Supporting Lower-Income Households' Purchase of Clean Vehicles:

Implications From California-Wide Survey Results

A Policy Brief

Gregory Pierce, Britta McOmber and J.R. DeShazo

UCLA Luskin Center for Innovation

Authorship

This report was produced by the UCLA Luskin Center for Innovation (LCI):
Gregory Pierce, Associate Director
Britta McOmber, Researcher
J.R. DeShazo, Director

Acknowledgments

The funding for this policy brief was provided by Strategic Growth Council Contract A19-1496-S003.

The original research informing this brief was conducted under California Air Resources Board contract #15RD011 and reported in "Designing Light-Duty Vehicle Incentives for Low- and Moderate-Income Households."

Thank you to Nick Cuccia for copy editing and report design.

Thank you to our graduate student researchers, Edgar Mejía and Erika Pinto, who helped draft this policy brief.

Disclaimer

The analysis presented is those of the authors and not necessarily those of UCLA, the funders or other aforementioned agencies and individuals. LCI appreciates the contributions of the above-listed reviewers; however, their review of this work does not imply any endorsement of the report's content or conclusions. Any mistakes or errors are solely attributable to the authors.

For More Information

Contact Gregory Pierce at gpierce@luskin.ucla.edu.

Learn more and view a digital copy of this report at www.innovation.luskin.ucla.edu.

Printed in the United States.

Executive Summary

In order to achieve air quality and climate change goals in California, the state must transform its light-duty vehicle fleet. State, regional and local agencies are already working actively to provide clean vehicle access to low- and moderate-income Californians. This brief synthesizes policy implications stemming from research performed by the UCLA Luskin Center for Innovation in partnership with the California Air Resources Board.

Our research was based on a statewide representative survey of 1,604 low- and moderate-income households. We assessed current barriers and informed future strategies to improve clean vehicle access and use by low- and moderate-income households, while generating broader environmental and economic benefits in California. The full results of our research are detailed in a comprehensive report published in 2019. This policy brief aims to identify the top implications from our research for enhancing and expanding policy efforts in California that most effectively promote the retirement of functional, high-emitting vehicles and the adoption of advanced clean vehicles among lower-income Californians.

Major Findings and Associated Policy Implications

1 Transportation affordability

We found that lower-income households spend a large portion of their income — over 16% — on vehicle purchase and maintenance for personal use, indicating the importance of vehicles to low- and moderate-income households. Moreover, the average reported one-time expenditure to purchase a vehicle was almost $14,000, or over 50% of the average yearly income of households surveyed.

> **Policy implication**
>
> Design more comprehensive transportation affordability support policies modeled on other basic service sector programs offered at state or federal levels.

2 Purchase incentive levels

We found that offering upfront purchase incentives of $2,500, $5,000 or $9,500 increased plug-in hybrid electric vehicle and battery-electric vehicle purchases incrementally by approximately 20%, 40% and 60–80% respectively. Upfront incentives had a much larger effect than offering guaranteed financing alternatives in inducing vehicle purchase.

> **Policy implication**
>
> Further refine household benefit levels to effectively target public dollars for clean vehicle incentives.

See full report: Gregory Pierce, J.R. DeShazo, Tamara Sheldon, Evelyn Blumenberg and Britta McOmber (2019). Designing Light-Duty Vehicle Incentives for Low- and Moderate-Income Households. California Air Resources Board. Contract # 15RD011.

3 Location of vehicle purchase

About 40% of survey respondents said they did not buy their main household vehicle from a dealership, credit union or purchasing service. Especially among the lowest-income households (with annual incomes of $25,000 or less), purchases tended to take place outside a dealership. Households who purchased used vehicles were nearly four times as likely as new vehicle purchasers to buy their vehicle somewhere other than a formal dealer (62% vs. 16%).

Policy implication

Consider more flexible incentive approaches to enable lower-income households to purchase clean vehicles through their preferred networks and locations.

4 Financing method of vehicle purchase

Surveyed households who bought a used vehicle were much more likely to be lower income and to pay for their vehicle in cash rather than finance their purchase with loans. These respondents were also more likely to have worse self-assessed credit. About 40% of all respondents paid for their most recent vehicle purchase in cash.

Policy Implication

Allow higher loan interest rates to make a larger share of lower-income households eligible for subsidized loan programs to purchase clean vehicles.

5 Clean vehicle charging

Obstacles in vehicle charging access and availability continue to serve as a barrier to clean vehicle ownership for lower-income Californians. In line with what previous studies have shown, the survey respondents living in single-family, detached homes were more likely (61%) to have convenient potential to charge a plug-in electric vehicle compared to respondents who reside in multi-unit dwellings (35%).

Policy implication

Accelerate more targeted strategies for overcoming clean vehicle charging infrastructure barriers in multi-unit dwellings and workplaces.

6 Alternative modes to solo driving

Surveyed households did not report high levels of currently using public transit or other non-car travel modes, nor a strong interest in these modes even if they were made more convenient and affordable. Less than 10% indicated they were aware of a transit stop near both their home and work locations. No modes besides personal vehicle use and walking exceeded 6% of daily use. Moreover, nearly 60% of respondents said they would choose to retain their personal vehicle if alternative modes were made as convenient and inexpensive as operating their vehicle.

Policy implication

Grow the focus on clean vehicle purchase assistance to support lower-income households' transport mode needs and preferences.

Motivation

California must get more clean vehicles on the road to improve air quality and reduce the impacts of climate change. Most relevant to transforming the state's light-duty vehicle fleet, former Governor Jerry Brown issued an executive order in 2018 setting a goal of 5 million zero-emission vehicles in California by 2030.

Financial incentives can play an important role by accelerating the retirement and replacement of older, high-polluting vehicles and by increasing the adoption of clean vehicles. Yet several challenges persist in enabling low- and moderate-income households, representing nearly 50% of the state's population and vehicle holdings, to adopt near-zero and zero-emission vehicles in California. Lower-income households are more likely to own higher-emitting vehicles (due to lower purchase costs), to hold on to these vehicles longer and to then bear a disproportionate burden of transportation-related air pollution when compared to higher-income households. Due to high upfront costs, low- and moderate-income households are also less likely to be able to afford or finance advanced clean vehicles without financial incentive support.

While many low-income households have participated in the incentive to retire an old vehicle through the state's Enhanced Fleet Modernization Program (EFMP) since 2010, few of these participants were able to take advantage of the replacement rebate for lower-emitting vehicles until the creation of the EFMP Plus-Up pilot program in 2015. The Plus-Up component provides an additional replacement incentive amount, dependent upon household income and type of replacement vehicle, for the purchase of a new or used clean vehicle. As shown in our full report and subsequent work, the EFMP Plus-Up pilot was successfully implemented in the San Joaquin Valley and South Coast air quality management districts and is now expanding to other areas of the state (the Bay Area, Sacramento and San Diego) as the renamed Clean Cars 4 All (CC4A) program.

A statewide incentive program, the Clean Vehicle Rebate Project (CVRP), has offered rebates for zero-emission plug-in hybrid electric, battery-electric, and fuel-cell electric vehicles since 2010. Like the early stages of the EFMP, at its outset, few low- and moderate-income households applied for CVRP rebates to aid in the purchase of hybrid and zero-emissions vehicles (Center for Sustainable Energy, 2014). Low initial adoption by this population prompted recent revisions to the income criteria used for increased incentive amounts offered through the project. Additionally, very few car sharing, ridesharing and other travel mode-shifting programs that use near-zero or zero-emission vehicles currently exist in low- and moderate-income neighborhoods. There are, however, several pilot programs underway throughout the state, including multiple car sharing and mobility options pilot projects in the Los Angeles and Sacramento areas. A new statewide program, the Clean Vehicle Assistance Program (CVAP), also launched recently to offer financing assistance to lower- income households for a clean vehicle purchase. The full report both informs further refinement of existing programs and helps respond to California Senate Bill 350, which prioritized the identification of barriers (and strategies to overcome them) to clean transportation access for low-income Californians.

This policy brief assesses current barriers and informs future strategies to improve clean vehicle access and use by low- and moderate-income households, while generating broader environmental and economic benefits in California. The research primarily aims to identify effective policy strategies, using incentives and preferential financing, that promote the retirement of functional, high-emitting vehicles and the adoption of advanced clean vehicles by the target population. Findings from our statewide representative survey of 1,604 low- and moderate-income households provide recommendations to improve access to and adoption of clean vehicles.

Survey Background and Methods

The purpose of the survey was twofold. LCI wanted to understand 1) the effectiveness of alternative incentive designs for low- and zero-emission vehicle purchases and 2) the role that enhanced financing options might play in increasing the purchase of new or used low- and zero-emission vehicles.

The survey covered a variety of topic areas to this end, and included questions on the respondents' socioeconomic, demographic and geographic background, current household and vehicle characteristics, past purchase behavior and future purchase preferences, commuting patterns and needs, and willingness to consider alternative travel modes. These factors helped inform the central module of the survey, the Vehicle Choice Experiment. The vehicle choice set results enabled us to model predicted clean vehicle uptake for the low- to moderate-income households across differing incentive level and financing scenarios.

The Vehicle Choice Experiment used a respondent's previous answers on preferred vehicle attributes and financing options (i.e., body type, make, down payment and monthly payment amount, loan term) for a future vehicle purchase, and guided the respondent through several sets of conventional vehicle choices. The module displayed five vehicles per screen, including a thumbnail picture, the make, model, year, mileage, cost per mile, fuel economy and market price. Respondents then selected the vehicle they would most prefer to purchase from the sets of five choices. Next, respondents were guided through a similar choice set process that included clean and alternative fuel vehicles, such as battery-electric vehicles (BEVs), plug-in hybrid electric vehicles (PHEVs) and hybrids (HEVs). From the results of the choice set experiments, we estimated a vehicle choice conditional logit model, which we subsequently used to predict clean vehicle uptake in various incentive and financing scenarios.

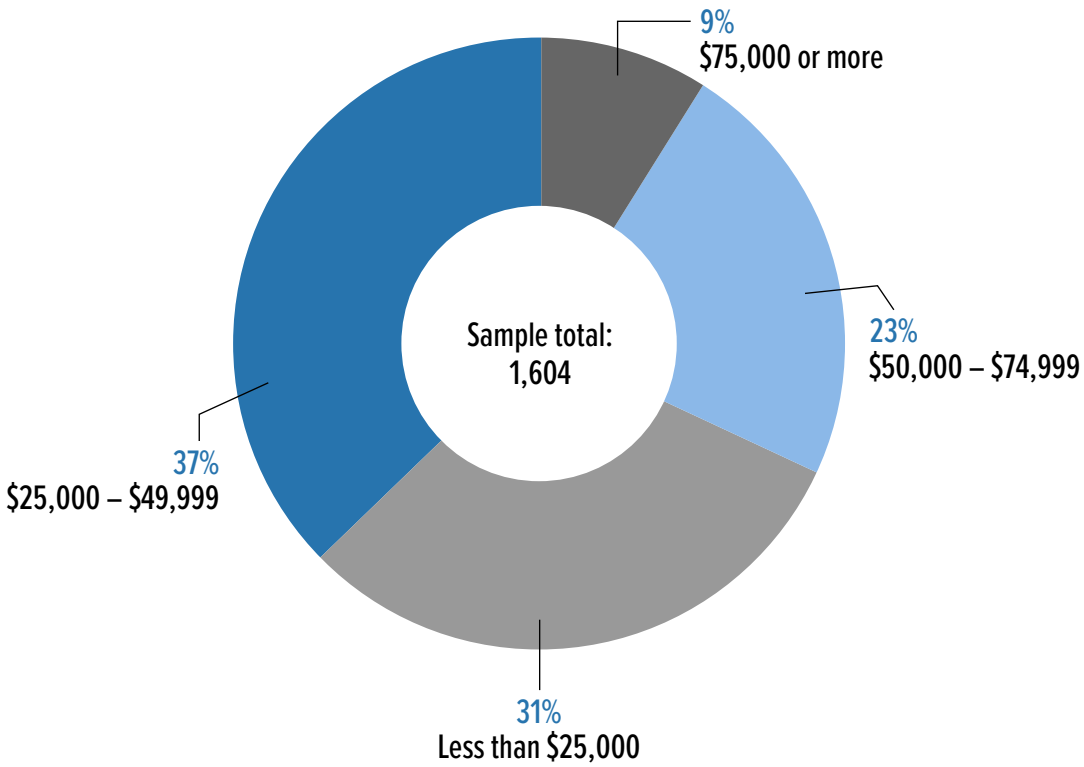
To develop the survey instrument, researchers at LCI coordinated with Valley Clean Air Now (Valley CAN), the San Joaquin Valley Air Pollution Control District and the South Coast Air Quality Management District to interview past or prospective EFMP Plus-Up participants. We also conducted complementary case studies of EFMP Plus-Up pilot programs. LCI formally contracted with the firm Growth from Knowledge Custom Research, LLC (GfK) to administer the full survey instrument.

The final usable survey sample size comprised 1,604 respondents from unique households, all of whom were adults residing in California and stated their intent to replace a household vehicle within the next three years. GfK assigned weights to each respondent which, when used to generate subsequent statistics, ensured representativeness of the sample to the statewide population in terms of race, ethnicity, income and education among low- to moderate-income households.

Survey Respondent Profile

All respondents reported household incomes below 300% of the Federal Poverty Level (FPL), with 68% of the weighted sample reporting household incomes below 225% of the FPL.[1] About two-thirds of respondents had an annual household income of less than $25,000 or between $25,000 and $49,999 (37%), compared to 23% of respondents making $50,000 to $74,999 and just 9% of households reporting more than $75,000 in income. Around 38% of the sample lived in a disadvantaged community at the time of the survey.[2] Further, 52% of the weighted sample were Spanish speakers.

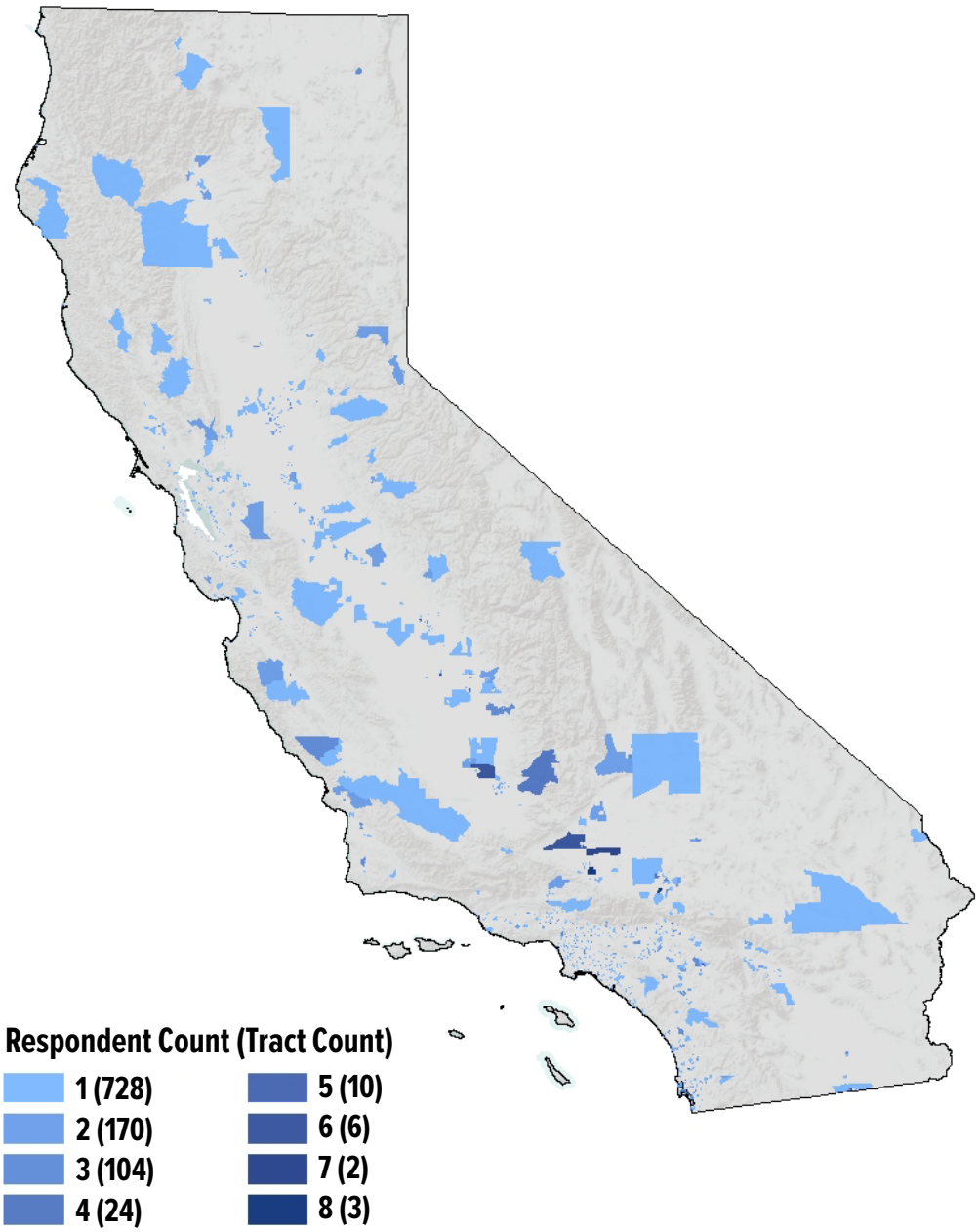
Figure 1. Income Category of Respondents



Survey respondents exhibited a high level of vehicle dependence; on average they reported owning as many vehicles per household as the statewide average for all households (2.0 vehicles). A little over half of respondents (55%) reported living in a detached single-family home, and about 54% of respondents were renters.

[1] For a household of four, the Federal Poverty Level amounts to $72,000.
[2] Using Cal EnviroScreen 3.0 DAC scores.

Figure 2. **Number of Survey Respondents by Census Tract**



Urban and suburban areas each contained about 43% of the sample respondents, while the remaining 14% were in rural areas.[3] Nearly half the survey participants lived in the South Coast Air Basin, around 10% in each the San Joaquin Valley, Bay Area and San Diego County air quality management district (AQMD) areas, 3% in Sacramento and 19% in other AQMD geographies.

[3] Using American Community Survey (ACS) population data and geocoding methods, a total of 17,034,449 people reside in principal cities, 16,774,426 in suburbs, and 5,584,301 in rural areas. See full report for a description of geocoding methods.

1 Transportation Affordability

The vast majority of low- and moderate-income households own and use automobiles, despite the substantial financial burden of vehicle ownership and operation, because of the benefits they derive from personal vehicle use.

Significant differences, however, existed between low- and moderate-income respondents. Survey respondents from the lowest-income bracket ($25,000 or less) held less than half as many vehicles as moderate-income households ($75,000 or more).

Survey participants also reported spending a large portion of their income on vehicle purchase and maintenance. Among households who gave full information on their annual fuel, insurance and repair expenditures, these outlays were equivalent to 16.2% of their reported annual household income. This level of expenditure exceeds the 15% affordability threshold for transportation expenditures recommended by several scholars (Smart and Klein, 2018). These estimates of the expenditure burden for the main vehicle excluded known but unquantified registration, depreciation and parking costs, as well as expenditures to operate other household vehicles or alternative modes. This suggests that Californian low- and moderate-income households likely pay far more than 15% of their annual income for necessary transportation expenditures.

Moreover, the average reported expenditure to purchase a vehicle was almost $14,000, or more than 50% of the average yearly income of households surveyed. Again, significant differences existed between low- and moderate-income respondents. These high levels of expenditure for vehicle purchase and operation indicate the importance of vehicles to low- and moderate-income households.

Policy Implications

King, Smart and Manville (2019) argue that policymakers should consider cars as basic infrastructure for low-income households. Our findings echo this call and underscore the importance of more broad, generous and uniform transportation affordability support policies for low-income households across the state, such as those found in the energy and food sectors (Pierce, Chow and DeShazo, 2020). We recommend that policymakers at state or federal levels design and fund more comprehensive transportation affordability support policies modeled on other basic service sector programs, such as the CARE or CalFresh efforts.

Further reading:

David A. King, Michael J. Smart and Michael Manville (2019). The Poverty of the Carless: Toward Universal Auto Access. Journal of Planning Education and Research, 1-18.

Gregory Pierce, Nicholas Chow and J.R. DeShazo (2020). The Case for State-Level Drinking Water Affordability Programs: Conceptual and Empirical Evidence From California. Utilities Policy, 63(C).

Michael J. Smart and David A. Klein (2018). Remembrance of Cars and Buses Past: How Prior Life Experiences Influence Travel. Journal of Planning Education and Research, 38(2), 139-151.

2 Vehicle Purchase Incentive Levels

Because of the affordability burden of a vehicle purchase, lower-income households are more likely to own higher-emitting vehicles, to hold on to these vehicles longer and to then bear a disproportionate burden of transportation-related air pollution when compared to higher-income households (Pierce and Connolly, 2018).

Low- and moderate-income households are less likely to be able to afford or finance advanced clean vehicles without financial incentive support. Evidence from our survey and case studies of EFMP Plus-Up pilot deployment supports these previous findings, and results from the vehicle choice experiment make a strong case that financial incentives increase the purchase propensity for alternative fuel vehicles among low- and moderate-income households.

Alternative fuel vehicles — including BEVs, PHEVs and HEVs — may lower annual vehicle expenditures for households by way of decreased fuel costs. However, the upfront price of cleaner vehicles is still a major barrier for households. Research has found that low- and moderate-income households have lower awareness and usage of electric vehicles than higher-income households (DeShazo et al., 2017). Furthermore, the low- to moderate-income population may be less aware of financial incentives they may qualify for to help with the purchase and operation of a clean vehicle. Our survey found that nearly 80% of respondents were aware of PEVs, but less than 40% of households surveyed reported that they were aware that "the State of California offered rebates that could lower your costs of purchasing" PEVs.

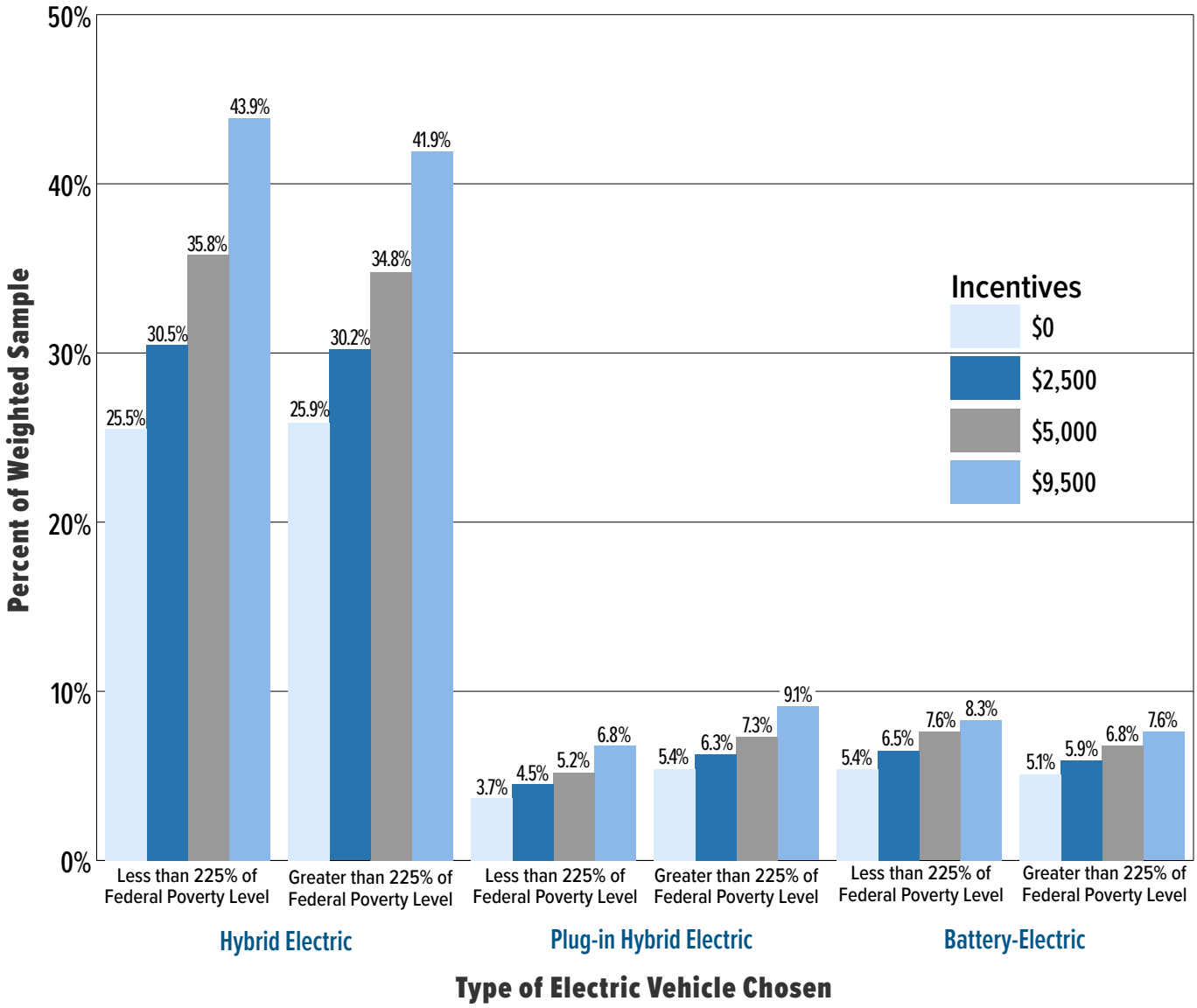
These survey results demonstrate that awareness of clean vehicle rebates and financial incentives, along with high upfront purchase costs, are barriers to increasing clean vehicle ownership among the low- to moderate-income population in California. The vehicle choice experiment section of the survey revealed the purchase propensity (or how likely a household would be to purchase a vehicle) for BEVs, PHEVs and HEVs across these upfront incentive and guaranteed financing scenarios. We found that all incentive levels create a positive and substantive impact on the propensity to purchase hybrids and electric vehicles. Offering upfront incentives of $2,500, $5,000 and $9,500 increased clean vehicle purchases incrementally by approximately 20%, 40% and 60–80% respectively, with only small differences in these rates across income groups (Figure 3, next page).

We also evaluated a policy scenario that would offer guaranteed financing (with interest rates at 5%, 7.5% and 15%) to these same households when they purchase cleaner vehicles. We found that rebates had a much larger impact than offering guaranteed financing alternatives. This difference reflects not only each population's preference for financing (which is lower for low-income consumers) but also the price elasticities of demand. Upfront incentives reduce the price at purchase, thus lowering both the down payment and total payment, as well as monthly financing payments, if any. With financing, the upfront payment goes down, which increases utility, but the monthly payment goes up, decreasing utility. For low-income consumers, the decrease in utility due to the increase in monthly payments (which are higher for BEVs since BEVs are generally more expensive than other vehicle types) outweighs the increase in utility due to lowering the upfront payment.

Policy Implications

Low- to moderate-income households show a strong interest in clean vehicles if the price is made affordable to them through incentive offerings. Our results on the effectiveness of upfront incentives and guaranteed financing at different levels for different clean vehicle types directly inform how the state's three major vehicle incentive programs—CC4A, CVRP and CVAP—can refine their existing parameters to make the best use of public dollars.

Figure 3. **Percent of Weighted Sample Choosing Electric Vehicle Types, by Subsidy and Income**



Further reading:

J.R. DeShazo, Tamara L. Sheldon and Richard T. Carson (2017). Designing Policy Incentives for Cleaner Technologies: Lessons from California's Plug-in Electric Vehicle Rebate Program. Journal of Environmental Economics and Management, 84, 18-43.

Gregory Pierce and Rachel Connolly (2018). Can Smog Repairs Create Social Justice? Luskin Center for Innovation.

3 Location of Vehicle Purchase

A handful of studies have analyzed how households search for automobiles and how technology access influences this search. Only one study, to our knowledge, focuses on potential differences in search by income groups (Klein and Ford, 2003). Given this dearth of information, we examined the survey results related to where households purchased their main vehicle and where they expected to purchase their next vehicle.

Understanding where low- and moderate-income households purchase vehicles can help inform outreach and targeting strategies for increasing clean vehicle ownership among this subpopulation. For example, if households prefer to go through informal channels, such as friends and family members, to purchase a vehicle (instead of visiting a new or used car dealership), this may be a barrier to raising awareness of existing rebates and incentives that aid in lowering the upfront costs of an alternative fuel vehicle. Furthermore, supporting vehicle purchases through public sector programs may prove more challenging for vehicles purchased through informal channels.

By far the most common seller (60%) of vehicles to surveyed households were formal (i.e., dealerships, etc.) with purchases from social networks the second-largest category (20%). No other seller category represents more than 10% of sales. As Figure 4 (next page) shows, there were major differences between past purchases and expected future purchases. Households expect to buy more often through formal channels, much less often through social networks and slightly more often via the internet. To the extent that households rely on social networks to acquire vehicles due to discrimination from external sellers, however, this lower expectation of purchases through social networks may not be realized.

The proportion of respondents who purchased their main vehicle through a formal channel, such as a dealership, increased substantially as income increased (just 47% of those making less than $25,000 compared to about 75% of those making over $50,000). Among racial-ethnic groups, by far the most likely group to purchase their main vehicle through a formal channel were non-Hispanic Asian respondents (74%). Moreover, non-Hispanic Black respondents were more likely to have utilized a social network, and higher proportions of Hispanic/Latino respondents went through semiformal channels for their past vehicle purchase, compared to other racial and ethnic groups.

We also examined where households purchased their main vehicle by language proficiency. English language proficiency may be related to the ability or comfortability to negotiate and purchase a vehicle at a formal institution. We found noticeably higher reliance on semiformal sellers (local repair shop, garage, on-street advertiser or "Buy Here Pay Here" used dealer) and internet sellers among Spanish-only speaking households, although we note that the small sample sizes do not allow us to determine whether these differences are significant.

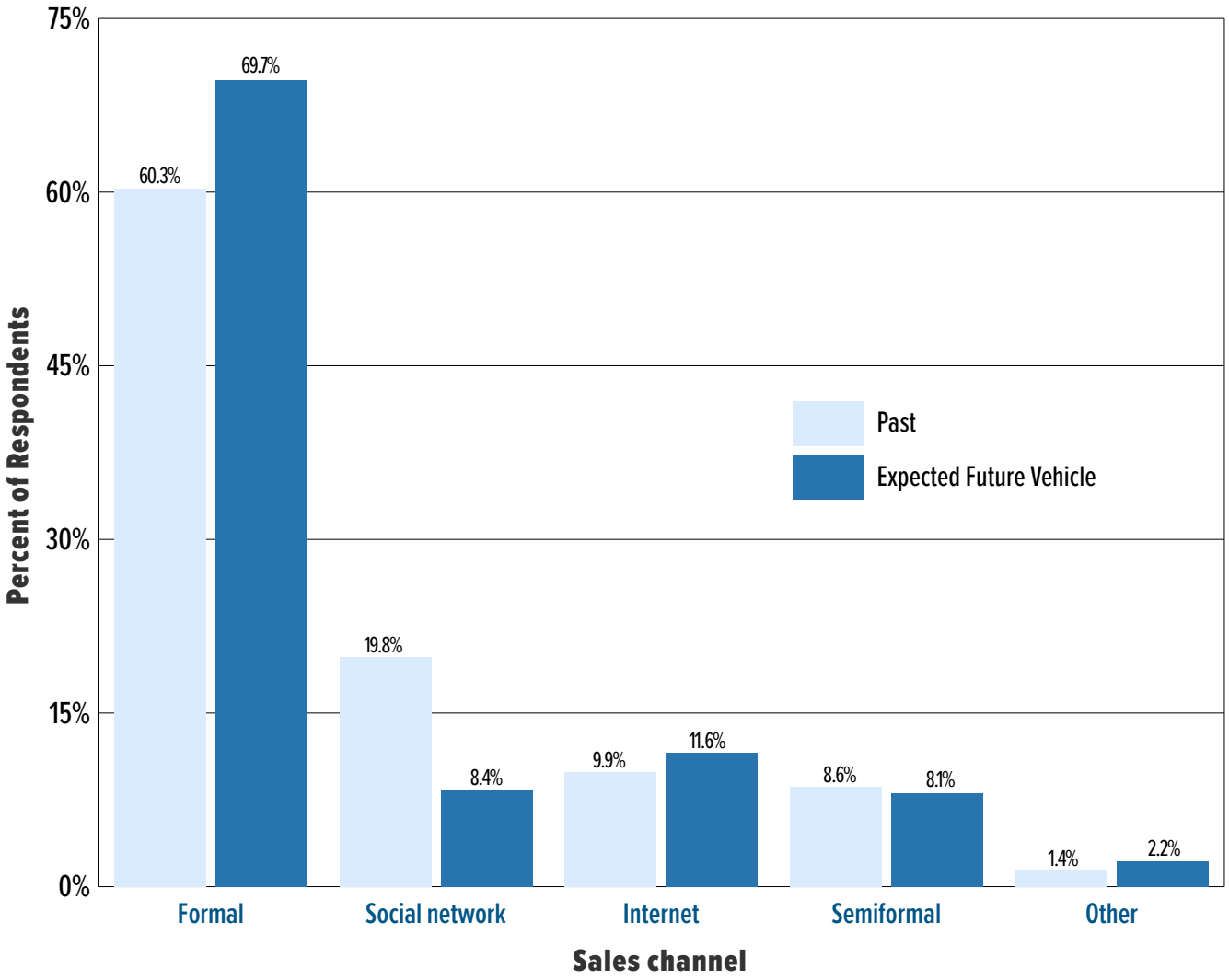
Policy Implications

Our survey findings show that the majority of low- to moderate-income households choose to go through a formal channel, such as a dealership, when purchasing a vehicle, but this comfort level with formal points of purchase varies widely by income, ethnicity and language. This suggests that considering more flexible incentives to allow lower-income households to purchase used clean vehicles in their preferred locations may be necessary to expand uptake among the low- to moderate-income population in California. Better integration of the provision of incentive information for alternative fuel vehicles at formal seller types may also be a useful strategy.

Further reading:

Lisa R. Klein and Gary T. Ford (2003). Consumer Search for Information in the Digital Age: An Empirical Study of Prepurchase Search for Automobiles. Journal of Interactive Marketing, 17(3), 29-49.

Figure 4. Seller Type of Prior Main Vehicle Purchases and Expected Future Vehicle Purchases



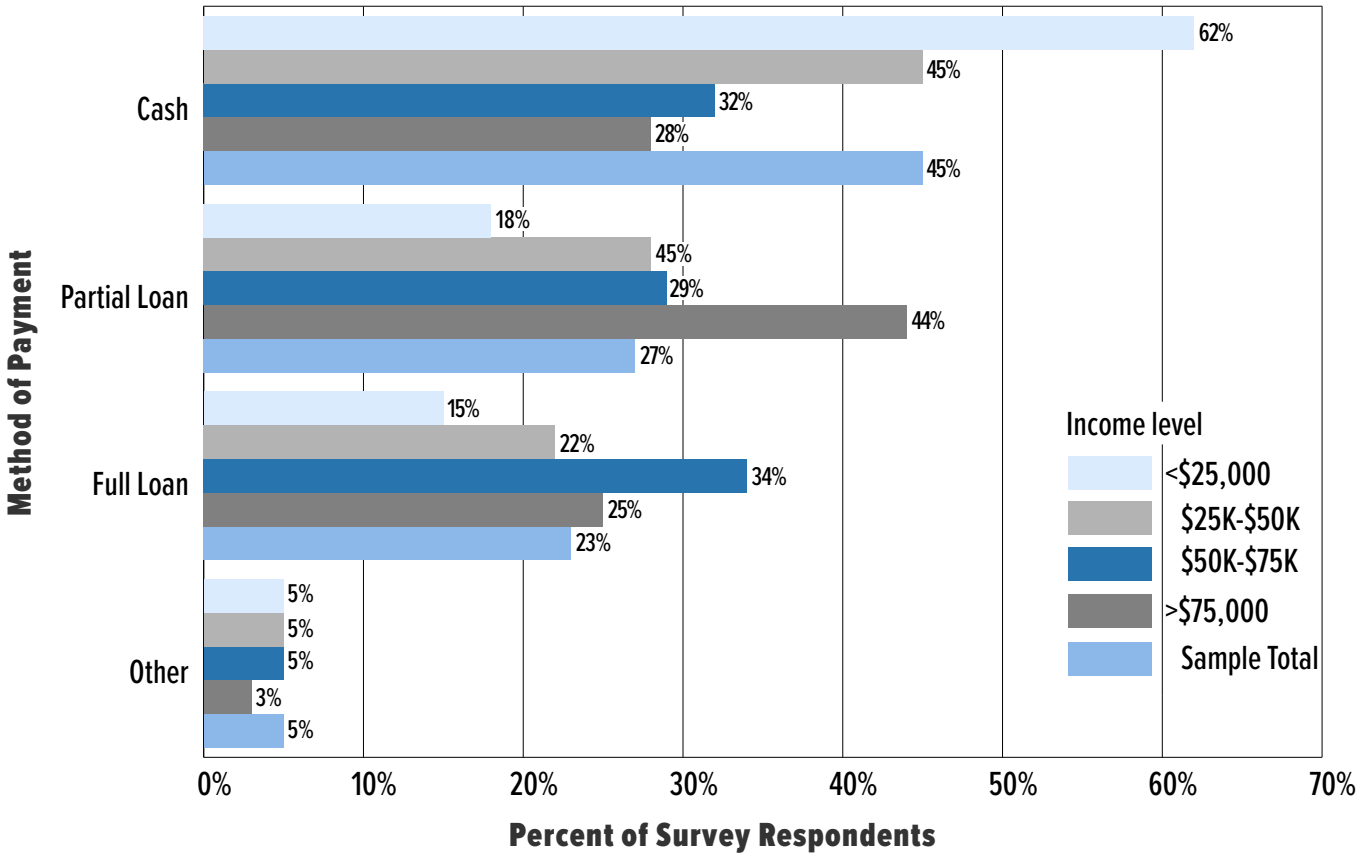
4 Financing Method of Vehicle Purchase

Unlike a house or other place of dwelling, which a typical household may purchase once or twice over a lifetime, low- and moderate-income households purchase vehicles more frequently. The magnitude and relative frequency of vehicle purchases suggest that differential outcomes by income, race or language in the vehicle search and buying process may have important implications for differences in wealth and financial well-being.

The frequent turnover observed in vehicle fleets represents an opportunity for policymakers to support a faster transition to cleaner vehicles than might typically be chosen by low- and moderate-income households in the absence of financial support. In this section, we examine how this subpopulation purchased or financed their main vehicle and discuss the barriers to clean vehicle ownership borne out of the survey results.

In terms of method of payment, about 45% of respondents paid for their vehicle upfront with cash, while 27% took out a loan to cover part of the purchase and 23% took out a loan to cover the full purchase of the vehicle. Households who paid in cash for their main vehicle paid a significantly lower purchase price (less than half, on average) than those who financed part or all of their purchase. The method of payment differed depending on the status of the vehicle, in that surveyed households were much more likely to pay in cash for used rather than new vehicles (46% vs. 30%). The method of payment also varied depending on income, where the lowest-income households were significantly more likely to pay for their vehicle purchase in cash (62%) than higher-income households.

Figure 5. Method of Payment for Main Vehicle, by Income



Difficulty obtaining a loan for a vehicle purchase may be the result of several factors, including access to credit or status of credit. Low-income households may have little access to savings or credit. To better understand these barriers, we analyzed surveyed households' self-reported credit capacity and assessment, and the characteristics of their vehicle financing history.

Because of the sensitivities around asking households for their credit score, we instead asked them to self-assess their credit. Lower-income households surveyed were much more likely to assess their own credit as poor or to have no credit history. Credit scores, in turn, affect the favorability of the terms of loans taken out for vehicle purchase, as shown in Figure 6. Respondents who assessed their credit as excellent or good obtained much better vehicle loan rates than those who assessed their credit as fair or poor.

As shown from our vehicle choice experiment results, offering guaranteed financing with interest rates of 15%, 7.5% and 5% increase the lower-income population's probability of purchasing a PHEV by 10%, 13% and 14%, respectively. Financing with the three rates increased the moderate-income population's probability of purchasing a PHEV by 11%, 15% and 17%, respectively. While financing increases the moderate-income population's probability of purchasing a BEV by up to 7%, it does not increase the lower-income population's probability of purchasing a BEV.

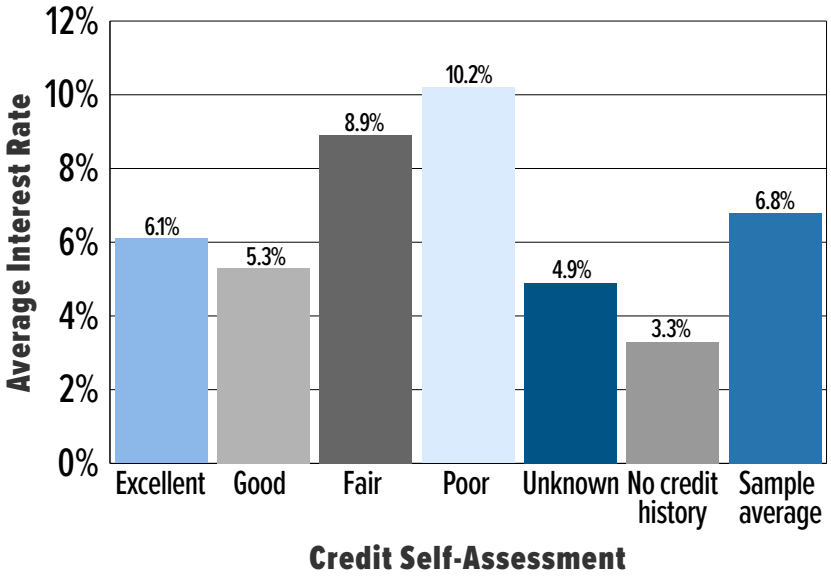
Policy Implications

Our survey findings suggest that differential and less favorable loan terms for vehicle purchase are a result of differences in income, credit, race and ethnicity. We expect that low- to moderate-income households would continue to face these barriers when purchasing a future vehicle, especially considering the upfront costs of used and new alternative fuel vehicles tend to be higher than traditional gasoline-powered vehicles. Allowing higher guaranteed loan interest rates (up to 15%), subsidized with public dollars, would allow a higher share of lower-income households to be able to purchase clean vehicles and thus overcome some of these challenges.

Further reading:

J.R. DeShazo, Tamara L. Sheldon and Richard T. Carson (2017). Designing Policy Incentives for Cleaner Technologies: Lessons from California's Plug-in Electric Vehicle Rebate Program. Journal of Environmental Economics and Management, 84, 18-43.

Figure 6. Average Interest Rate, by Credit Self-Assessment



5 Clean Vehicle Charging

A range of built environment, housing type and tenure characteristics, and commuting patterns present barriers to clean vehicle ownership for low- and moderate-income Californians. Each of these factors affects whether and what type of electric vehicle fits with household travel needs. For example, households making longer trips or commutes require PEVs with longer travel ranges between charging times.

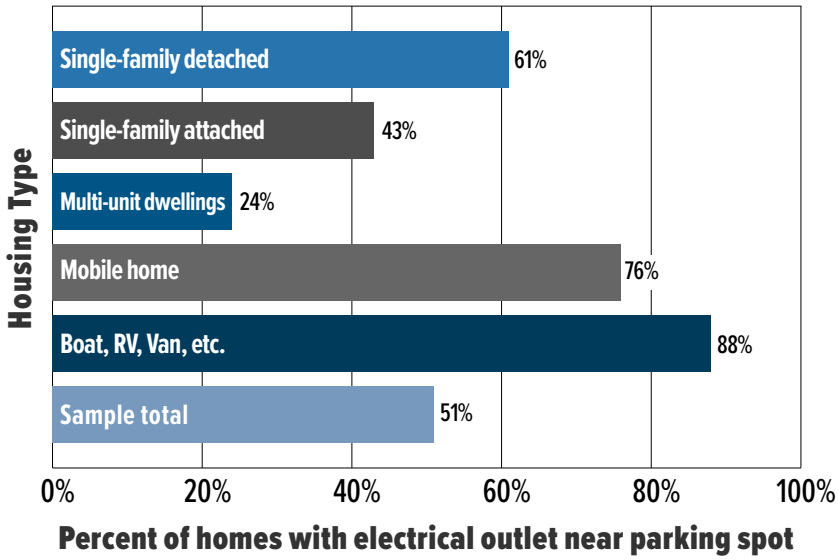
The most important travel behavior element for the feasibility of PEV use by households is the frequency of long trips that might exceed or test the electric range of some PEVs. We find, however, that only about 7% of respondents take a vehicle trip exceeding 100 miles (round trip per week).

Furthermore, the nature of employment and its locational stability influences commute distance.[4] Nearly a quarter of respondents do not report to the same primary work location each workday.[5] About half of these individuals commute to a different work site daily while the other half commute to multiple work sites or locations each workday. The fairly substantial levels of variability in workplace location among the low- and moderate-income population suggest that these households may not benefit as much from workplace-located electric vehicle charging.

Finally, we analyze attributes of low- and moderate-income households' place of residence that would make PEV charging at home more or less difficult. The proximity of an existing electrical outlet to where vehicles are parked at home affects rates of PEV adoption. Studies have found that the type and ownership status of residence affects charging proximity (DeShazo, Wong and Karpman, 2017; DeShazo, Krumholz, Wong, and Karpman, 2017).

The presence of an electrical outlet or plug-in suitable for PEV/BEV charging is influenced by two main factors: housing tenure and housing type. As previous studies have shown, respondents living in single-family detached homes have the most convenient PEV charging potential. We found that 61% of surveyed households had an electrical outlet within 25 feet of their parking spot (Figure 7). On the other hand, residents of multi-

Figure 7. Presence of Electrical Outlet Within 25 Feet of Parked Car, by Housing Type



[4] We did not ask questions regarding respondents' employment sector or specific job title.
[5] We searched, but could not find, available reference points to contextualize this finding from other data sources or studies in any U.S. context.

unit dwellings appear to have the lowest charging potential, with 65% of respondents reporting there were no electrical outlets near their parking spot. The results were quite similar when looking at the 100-foot threshold for a proximate electrical outlet. Furthermore, a higher share of respondents who owned their home reported the presence of an electrical outlet within 25 feet of their parking spot (65%), compared to those who rented (40%).

Policy Implications

Our research suggests that low- and moderate-income households may not benefit as much as higher-income households from workplace charging due to the variability in workplace locations and commuting patterns. While the presence of publicly available electric vehicle charging may influence a household's decision to purchase an electric vehicle, previous studies have shown relatively low levels of awareness of charging stations located at work, stores or places they frequent and pass regularly (Singer, 2017). To increase charging ability and availability among renters and those who live in multi-unit dwellings, there is evidence that offering rebates for electric panel upgrades may be a cost-effective strategy. Policymakers should also consider accelerating additional targeted strategies for overcoming clean vehicle charging infrastructure barriers in multi-unit dwellings or via gas station models.

Further reading:

J.R. DeShazo, Sam Krumholz, Norman Wong and Jason Karpman (2017). Siting Analysis for Plug-in Electric Vehicle Charging Stations in the City of Santa Monica. UCLA Luskin Center for Innovation Report.

J.R. DeShazo, Norman Wong and Jason Karpman (2017). Overcoming Barriers to Electric Vehicle Charging in Multi-Unit Dwellings: A Westside Cities Case Study. UCLA Luskin Center for Innovation Report.

Mark Singer (2017). The Barriers to Acceptance for Plug-in Electric Vehicles: 2017 Update. National Renewable Energy Laboratory.

6 Alternative Modes to Single-Occupancy Vehicles

In addition to examining the barriers to vehicle access, we also assessed the use of alternative travel modes to the personal vehicle. While alternative modes are often considered a second-best solution to meet household travel needs in the presence of vehicle access deficits (such as mode of travel when a vehicle is being repaired), they may also be the best solution if they can be made as convenient and timely as vehicle use.

To look at alternative mode use and interest, we first analyzed respondents' self-assessment of whether a transit stop (i.e., bus or rail) is located within a comfortable walking distance to either their home or workplace. More than two-thirds of respondents indicated that there was a walkable transit stop near their home, but less than 15% indicated there was such a stop near their workplace. Less than 10% reported a transit stop near both locations. Differences in perceived proximity to a transit stop did not vary substantially by race or income.

Second, we examined how frequently households used alternative modes to solo driving their own vehicle. The self-reported frequency of use of travel modes, with respondents able to select as many modes as they take, exhibited personal vehicle dominance. About 70% of respondents reported using a vehicle within their household daily, with 20% also reporting at least one walking trip. No other mode exceeded 6% of daily use.

Last, we asked survey takers whether they would seriously consider selling their main vehicle if transit were made as convenient and inexpensive as operating their vehicle. Less than 60% of respondents said they would choose to keep their vehicle despite the transit option. The primary reason respondents gave for preferring to keep their vehicle was that they enjoyed driving, especially among higher-income households. Respondents also mentioned economic reasons around the asset value of the vehicle, which explained 40% of the preference for vehicle retention. Despite the high necessary expenditure for vehicle operation, one-third of the sample preferred to keep their vehicle because they thought that alternative modes would not be as cheap or convenient as their main vehicle for travel purposes. This relative lack of use of, or interest in, transit alternatives reflects recent research on transit usage trends in Southern California (Manville, Taylor, and Blumenberg, 2018; Blumenberg et al., 2020)

Policy Implications

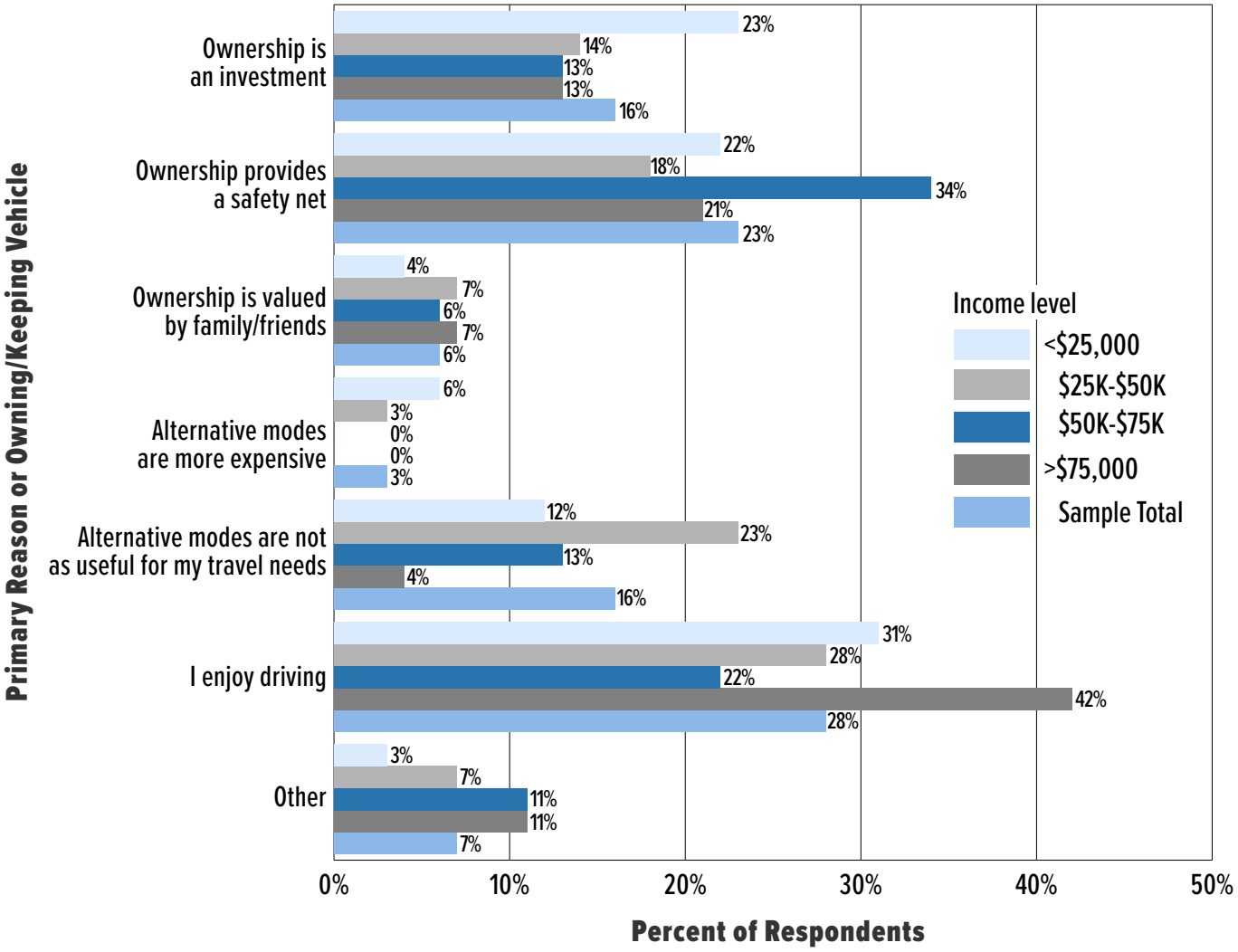
Our survey findings indicate that there is low overall interest in taking alternative modes of transit, even if they are made as convenient and inexpensive as operating a vehicle. While an overarching goal for inducing more people to take transit trips or use alternative modes in lieu of single-passenger automobile trips should remain, the survey results further the case for focused policies and investments to increase uptake of cleaner vehicles among low- to moderate-income households as an equitable mitigation strategy to air pollution and GHG emissions.

Further Reading:

Evelyn Blumenberg, Mark Garrett, Hannah King, Julene Paul, Madeline Ruvolo, Andrew Schouten, Brian D. Taylor and Jacob Wasserman (2020). What's Behind Recent Transit Ridership Trends in the Bay Area? UCLA Institute of Transportation Studies.

Michael Manville, Brian D. Taylor and Evelyn Blumenberg (2018). Falling Transit Ridership: California and Southern California. UCLA Institute of Transportation Studies Report for Southern California Association of Governments.

Figure 8. Primary Reason Households Prefer to Own/Keep Vehicle Regardless of Alternative Travel Modes, by Income



innovation.luskin.ucla.edu