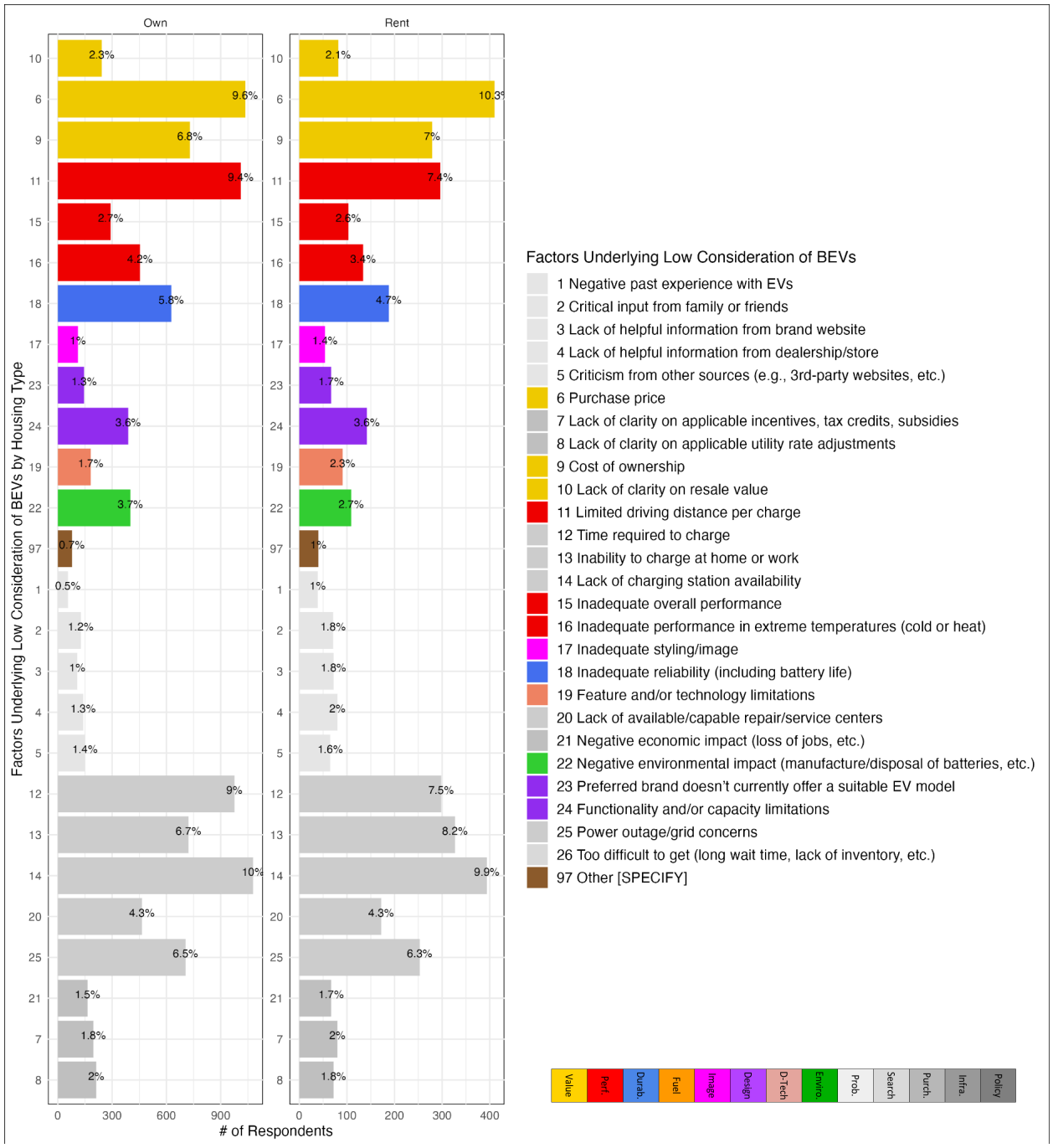


Figure 49: Commonality of BEV non-consideration reasons by homeownership. **Source:** EVCS

PEV purchase and BEV rejection reasons today: Housing type

The type of residential housing of people who are considering purchasing a PEV or who reject the idea of purchasing a PEV has been relatively understudied, when compared to other demographic characteristics. Here we provide an initial look at the housing type of respondents to the MY2023 EVOS and EVCS.

Figure 50 shows how frequently respondents to the MY2023 EVOS – grouped either as residents of single-family homes (labeled “single family” here) or residents of apartments, condominiums, or duplexes (labeled “multi-family” here) – reported various reasons to be important to their PEV purchase. Residents of single family and multi-family homes shared the following two reasons as their most and second-most commonly cited reasons for purchase: (1) “model design & styling” (design, which 11.1% of single-family respondents cited and 10.8% of multi-family respondents cited); and (2) “driving performance” (performance, which 10.3% of single-family respondents cited and 9.8% of multi-family respondents cited, the latter in a tie with the durability criterion of “expected quality and reliability.”

Single family respondents also cite other reasons as important, in the following frequency order: (3) “lower running costs” (value, cited at 10% in a tie with the durability criterion of “expected quality and reliability”); (4) “battery driving range” (performance, cited by 9.5%); and (5) “tax credits or other incentive programs for this vehicle” (a non-vehicle attribute of policy that is associated with value, cited by 8.7%). Multi-family respondents, by contrast, cited: (3) “expected quality and reliability” (durability, cited by 9.8%); (4) “expected lower running costs” (value, cited by 9.7%); and (5) “tax credits or other incentive programs for this vehicle” (a non-vehicle attribute of policy that is associated with value, cited by 9%).

“Design – technology” and “environment,” the values associated with the EV driver archetype, were again cited at a modest frequency by single-family and multi-family respondents to the EVOS as reasons for purchasing their PEVs. “Innovative product features” (design – technology) was cited by 7.4% of multi-family respondents and 7.2% of single family respondents, while “better environmental/green credentials” (environment) was cited by 8% of multi-family respondents and 7.7% of single family respondents.

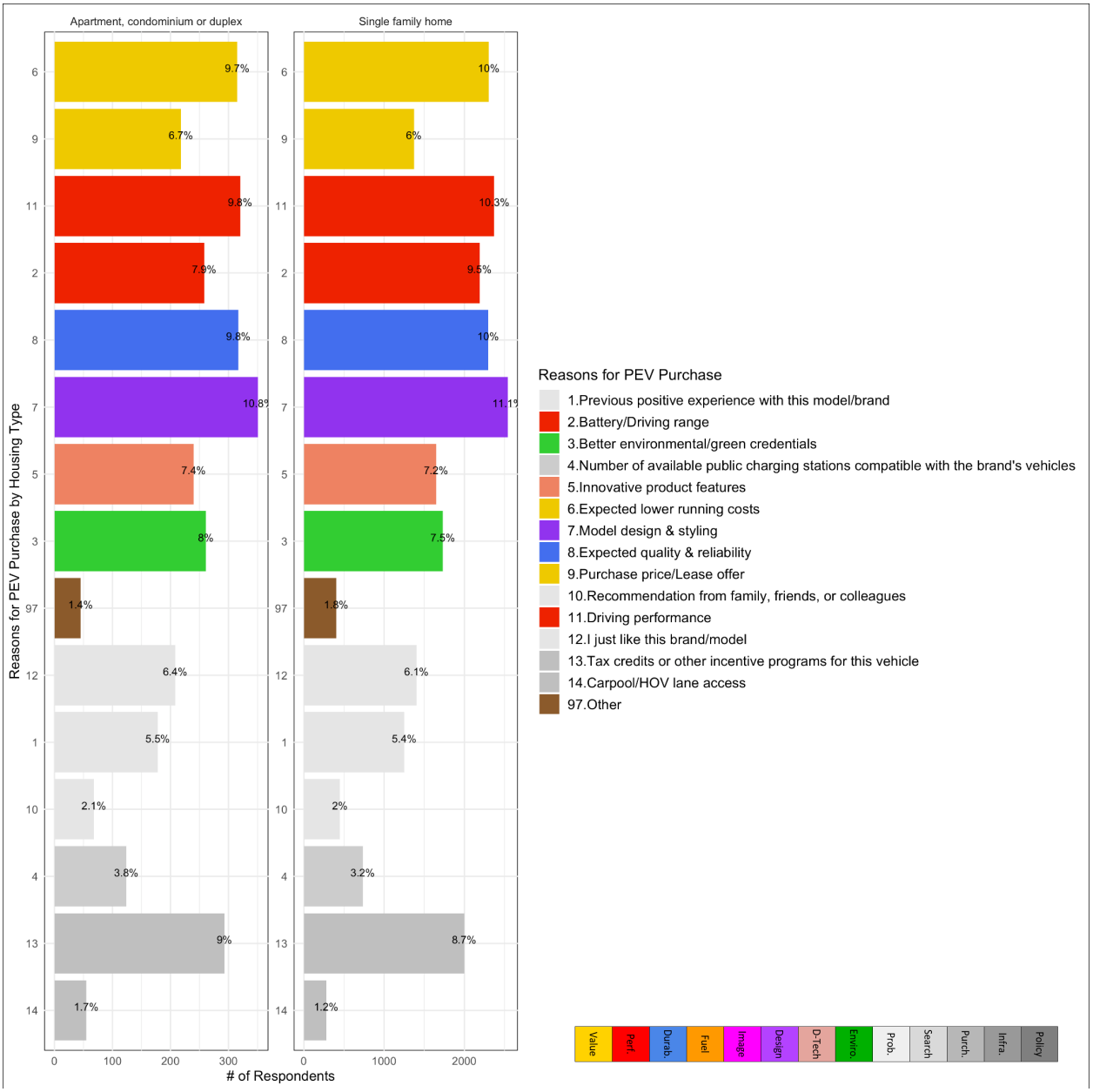


Figure 50: Commonality of PEV purchase reasons by housing type. **Source:** EVCS

Figure 51 shows which factors single-family and multi-family respondents to the 2023 EVCS who were "very unlikely" or "somewhat unlikely" to consider a BEV for their next purchase or lease reported as underlying their low consideration of BEVs. In Figure 51, BEV rejecters who reside in single family homes cited the following factors most frequently: (1) "lack of charging station availability" (a non-vehicle attribute tied to infrastructure, cited by 9.7%, in a tie with the value criterion of "purchase price"; (2) "limited driving distance per charge" (performance, cited by 9.1%); and (3) "time required to charge" (a non-vehicle attribute tied to infrastructure, cited by 8.6%). Meanwhile, BEV rejecters who reside in multi-family homes cited the following: (1) "lack of charging station availability" (a non-vehicle attribute tied to infrastructure, cited by 10.8%); (2) "purchase price" (value, cited by 10.3%); (3) "inability to charge at home or work" (a non-vehicle attribute tied to infrastructure, cited by 8.7%); and (4) "time required to charge" (a non-vehicle attribute tied to infrastructure, cited by 8.4%).

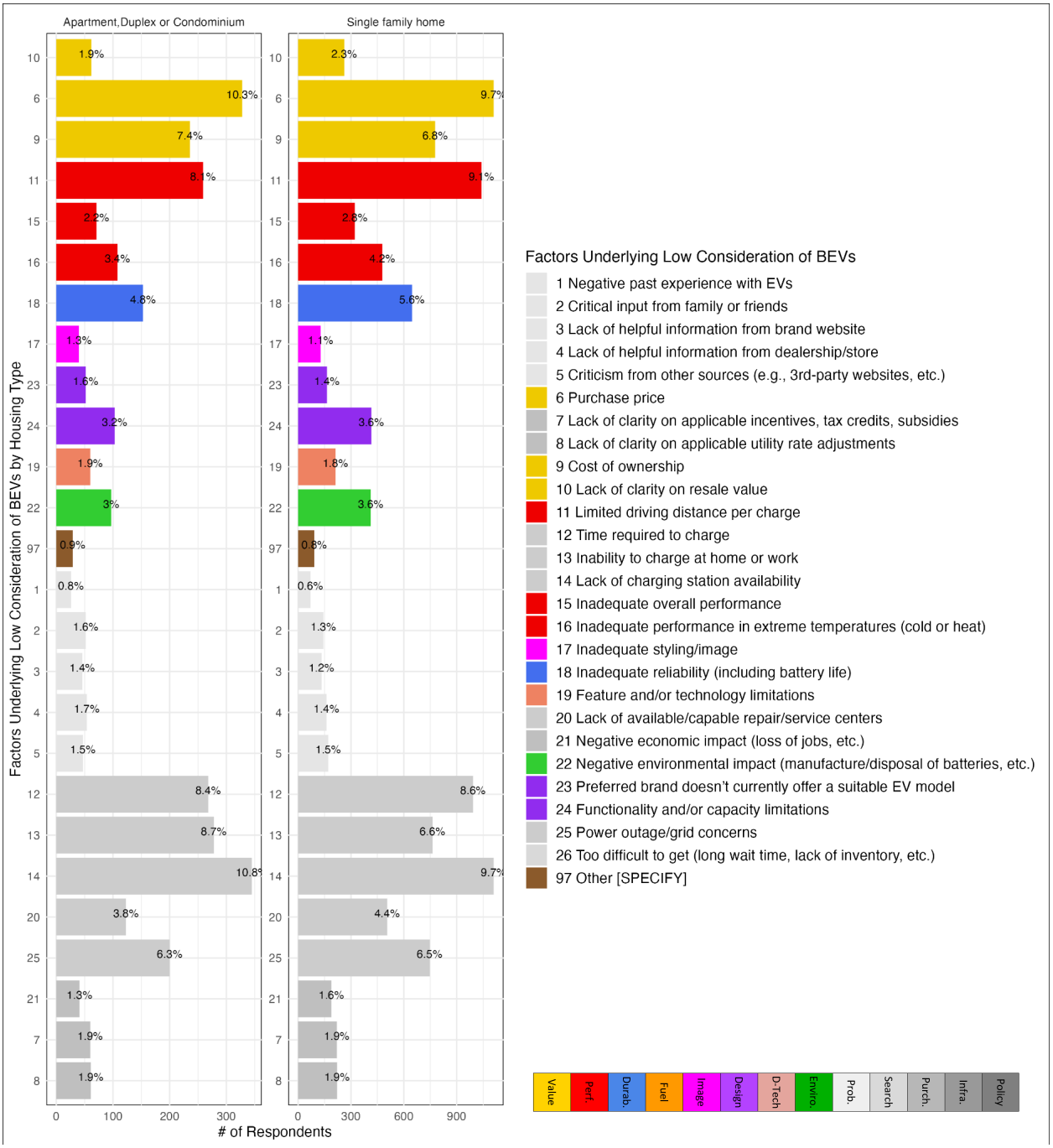


Figure 51: Commonality of BEV non-consideration reasons by housing type. **Source:** EVCS

4. DISCUSSION

This discussion section has two parts: (1) a summary of results; and (2) a set of reflections on the EV driver archetype.

4.1 Summary of results

The introduction to the report provided a brief overview of changes in the U.S. offerings of battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs) over model year (MY) 2016-23, according to body style, range, and price. There has been an increasing diversity of BEV and PHEV offerings by body style over these years which is expected to continue, although this increase is coupled with a decline in hatchback offerings, a subtype of the sedan/wagon body style which had long dominated BEV body styles before this period. With respect to the median electric range of BEV and PHEV model offerings in MY 2016-23, it is noteworthy that BEV electric range grew dramatically over these years while PHEV electric range stayed generally unchanged at levels only about a tenth of that of BEVs, throughout the period. Finally, this section pointed out that the price gap between higher-priced BEVs and conventional internal combustion engine (ICE) vehicles has generally been closing.

With the changing supply side context of electrified drive train vehicles thus introduced, most of the report focused on the evolving demand for PEVs, which encompasses both BEVs and PHEVs. Section 2 introduced key terminology and described the data sources and methods we used to discuss this changing demand. Section 3 presents information on the characteristics of the shopper and buyer of new vehicles, and of the shopper, buyer, and rejecter of new PEVs, over the period MY2014-23. Section 3.1 reflects on what it means for someone to "own" a PEV in recent years. With about 90% of PEV owners part of multi-car households, like the majority of U.S. households, it is clear that PEV ownership cannot easily be defined as a binary variable of "Yes PEV" versus "No PEV." PEV ownership should perhaps best be represented as a categorical variable with the categories of "PEV Only," "PEV-And," and "Only Not PEV." Note that 49-52% of suburban and rural respondents, respectively, and 61% of urban respondents to the 2023 EVCS state that they expect to be in the "PEV Only" category within four years (see Figure 29).

Section 3.2 considers the preferences of all U.S. new vehicle shoppers during the MY2014-23 period, first in terms of body style – in keeping with Figure 1 – and then in terms of other vehicle and non-vehicle attributes. Generally understood as a non-compensatory shopping criteria for vehicle shoppers, body style limitations on the PEVs offered for sale in the U.S. have long been considered a barrier to PEV adoption. Before the MY 2016-23 period, the limited existing PEV body style offerings were dominated by hatchbacks, a less popular body style overall in the U.S. market, and did not include the very popular sport utility vehicle (SUV) body style. The SUV body style is particularly non-negotiable for U.S. new vehicle buyers. Table 3, which examines NVES and NVCS data on the vehicle a consumer purchased and the vehicle the consumer alternatively considered, demonstrates the "stickiness" of consumer preferences regarding body style, in general, and regarding pickup trucks and SUVs, in particular.

Section 3.3 explores the preferences of U.S. new vehicle shoppers as they relate to PEVs. This includes people who ultimately buy PEVs, but also those who are "very" or "somewhat" likely to consider a BEV for their next purchase or lease (BEV considerers), and those who are "very" or "somewhat" unlikely to consider a BEV for their next purchase or lease (BEV rejecters). Section 3.3 begins by considering the overall population of PEV owners, BEV considerers, and BEV rejecters, then proceeds to explore demographic cross-cuts of MY2023 data. These demographic characteristics include those of direct relevance to the EV driver archetype – income, degree of urbanicity, gender, age, race/ethnicity, educational attainment, and homeownership – as well as housing type. For each of these demographic characteristics, the pertinent subsection of 3.3 first considers PEV acceptance over time before it delves into the reported reasoning of vehicle shoppers either to purchase the PEV they bought or to not

consider BEVs at all. This detailed demographic exploration allows us to highlight the current status of the various facets of the EV driver archetype. It also allows us to better understand current BEV rejecters, helping to guard against any framing of the non-EV driver on the basis of oppositional heuristics to particular demographics of the EV driver archetype.

We began section 3.3 by focusing on income and vehicle price. Figure 22 shows that as of 2023, a majority of all EVCS respondents of all income groups could be characterized as BEV considerers (i.e., the respondents are very or somewhat likely to consider a BEV for their next vehicle purchase or lease). This may reflect the fact that BEVs now exist at multiple price points, both in the new and used vehicle markets. In addition, the shrinking upfront price gap between PEVs and ICE vehicles, mentioned above, is even smaller for many consumers today because of tax credits, rebates, and other policy incentives.

Section 3.3 moved next to focus on urbanicity as it relates to PEV acceptance. As the earliest instances of PEV adoption were concentrated in urban areas, it is perhaps no surprise that PEV purchase and BEV consideration rates remain higher in urban, versus non-urban areas. Nevertheless, Figure 26 shows that more than half of rural respondents to the 2023 EVCS could be characterized as BEV-considerers (i.e., the respondents are very or somewhat likely to consider a BEV for their next vehicle purchase or lease). This represents a substantial increase from the 21% of rural respondents who expressed willingness to consider a BEV purchase in Singer (2017). In addition, Figure 28 demonstrates how BEV rejection (i.e. respondents are very or somewhat unlikely to consider a BEV for their next vehicle purchase or lease) declines dramatically for rural, suburban, and urban new vehicle shoppers when their physical experience of BEVs increases from the level of none to that of having had any past experience as a BEV passenger. Never having been in a BEV is tied to BEV rejection for rural respondents at a rate of over 60%, suburban respondents at over 50%, and urban respondents at under 50%. Meanwhile, an experience as a passenger in a BEV is tied to BEV rejection for respondents at a rate of just over 30% for both rural and suburban respondents and at just over 20% for urban respondents. These findings suggest that experiential programs like “ride and drives” are potentially useful for increasing the openness of U.S. consumers to BEVs.

Section 3.3 next focused on gender, age, and race/ethnicity. With respect to gender, the EV archetype is male, reflecting men’s historically disproportionate rates of BEV adoption. The BEV gender gap has been narrowing, however. According to the 2023 EVCS, the majority of respondents, regardless of gender, could be characterized as BEV-considerers (i.e., the respondents are very or somewhat likely to consider a BEV for their next vehicle purchase or lease). The gender gap today is 8 percentage points, with BEV consideration expressed by 64% of men and 56% of women (Figure 33). In the 2018 SF Bay Area WholeTraveler survey, which the authors contributed to, that gender gap was 15 percentage points (see Spurlock et al. 2019).

With respect to age, between MY 2016 and 2020 there was a noticeable trend away from the older middle-aged buyers who constituted some of the earliest EV adopters (Axsen and Kurani 2013) and towards PEV purchasers from Generations X and Y (aged 29-58, see Figure 36). The 2023 EVCS data now reveals that new vehicle buyers aged 25 to 39 have the highest concentrations of BEV considerers, while those over age 70 have the lowest (Figure 37). This fact may not affect the EV driver archetype much, however, given the declining share of younger buyers in the overall new vehicle market since 2000 (Kurz et al., 2016).

With respect to race/ethnicity, the archetype of a White EV driver does not match the relative affinity of this racial/ethnic group for BEVs in recent years. Both in terms of purchase rates for PEV vehicle models between 2017 and 2020 and expressed likelihood in the 2023 EVCS to

consider a BEV for their next vehicle purchase or lease, Asian Americans (6% of the population) are the leading racial/ethnic group (see Figure 41 and Figure 42). In the 2023 EVCS, we find that Asian Americans have the highest concentration of BEV-consideration (at 75%, as displayed in Figure 42). Black Americans (13% of the population) have the second-highest concentration (at 67%), Hispanic/Latino Americans (18% of the population) are next (at 65%), and White Americans (60% of the population) have the lowest level of BEV consideration (59%). Regardless of racial or ethnic group, however, the majority of vehicle buyers can be categorized as BEV considerers.

Section 3.3 concluded by exploring PEV purchase, consideration, and rejection as they relate to the educational attainment, homeownership status, and housing types of prospective vehicle buyers. With respect to education, there appears to be little change in the archetype of the highly educated EV driver from 2020 dating back at least to 2012, when close to 90% of PEV owners had a bachelor's or advanced degree, far more than the U.S. average (Axsen and Kurani 2013). The more recent NVCS data, which ends in 2020, documents substantially higher levels of PEV adoption amongst those with bachelor's and graduate degrees compared to those with fewer years of formal education (Figure 45), although PEV adoption increased across all levels of educational attainment. Note that throughout the MY2016-20 period covered by the NVCS data we had access to, people adopted traditional hybrid electric vehicles that cannot be plugged in at much higher rates than they did PEVs, regardless of education level. Unfortunately, we do not have 2023 EVCS data on the education levels of respondents, which precludes assessing BEV consideration and rejection by education level.

While none of our main primary data sources allowed us to address trends in PEV acceptance by homeowners and renters or by single versus multi-family resident, we were able to glean useful insights in other ways. With respect to homeownership, we drew from 2015 and 2020 Residential Energy Consumption Survey (RECS) data to learn that homeowners in 2015 were about twice as likely as renters to have a PEV, while homeowners in 2020 were more than three times as likely as renters to have a PEV. Figure 47 juxtaposes two questions from the 2023 EVCS, namely the likelihood of future purchase by owners and renters and the responses to "If needed, do you have access to EV charging or the ability to install an EV charger at your home?" Figure 47 has several takeaways. First, it indicates that most homeowners – with the exception of those who are "very unlikely" to consider a BEV for their next vehicle purchase – expressed that they either already have or could install an EV charger at home "if I needed to." Second, it shows that the majority of BEV considerers (i.e., EVCS respondents who are very or somewhat likely to consider a BEV for their next vehicle purchase or lease) – regardless of homeownership status – have some form of charging access, either at home or at work. The converse generally holds true as well. The majority of BEV rejecters (i.e., EVCS respondents who are very or somewhat unlikely to consider a BEV for their next vehicle purchase or lease) state either that they "cannot install an EV charger at my home and don't have access to an EV charger at my workplace" or that they don't know if they have access to charging or the ability to install a charger at home. The exception is homeowners who are "somewhat unlikely" to consider a BEV for their next purchase, just under 60% of whom already have a home EV charger and/or access to a charger at work, or could install a charger at home if necessary. Finally, Figure 47 shows that having access to EV charging at work appears to be a major factor in increasing the likelihood that a renter will consider purchasing a BEV.

The last demographic characteristic explored in Section 3.3 is the type of residential housing – single or multi-family – of BEV considers, PEV buyers, and BEV rejecters. This topic has been relatively understudied when compared to other demographic characteristics, and we did not consider it over time as it related to PEV acceptance, primarily because of data issues. Instead,

we focused on the reasoning of MY2023 EVOS and EVCS respondents, by housing type, with respect to PEV purchase and BEV rejection.

The next few tables present compiled material from that demographic segment, as well as all the others considered in this report, with respect to the reasoning that MY2023 EVCS and EVOS respondents provided regarding their decisions to shop for a new vehicle, to choose the PEV they bought, or to have a low consideration of BEVs. The pertinent survey questions we drew on for these tables are: (1) EVCS "CV4. Why are you shopping for a new vehicle? Mark all that apply"; (2) for BEV rejecters, EVCS "EV13. What factors contribute to your low consideration of EVs? Mark all that apply"; (3) for BEV considerers, an EVCS question asked following a hypothetical listing of what their top choice BEV model would be: "EV6. Why is the [Insert EV5 response] your top choice? Mark all that apply"[13]; and (4) for PEV purchasers, the EVOS question "EV06_MULTI. Why did you choose to purchase or lease your [S2_Make] [S2_Model]? Mark all that apply". The color scheme in these tables is based on Fujita et al. (2022), as articulated in Table 2.

Table 5 depicts the compiled reasoning of MY2023 EVCS respondents with respect to why they are shopping for a new vehicle. The columns display the most commonly cited reasons in order of frequency, from 1st through 4th, while the rows delineate a given demographic segment, starting with the full population of respondents, then the segment of all respondents who are BEV-considerers, then respondent segments based on income, urbanicity, gender, and housing type. One major observation that pops out from this table is that there is very strong agreement across demographic segments regarding the most common reason people shop for a new vehicle, which is that they want better features/technology. As mentioned in the discussion of the commonality of interest in "better features/functionality/technology" in Figure 9, however, the EVCS response write-up does not clarify the nature of these features/technology or the purpose they serve, instead leaving this topic subject to the interpretation of the respondent. Given other areas of automotive innovation in recent years, the nature and purpose of these new technologies could include a safety purpose, satisfied by new driver assistance features like adaptive cruise control, automatic emergency braking, etc., or a comfort purpose, satisfied by better connectivity features, etc.

A second observation from Table 5 is related to the first, which is that the top four most commonly cited reasons to shop for a new vehicle provided by any demographic segment are comprised of a universe of only four "wants" for a new vehicle, namely: (1) better features/technology; (2) more reliable; (3) better fuel economy; and (4) better performance. Better reliability is the only "want" other than better features/technology to be the most commonly-cited new vehicle shopping reasons of any demographic segment, but only for people either with incomes less than $40k or who live in rural areas. It is the second-most commonly cited new vehicle shopping reason for all respondents, and particularly for people in the following segments: those with incomes $40-80k; those who live in suburban areas; and women. Better fuel economy is the second-most commonly cited new vehicle shopping reason for the following segments: BEV considerers; people with incomes above $80k; and men; it is the fourth most commonly-cited shopping reason of all respondents in the EVCS. Finally, better performance is the third most commonly-cited shopping reason for all respondents in the EVCS.

[13] In section 3.3, we generally reported on the responses to EV06_Multi in the EVOS, rather than this question, as we thought it would be more compelling to consider the reasons for PEV purchase rather than simply BEV consideration (i.e., how people decide to "put their money where their mouth is," so to speak). We did report on the EVCS question EV6 in the section 3.3 discussion of race/ethnicity, however.

Table 5: Most common reasons for vehicle shopping, by segment of respondents (EVCS)

Segment		1st most common	2nd most common	3rd most common	4th most common
All		Want better features/tech	Want more reliable	Want better performance	Want better fuel economy
BEV-considerer		Want better features/tech	Want better fuel economy	Want more reliable	Want better performance
Income	<$40k	Want more reliable	Want better features/tech	Want better performance	Want better fuel economy
	$40 to <$80k	Want better features/tech	Want more reliable	Want better performance	Want better fuel economy
	$80k to <$150k	Want better features/tech	Want better fuel economy	Want better performance	Want more reliable
	> $150k	Want better features/tech	Want better fuel economy	Want better performance	Want more reliable
Urbanicity	Rural	Want more reliable	Want better features/tech	Want better performance	Want better fuel economy
	Suburban	Want better features/tech	Want more reliable	Want better fuel economy	Want better performance
	Urban	Want better features/tech	Want better performance	Want more reliable	Want better fuel economy
Gender	Female	Want better features/tech	Want more reliable	Want better fuel economy	Want better performance
	Male	Want better features/tech	Want better fuel economy	Want better performance	Want more reliable
Housing Type	Multi-family	Want better features/tech	Want more reliable	Want better performance	Want better fuel economy
	Single family	Want better features/tech	Want more reliable	Want better fuel economy	Want better performance

Table 6 depicts the compiled reasoning of BEV rejecters (i.e., MY2023 EVCS respondents who are very or somewhat unlikely to consider a BEV for their next vehicle purchase or lease) with respect to the factors that contribute to their low consideration of BEVs. It presents a very clear contrast with Table 5, as *none* of the four reasons why people say they shop for new vehicles is a top-four commonly cited factor underlying people's low consideration of BEVs. Instead, non-vehicle attributes tied to EV charging infrastructure dominate Table 6. For the overall population of BEV rejecters, the top four most commonly cited reasons to reject BEVs are, in order: (1) lack of charging station availability; (2) purchase price; (3) limited driving distance per charge; and (4) time to charge. The only other factor for low consideration of BEVs that appears in Table 6 is "inability to charge at home or work." Note that major federal policy initiatives in recent years are targeted toward improving the availability of public EV charging stations across the U.S. and to reducing the purchase price of PEVs for many consumers, particularly through tax credits. There is also a clear trend toward improved battery range, as seen in Figure 1. These developments may well change the nature of BEV rejection over the next few years.

Table 6: Most common reasons for BEV non-consideration, by segment of respondents (EVCS)

Segment		1st most common	2nd most common	3rd most common	4th most common
All		Lack of charging	Purchase price	Limited range	Time to charge
Income	**<$40k**	Purchase price	Lack of charging	Cost of ownership	Time to charge
	$40 to <$80k	Lack of charging	Purchase price	Limited range	Time to charge
	$80k to <$150k	Lack of charging	Limited range	Purchase price	Time to charge
	> $150k	Lack of charging	Time to charge	Limited range	Purchase price
Urbanicity	**Rural**	Purchase price	Lack of charging	Limited range	Time to charge
	Suburban	Lack of charging	Purchase price	Limited range	Time to charge
	Urban	Lack of charging	Purchase price	Time to charge	Limited range
Gender	**Female**	Lack of charging	Purchase price	Limited range	Time to charge
	Male	Lack of charging	Limited range	Purchase price	Time to charge
Generation	**Gen Z**	Purchase price	Lack of charging	No home/work charging	Cost of ownership
	Gen Y	Purchase price	Lack of charging	Time to charge	Limited range
	Gen X	Lack of charging	Purchase price	Limited range	Time to charge
	Boomers	Lack of charging	Limited range	Purchase price	Time to charge
	Pre-Boomers	Lack of charging	Purchase price	Limited range	Time to charge
Race / Ethnicity	**Asian American**	Purchase price	Time to charge	Lack of charging	Limited range
	Black	Purchase price	Lack of charging	No home/work charging	Time to charge
	Hispanic/Latino	Purchase price	Lack of charging	Cost of ownership	No home/work charging
	White	Lack of charging	Purchase price	Limited range	Time to charge
Housing	**Own**	Lack of charging	Purchase price	Limited range	Time to charge
	Rent	Purchase price	Lack of charging	No home/work charging	Time to charge
	Multi-family	Lack of charging	Purchase price	No home/work charging	Time to charge
	Single family	Purchase price	Lack of charging	Limited range	Time to charge

Table 7 depicts the compiled reasoning of BEV considerers (i.e., MY2023 EVCS respondents who are very or somewhat likely to consider a BEV for their next vehicle purchase or lease) with respect to why they would select a given BEV model as their hypothetical top choice model. We provide it as a point of comparison to

Table 8, which compiles the reasoning of PEV purchasers (i.e., MY2023 EVOS respondents) with respect to why they bought their particular vehicle. Table 7 is hypothetical, to some extent, while

Table 8 represents the reasoning behind actual PEV purchase decisions.

Table 7: Most common reasons for BEV model choice, by segment of BEV considerers (EVCS)

Segment		1st most common	2nd most common	3rd most common	4th most common
All BEV Considerers		Performance	Styling/image	Features/tech	Reliability
Income	**<$40k**	Performance	Styling/image	Reliability	Features/tech
	$40 to <$80k	Performance	Styling/image	Features/tech	Reliability
	$80k to <$150k	Performance	Features/tech	Styling/image	Reliability
	> $150k	Performance	Features/tech	Styling/image	Brand affinity
Urbanicity	**Rural**	Performance	Features/tech	Styling/image	Reliability
	Suburban	Performance	Styling/image	Features/tech	Reliability
	Urban	Performance	Styling/image	Features/tech	Reliability
Gender	**Female**	Performance	Styling/image	Features/tech	Reliability
	Male	Performance	Features/tech	Styling/image	Reliability
Generation	**Gen Z**	Performance	Styling/image	Reliability	Features/tech
	Gen Y	Performance	Styling/image	Features/tech	Reliability
	Gen X	Performance	Styling/image	Features/tech	Reliability
	Boomers	Performance	Features/tech	Styling/image	Reliability
	Pre-Boomers	Reliability	Brand experience	Environment	Performance
Race / Ethnicity	**Asian American**	Performance	Styling/image	Reliability	Features/tech
	Black	Performance	Styling/image	Features/tech	Reliability
	Hispanic/Latino	Performance	Styling/image	Features/tech	Reliability
	White	Performance	Styling/image	Features/tech	Reliability
H	**Own**	Performance	Styling/image	Features/tech	Reliability

Rent	Performance	Styling/image	Features/tech	Reliability
Multi-family	Performance	Styling/image	Features/tech	Reliability
Single family	Performance	Styling/image	Features/tech	Reliability

Table 8: Most common reasons for PEV purchase, by segment of respondents (EVOS)

Segment		1st most common	2nd most common	3rd most common	4th most common
All BEV buyers		Design & styling	Driving performance	Lower running costs	Quality & reliability
All PHEV buyers		Quality & reliability	Design & styling	Range	Driving performance
Income	**<$40k**	Lower running costs	Range	Quality & reliability	Price/lease offer
	$40 to <$80k	Lower running costs	Tax credits/incentives	Design & styling	Quality & reliability
	$75k to <$150k	Lower running costs	Design & styling	Quality & reliability	Driving performance
	> $150k	Design & styling	Driving performance	Quality & reliability	Range
Urbanicity	**Rural**	Lower running costs	Range	Quality & reliability	Design & styling
	Suburban	Design & styling	Range	Lower running costs	Quality & reliability
	Urban	Design & styling	Quality & reliability	Driving performance	Range
Gender	**Female**	Design & styling	Quality & reliability	Lower running costs	Better environmental credentials
	Male	Design & styling	Driving performance	Lower running costs	Range
Generation	**Gen Z**	Tax credits/incentives	Lower running costs	Design & styling	Driving performance
	Gen Y	Design & styling	Driving performance	Lower running costs	Range
	Gen X	Design & styling	Driving performance	Lower running costs	Quality & reliability
	Boomers	Design & styling	Quality & reliability	Driving performance	Lower running costs
	Pre-Boomers	Quality & reliability	Design & styling	Range	Lower running costs
Education	**High school or less**	Lower running costs	Design & styling	Quality & reliability	Driving performance
	Some college or associate's degree	Design & styling	Lower running costs	Driving performance	Quality & reliability
	Bachelor's degree	Design & styling	Driving performance	Lower running costs	Quality & reliability
	Graduate or professional degree	Design & styling	Quality & reliability	Driving performance	Range
Housing	**Own**	Design & styling	Driving performance	Lower running costs	Quality & reliability
	Rent	Design & styling	Lower running costs	Driving performance	Quality & reliability
	Multi-family	Design & styling	Driving performance	Quality & reliability	Lower running costs
	Single family	Design & styling	Driving performance	Lower running costs	Quality & reliability

One observation that is common to Table 7 and

Table 8 is that a pro-environment sentiment is barely mentioned in the top four most highly-cited reasons for BEV selection/PEV purchase by any segment of survey respondents. In Table 7, only the very small population of "Pre-Boomers" in the EVCS mentions it as their third most commonly cited reason for hypothetical BEV model selection, while in

Table 8, women mention it as their fourth most commonly cited reason for PEV purchase.

It is interesting to note the dominance of performance as the most commonly cited reason for hypothetical BEV model selection by BEV considerers in Table 7, with styling/image almost as dominant as the second most commonly cited reason for hypothetical selection. This implies that BEVs have achieved a fairly widespread reputation for performance and styling amongst BEV Considerers. The third and fourth most frequently cited reasons for hypothetical BEV model selection in Table 7 are features/technology and reliability, respectively. Features/technology is of particular interest, as it aligns with the most commonly cited reason for people to shop for any new vehicle, as observed in Table 5.

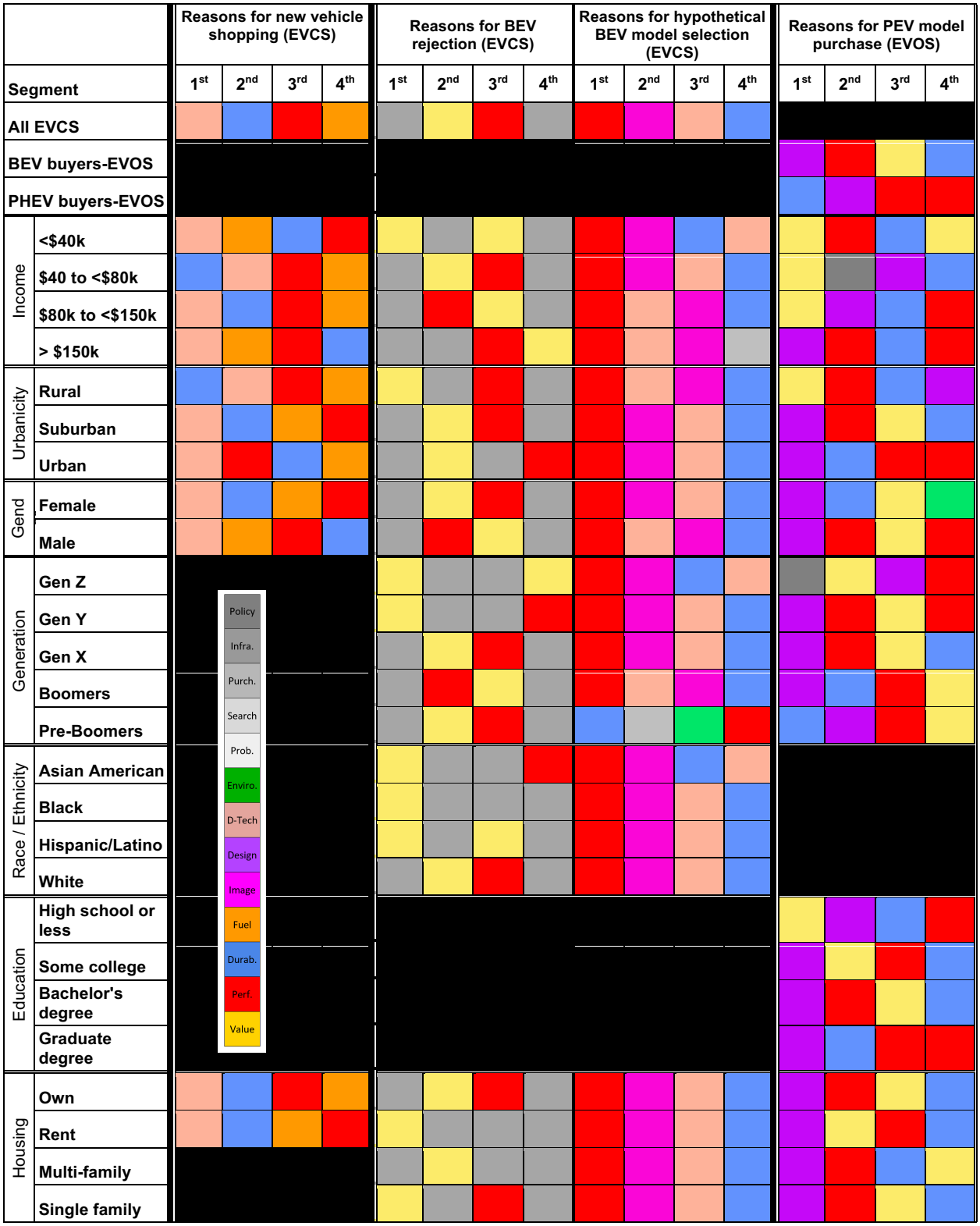
The prominence of styling as a reason for hypothetical BEV model selection, observed in Table 7, is mirrored in

Table 8 by the way that design & styling dominates the most commonly cited reason for PEV purchase by various EVOS segments. This is particularly true for BEV buyers; PHEV buyers most commonly cite quality & reliability as a reason for purchase and only mention design & styling as their second most commonly cited reason for PEV purchase. Note that lower running costs are the most commonly cited reason for PEV purchase by all EVOS income group segments under $150k.

We conclude this section with

Table 9, which uses the color scheme from Table 2 to compile the top four most commonly cited reasons for new vehicle shopping, BEV rejection, and hypothetical BEV model selection in the EVCS and for PEV purchase in the EVOS.

Table 9: Commonly cited reasons for new vehicle shopping, BEV rejection, hypothetical BEV selection, and PEV purchase, colored in accordance with Table 2



4.2 Reflections on the EV driver archetype

What do the explorations in this report mean for the archetypal EV driver and its potential to spin off "false dichotomies" with respect to demographic characteristics?

As stated in the Introduction, the EV driver archetype can generally be characterized as a high-income, highly-educated, urban-dwelling, married, middle-aged white male who owns his home and values the latest technology and/or the environment. Today, however, the majority of all people who responded to the EVCS are BEV considerers, using the definition of being very or somewhat likely to consider a BEV for their next vehicle purchase or lease (see Appendix A, Table A.1- 1). This holds across all of the income groups we looked at in this report, as well as the three levels of urbanicity we considered, namely urban, suburban, and rural residence. It also holds for men and women, all people under 65, the four racial/ethnic groups we looked at, and both the owners and renters of homes. Unfortunately, we do not have 2023 EVCS data on the education levels of respondents, which precludes assessing BEV consideration by education level. If this high level of BEV consideration across demographic groups translates to actual future purchases, it appears that the EV driver of the future will be hard to single out from the crowd.

Even today, we see that two key demographic characteristics of today's BEV considerers differ from those of the classic EV driver archetype. First, new vehicle buyers aged 25 to 39 have the highest concentrations of BEV considerers, which contrasts with the middle-aged characteristic of the EV archetype. Second, both in terms of purchase rates for PEV vehicle models between 2017 and 2020 and of BEV consideration, Asian Americans (6% of the population) are the leading racial/ethnic group. In the 2023 EVCS, we find that Asian Americans have the highest concentration of BEV-consideration (at 75%), Black Americans (13% of the population) have the second-highest concentration (at 67%), Hispanic/Latino Americans (18% of the population) are next (at 65%), and White Americans (60% of the population) have the lowest level of BEV consideration (59%).

Meanwhile, other demographic characteristics of the EV driver archetype are in the process of changing. According to MY2023 EVCS data, it appears that the gap today between male and female consideration of BEVs is smaller, at 8 percentage points, than it was even in 2018, at 15 percentage points (see Spurlock et al. 2019). In addition, the prevalence of homeownership in the EV archetype is likely to be changing with increased availability of multi-family, workplace, and public charging stations. The majority of BEV considerers, regardless of homeownership status, have some form of charging access, either at home or at work. Meanwhile, major recent federal policy initiatives aim to improve the availability of public EV charging stations across the U.S. The results of these initiatives, as well as ongoing BEV battery improvements, may well change the nature of BEV consideration and rejection on the basis of homeownership over the next few years.

Beyond demographics, the technophilic facet of the EV archetype appears to resonate with BEV considerers and PEV purchasers today, based on Table 7 and

Table 8. This is unsurprising, however as Table 5 shows that all new vehicle shoppers share that value; it is the most highly cited reason for anyone to purchase a new vehicle today. The EVCS and EVOS data do not make apparent that BEV considerers and PEV purchasers have a particular affinity for the environment, however. A pro-environmental sentiment is barely mentioned in the top four most highly cited reasons for BEV selection/PEV purchase by any segment of EVCS or EVOS survey respondents. Of all the demographics of BEV considerers investigated here, only the very small population of "Pre-Boomers" mentions the environment, and only as their third most commonly cited reason for hypothetical BEV model selection. Similarly, only one demographic of PEV purchaser – women – mention it, and only as their fourth most commonly cited reason for PEV purchase.

Although there are clearly several indications that the EV driver archetype has already changed and is likely to continue to evolve to better reflect the full diversity of U.S. drivers, the timing of this transition is unclear. The average age of vehicles on the road is on the order of 13 years (U.S. Bureau of Transportation, 2024), which implies that yesterday's EV purchasers may still be tomorrow's drivers, at least for a significant period of time. Leasing rates and the used vehicle market can counteract this, but uncertainty remains. In addition, not every demographic change in BEV considerers can be expected to have the same impacts on the new vehicle market as every other demographic characteristic. A simple example is that Asian Americans, the racial/ethnic group with the highest concentration of BEV considerers, represents only a small share of the U.S. population and may have less of an impact on new vehicle purchases overall than a more populous group with a lower concentration of BEV considerers. Similarly, the higher preponderance of BEV consideration by younger drivers may not have as large an impact on the U.S. vehicle market as their overall population might imply, simply because they have been underrepresented in the ranks of new vehicle buyers since the 2008 financial crisis.

Still, the explorations in this report point to an important observation, which is that it would be very inaccurate indeed to discount the latent demand for PEVs amongst people who do not share the demographic characteristics of the archetypal EV driver with respect to income, urbanicity, gender, age, race/ethnicity, and other factors. The appeal of BEVs and PHEVs is likely to only continue to increase as more models, body styles, electric range improvements, and price points diffuse across the vehicles offered for sale in the U.S. Some of this diversification may happen organically, while other aspects may be inspired by policy change. Either way, with the further diversification of PEV body styles, multiple EV archetypes may emerge which are no longer tied to the fuel source but to the body style, as in the existing market for conventional vehicles. For example, the apocryphal "soccer mom" associated with minivan driving in the 1990s may in the future continue to be associated with minivans, but with no distinction between the PEV and ICE versions of that body style.

5. REFERENCES

Alternative Fuels Data Center. (2024). *All-Electric Vehicles*. https://afdc.energy.gov/vehicles/electric_availability.html

Axsen, J., & Kurani, K. (2013). Connecting plug-in vehicles with green electricity through consumer demand. *Environmental Research Letters*, *8*(1). https://ui.adsabs.harvard.edu/abs/2013ERL.....8a4045A/abstract

Coltura. (2021). *Gasoline Super Users*. https://coltura.org/gasoline-superusers/

Cox Automotive. (2023). *Kelley Blue Book Analysis: New-Vehicle Transaction Prices in June Post Smallest Annual Gain in Nearly 4 Years*. coxautoinc.com

Cyril, S., Oldroyd, J. C., & Renzaho, A. (2013). Urbanisation, urbanicity, and health: A systematic review of the reliability and validity of urbanicity scales. *BMC Public Health*, *13*(1), 1–11. https://doi.org/10.1186/1471-2458-13-513/TABLES/3

Davis, L. W. (2023). Electric vehicles in multi-vehicle households. *Applied Economics Letters*, *30*(14), 1909–1912. https://doi.org/10.1080/13504851.2022.2083563

Fujita, K. S., Yang, H.-C., Taylor, M., & Jackman, D. (2022). The Green Light on Buying a Car: How Consumer Decision-Making Interacts with Environmental Attributes in the New Vehicle Purchase Process. *Transportation Research Record*, *March*. https://doi.org/10.1177/03611981221082566

Ge, Y., Simeone, C., Duvall, A., & Wood, E. (2021). *There's No Place Like Home: Residential Parking, Electrical Access, and Implications for the Future of Electric Vehicle Charging Infrastructure*. *October*. https://www.nrel.gov/docs/fy22osti/81065.pdf.

Gillingham, K. T., van Benthem, A. A., Weber, S., Saafi, M. A., & He, X. (2023). Has Consumer Acceptance of Electric Vehicles Been Increasing? Evidence from Microdata on Every New Vehicle Sale in the United States. *AEA Papers and Proceedings*, *113*, 329–335. https://www.aeaweb.org/articles?id=10.1257/pandp.20231065

Grieve, P. (2023). *The Average Electric Car Is 22% Cheaper Than a Year Ago*. Money. https://money.com/ev-vs-gas-cars-price-difference-decreasing/

Jackman, D., Fujita, K. S., Yang, H.-C., & Taylor, M. (2023). *Literature Review of U.S. Consumer Acceptance of Light-Duty (LD) Plug-in Electric Vehicles (PEVs)*. https://cfpub.epa.gov/si/si_public_record_report.cfm?Lab=OTAQ&dirEntryId=353465

J.D. Power. (2023a). *U.S. Electric Vehicle Consideration Study (EVCS)*. https://www.jdpower.com/business/powersource

J.D. Power. (2023b). *U.S. Electric Vehicle Experience Ownership Study (EVOS)*. https://www.jdpower.com/business/powersource

Kelley Blue Book. (2024). *Original MSRP and KBB Fair Purchase Price (nat'l average)*. kbb.com

Kurz, C., Li, G., & Vine, D. (2016). *The Young and the Carless*. FEDS Notes. https://www.federalreserve.gov/econresdata/notes/feds-notes/2016/the-young-and-the-carless-the-demographics-of-new-vehicle-purchases-20160624.html

Lee, J. H., Hardman, S. J., & Tal, G. (2019). Who is buying electric vehicles in California? Characterising early adopter heterogeneity and forecasting market diffusion. *Energy Research & Social Science*, *55*, 218–226. https://doi.org/10.1016/J.ERSS.2019.05.011

MaritzCX. (2020). *New Vehicle Customer Survey (NVCS, 2016-2020)* . https://inmoment.com/

Plante, M., & Howard, S. (2022). *Electric vehicles gain ground but still face price, range, charging constraints*. Dallas Fed Economics. https://www.dallasfed.org/research/economics/2022/0222#:~:text=In%20inflation%2Dadjusted%20terms%2C%20the,down%20from%20%24352%20in%202012

Singer, M. (2017). *The Barriers to Acceptance of Plug-in Electric Vehicles: 2017 Update*. https://doi.org/10.2172/1408997

Spurlock, C. A., Sears, J., Wong-Parodi, G., Walker, V., Jin, L., Taylor, M., Duvall, A., Gopal, A., & Todd, A. (2019). Describing the users: Understanding adoption of and interest in shared, electrified, and automated transportation in the San Francisco Bay Area. *Transportation Research Part D: Transport and Environment*, *71*(January), 283–301. https://doi.org/10.1016/j.trd.2019.01.014

Strategic Vision. (2016). *New Vehicle Experience Study (NVES, 2014-2016)*. https://www.strategicvision.com/nves

Taylor, M., & Fujita, K. S. (2018). *Consumer Behavior and the Plug-In Electric Vehicle Purchase Decision Process: A Research Synthesis*. https://eta.lbl.gov/publications/consumer-behavior-plug-electric

U.S. Bureau of Labor Statistics. (2024). *Consumer Price Index, series: CUUS0000SA0, Consumer Price Index for All Urban Consumers, All Items, 2016-2023*. https://www.bls.gov/cpi/data.htm

U.S. Bureau of Transportation. (2024). *Average Age of Automobiles and Trucks in Operation in the United States*. https://www.bts.gov/content/average-age-automobiles-and-trucks-operation-united-states

U.S. Census Bureau. (2019). *National Population by Characteristics: 2010-2019, Sex, Race, and Hispanic Origin*. https://www.census.gov/data/tables/time-series/demo/popest/2010s-national-detail.html

U.S. Census Bureau. (2022). *Redefining Urban Areas following the 2020 Census*. https://www.census.gov/newsroom/blogs/random-samplings/2022/12/redefining-urban-areas-following-2020-census.html

U.S. Census Bureau. (2024). *Urban and Rural*. https://www.census.gov/programs-surveys/geography/guidance/geo-areas/urban-rural.html

U.S. Energy Information Administration. (2020). *Residential Energy Consumption Survey (RECS, 2015, 2020)*. https://www.eia.gov/consumption/residential/data/2020/index.php?view=microdata

Vlahov, D., & Galea, S. (2002). Urbanization, urbanicity, and health. *Journal of Urban Health 2002 79:1*, *79*(1), S1–S12. https://doi.org/10.1093/JURBAN/79.SUPPL_1.S1

Appendix A. EVCS and EVOS Sample Distributions

In this appendix, we provide demographic breakdowns of the J.D. Power U.S. Electric Vehicle Consideration Study (EVCS) and the J.D. Power Electric Vehicle Ownership Study (EVOS) for MY2023. We include counts and percentages of sample for each of the demographic groups we discussed in the main body of the report.

A.1. EVCS Distributions

Table A.1- 1 EVCS distribution of likelihood to consider a BEV for the next purchase or lease

	Number	Percent of Sample
Likely and somewhat likely	4973	61.1%
Unlikely and somewhat unlikely	3163	38.9%

Table A.1- 2 EVCS income distribution

Income	Number	Percent of Sample
<$40k	2090	25.7%
40k<79.9k	2605	32.0%
80k<149.9k	2283	28.1%
$150k<	1158	14.2%

Table A.1- 3 EVCS urbanicity distribution

Urbancity Level	Number	Percent of Sample
Rural	1247	15.3%
Suburban	4547	55.9%
Urban	1617	19.9%
Unidentifiable	725	8.9%

Table A.1- 4 EVCS gender distribution

Gender	Number	Percent of Sample
Female	3461	42.5%
Male	3228	39.7%
No Response	1447	17.8%

Table A.1- 5 EVCS age distribution by generation

Generation	Number	Percent of Sample
Gen Z	836	10.3%
Gen Y	3421	42.0%
Gen X	1680	20.6%
Boomers	2012	24.7%
Pre-Boomers	187	2.3%

Table A.1- 6 EVCS homeownership distribution

Homeownership	Number	Percent of Sample
Own	5470	67.2%
Rent	2450	30.1%
Other	216	2.7%

Table A.1- 7 EVCS housing type distribution

Housing type	Number	Percent of Sample
Single family home	6003	73.8%
Apartment, condo, duplex	1880	23.1%
Other	253	3.1%

A.2. EVOS Distributions

Table A.2- 1 EVOS distribution of PEV purchases by BEV and PHEV drive train

	Number	Percent of Sample
BEV	4423	95.1%
PHEV	227	4.9%

Table A.2- 2 EVOS income distribution

Income	Number	Percent of Sample
<$25k	18	0.4%
25k<74.9k	331	7.1%
75k<149.9k	1266	27.2%
$150k<	2282	49.1%
No Reponse	753	16.2%

Table A.2- 3 EVOS urbanicity distribution

Urbanicity Level	Number	Percent of Sample
Rural	384	8.3%
Suburban	2877	61.9%
Urban	651	14.0%
Unidentifiable	738	15.9%

Table A.2- 4 EVOS gender distribution

Gender	Number	Percent of Sample
Female	995	21.4%
Male	3450	74.2%
Others/No Response	205	4.4%

Table A.2- 5 EVOS age distribution by generation

Generation	Number	Percent of Sample
Gen Z	86	1.8%
Gen Y	1067	22.9%
Gen X	1068	23.0%
Boomers	1765	38.0%
Pre-Boomers	197	4.2%
No Response	467	10.0%

Table A.2- 6 EVOS educational attainment distribution

Education Level	Number	Percent of Sample
High School or less	139	3.0%
Some college or Associate's Degree	672	14.5%
Bachelor's Degree	1602	34.5%
Graduate or Professional Degree	2055	44.2%
Other	182	3.9%

Table A.2- 7 EVOS homeownership distribution

Homeownership	Number	Percent of Sample
Own	4228	90.9%
Rent	376	8.1%
Other	46	1.0%

Table A.2- 8 EVOS housing type distribution

Housing type	Number	Percent of Sample
Single family home	4050	87.1%
Apartment, condo, duplex	558	12.0%
Other	42	0.9%