Accelerating Electric Vehicle Adoption in the Bay Area

Market Research Findings from the Bay Area Air Quality Management District

Prepared by the Center for Sustainable Energy

Center for Sustainable Energy™

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CSE Headquarters
Center for Sustainable Energy
3980 Sherman Street, Suite 170
San Diego, CA 92110
858-244-1177
EnergyCenter.org

CSE Offices
CA: Los Angeles, Oakland, Sacramento
MA: Boston
NY: Brooklyn, Stony Brook

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I. Executive Summary

The Bay Area Air Quality Management District (BAAQMD) is a regional air pollution control agency serving a nine-county area surrounding the San Francisco Bay (Bay Area) that is home to more than 5 million adult residents.[1] BAAQMD has worked to improve air quality in the Bay Area since 1955 and has a goal to increase electric vehicle (EV) adoption to reduce air pollution and greenhouse gas emissions. To this end, BAAQMD contracted with the Center for Sustainable Energy (CSE) to study vehicle market stakeholders in the Bay Area to understand their barriers to EV adoption. The following target populations were included in this analysis.

- Bay Area residents, particularly:
  - Apartment dwellers
  - Low-to-moderate income residents (under $100,000 of family income per year)
  - Residents with nontraditional commuting patterns
- Ride-hail drivers (e.g., Uber/Lyft)
- Multi-unit dwelling (MUD) property owners/managers
- Vehicle fleet managers
- Car dealerships

Using a mixed-method approach, CSE analyzed these consumer and business perspectives on EV adoption and infrastructure across the Bay Area. Over 1,100 survey responses were collected along with information from focus groups and interviews, adding 40+ stakeholders. Non-probability sampling was used to collect survey responses and should be considered when generalizing findings to the broader Bay Area population. However, these findings provide a useful roadmap to incentives, programs and outreach/education activities that can accelerate EV adoption and reduce emissions. Key findings from each target population are summarized.

Bay Area Residents

Overall, 7% of respondents already owned an EV and 40% of non-EV owners have considered one. Respondents' average daily commute was 27.4 miles, and many (40%) use multiple commute methods. On average, respondents spend 50% of their drive time commuting to work. The most important factors that go into their decisions to purchase EVs are costs of purchase, fuel costs, safety and dependability. The overall biggest concerns with EVs were related to range and charging availability. Interestingly, audiences who were more likely to have considered acquiring an EV also reported higher levels of concern about various aspects of the technology. Lastly, awareness of EV brands, available charging infrastructure and available incentives were low.

[1] American Community Survey; 2017 ACS 5-year estimates. *ACS Demographic and Housing Estimates* (DP05). https://factfinder.census.gov

To understand the appeal of various types of incentives, respondents were asked to rank possible incentive structures from one to ten in order of how likely they were to influence their decision to get an EV. Overall, discounts off a new EV, tax credits, discounts on home charging equipment and attractive financing offers were identified as most likely to influence their decision to buy an EV. While commonly considered an effective incentive for EV buyers (and identified as important by dealers interviewed), respondents ranked high-occupancy vehicle (HOV) lane access eighth out of ten options.

Differences among the target populations were noticed in the findings. Apartment dwellers earned less income, were less likely to own a vehicle or be planning to purchase/lease one and tended to own older vehicles. Further, those planning to acquire a vehicle were more likely to indicate that they would purchase/lease a used vehicle. Apartment dwellers also had significantly less access to home charging (even standard 120-volt outlets) and were much more likely to park in shared lots or on the street.

Nontraditional commuters spent more of their time using their personal vehicles for things other than commuting, but still supplemented their alternative methods of commuting with driving their personal vehicle. Nontraditional commuters also had newer vehicles, owned a lower proportion of gasoline vehicles and a higher proportion of clean vehicles (e.g., hybrids, BEVs and PHEVs). While more research is needed to confirm, these findings suggest that their commuting choices may be slightly more rooted in concern for the environment. They also tended to have fewer concerns about EVs than traditional commuters. Lastly, nontraditional commuters ranked the incentive of free or reduced charging vouchers as more influential in their decision to get an EV than the overall. This may be due to their limited driving and willingness to charge at various locations, but more research is needed to confirm.

The largest differences between target groups existed in respondents by income. Respondents making under $100K had older vehicles, were less likely to be planning a vehicle purchase and were much less likely to be considering a new car. Respondents making over $100K were willing to pay 1.5 times the amount for a car on average and spent significantly less on transportation-related costs as a proportion of their income. Respondents making over $100K had more interest in EVs but also more concerns about EVs, possibly indicating that they had spent more time thinking about the pros and cons of an EV.

Ride-Hail

Overall, 185 ride-hail drivers were surveyed. These respondents do not constitute a random sample of ride-hail drivers and should not be used to generalize findings to the Bay Area ride-hail community. A majority of ride-hail drivers surveyed worked on a part-time basis of less than 20 hours per week and have other jobs in addition to driving ride-hail. They averaged 228 miles per week driving for ride-hail services, with 75% commuting less than 20 miles to where they start work. The respondents tend to work earlier shifts early in the week and later shifts as the week goes on and into the weekend. Their wait times between rides also tend to get shorter as the week goes on. On average they take a 26-minute break during their shift. Ride-hail drivers reported owning newer vehicles that they have already paid off, most likely due to company requirements. Overall, 16% drive an EV, and this group had a generally higher familiarity with EV incentives than the residents surveyed. For this audience, the most

important factors for their purchasing decisions were still cost, safety and dependability, however, they ranked things like comfort and technology higher. More research is needed to confirm, but this may be due to the amount of time spent in their vehicles and the fact they use their vehicle to provide a customer service.

Three-quarters of respondents said their out-of-pocket expenses play an influential role in their car-buying decision. Compared to Bay Area residents in general, a higher percent of drivers said they would consider an EV (64%) but brand and charging infrastructure awareness was low in this group. Their concerns about EVs mirrored the residential survey population. However, over half (58%) of respondents indicated that long-range EVs would have enough range to meet their ride-hail driving needs during a shift.

When ranking the value of possible incentive structures, ride-hail respondents ranked discounts off of a new EV had the highest —as in the resident survey—however it was followed by incentives that would lower driving costs (charging vouchers) and increase driver revenue (additional dollar amounts per trip, allowing ride-hail passengers to select clean rides).

Multi-Unit Dwelling Property Managers

Most MUD property managers had done little to no research on installing EV charging at their buildings despite agreement that EV charging would attract high-quality tenants and would eventually become a necessity. These property managers face several barriers—a lack of time to research EV charging, uncertainty about cost and scope of project (e.g., need for electrical upgrades) and a fear that chargers will become a future additional maintenance problem.

As some participants suggested, providing information and technical assistance would be valuable for many property managers. Interestingly, during the focus groups, one participant would occasionally offer a potential solution to another participant's concern. For example, one participant raised a concern that drivers will park all day in front of a charger, and another participant mentioned that her property had avoided this issue by implementing an hourly rate structure. Technical assistance that includes a site walk to assess electrical capacity and provide a cost estimate could also help alleviate fears and provide momentum for many property managers.

Finally, most participants agreed that despite any technical or logistical concerns, they would be willing to install EV charging with a high enough subsidy.

Public Fleet Managers

The fleet managers who participated in these interviews were very supportive of adding EVs to their fleet, and many expressed a desire to do their part for a cleaner environment. While discussing light-duty vehicles, there was almost no concern about driver apprehension around EVs nor any concern that EVs would be unable to meet fleet needs (except for emergency vehicles). For most interviewees, the biggest barrier to adding EVs to their fleet was EV infrastructure. EV charging stations represent a large

upfront cost that fleets have not had to budget for in the past. Creating an EV infrastructure grant with clear rules and minimal participation restrictions could provide significant acceleration in EV adoption among fleets. In addition, some fleets currently own plug-in hybrid electric vehicles (PHEVs) but almost never charge them. Providing charging infrastructure could enable more electric vehicle miles traveled with these existing PHEVs.

For fleets with many trucks and vans, their biggest barrier is a lack of existing electric trucks. While electric retrofits for trucks and vans exist, they are extremely expensive and were not seen as a viable option by any of the interviewees. Some fleet managers expressed excitement about the upcoming electric Ford F-150. Providing significant rebates for electric trucks as they become available is likely to have a large impact for fleets.

Finally, for heavy-duty vehicles, such as buses or waste collection trucks, pilot programs may be very helpful because of the high risk associated with buying such expensive equipment.

Car Dealerships

Dealerships interviewed agreed that customers who come in looking for an EV largely have general knowledge about the technology and are committed to getting one. Dealers were asked whether they purposely steer customers towards a gas vehicle; the only time they report doing this is if the customer had budgetary considerations that made an EV unaffordable or they were interested in a body style not available as an EV. Conversely, they might encourage consumers to consider an EV if they have a long commute and can take advantage of fuel savings and HOV lane access. The questions that prospective EV customers ask are most often related to range and charging.

Outside of marketing available incentives for EVs like rebates and HOV lane access, successful EV sales strategies were most often dealership-wide strategies that are particularly effective when engaging with prospective EV car shoppers. They included:

- Conducting Q&A with customers as they walk in the door to gauge their needs
- Providing two-week follow-up visits with customers
- Five-day return policy and free delivery
- Test drives/demonstrations

Both high- and low-volume dealerships cited EV inventory as the biggest challenge. Some brands were shifting production to newer models, limiting inventory of demonstration vehicles or creating competition among dealerships for EVs. High-volume dealerships also expressed incentive limitations as a challenge.

Both high- and low-volume dealerships indicated customers' lack of understanding about EVs, and subsequent hesitancy to switch as another challenge. Further, several dealerships indicated a perceived lack of public and MUD charging by customers as challenges to selling EVs. Another commonly cited challenge was that customers are often concerned that newer/better versions of EVs will be coming out, leaving them hesitant to buy current models.

For used EVs, sales were driven primarily by the availability of lease returns/trade-ins. Often newer EV models have not yet been available long enough to be traded in or have their lease terms expired. While dealerships often reach out to customers at the end of their lease terms to gain repeat business, they are not always successful. If they get used EV inventory, those vehicles are usually priced attractively and sell quickly. Others indicated that it is challenging to move used EVs due to range restrictions of three-year-old models or issues with battery degradation in the used sales market.

When asked what could be done to help dealerships accelerate the sales of EVs, the key drivers indicated were more customer rebates, greater investment in infrastructure, extending HOV lane access and providing dealership EV sales support.

Recommendations

Based on the research findings, and the desire of BAAQMD to accelerate EV adoption in the Bay Area, CSE proposes a series of recommendations presented in five categories:

- Incentives to accelerate EV adoption in the Bay Area (Within BAAQMD's scope)
- Raising awareness of EVs
- Facilitation and education
- Additional incentive ideas to accelerate EV adoption in the Bay Area (outside BAAQMD's scope)
- Further research

Specific recommendations include modifications to the Clean Cars for All program, other incentive ideas that BAAQMD or other key stakeholders in the Bay Area could pilot, ways to focus marketing and outreach on the benefits of EV ownership and ideas for future research and further analysis of the data collected through this project. More information can be found in the Recommendations section of this report.

II. Methodology

CSE utilized a mixed-method approach to gather perspectives on EVs and EV infrastructure from five target populations known to have barriers to EV adoption. A series of surveys, focus groups and interviews were used to reach each audience. Figure 1 shows each target population and the research method used to reach them.

Figure 1: Target Populations and Research Methods

Target Population	Research Method Employed
Bay Area residents, specifically: - Apartment dwellers - Low-to-moderate income - Nontraditional commuters	Survey
Ride-hail drivers	Survey
MUD property owners/managers	Focus Groups/Interviews
Vehicle fleet managers	Focus Groups/Interviews
Car dealerships	Interviews

CSE first conducted a literature review on EV adoption, charging behaviors and EV infrastructure to inform the creation of the data collection instruments used in this study. Key findings from the literature review suggested that while in many ways California is ahead of the EV adoption curve, barriers to adoption still exist, such as:

- Lack of awareness of EVs and EV infrastructure
- High price of EVs that will not reach cost parity with conventional gas vehicles for several years
- Factors that lead people to consider an EV (e.g., environmental impacts, future of electricity, experience with the technology) are different than the general population of car buyers (e.g., price, fuel economy, safety and dependability)
- Lack of experience with EV technology
- Income and residence type barriers
- Cost and structural barriers for ride-hail drivers
- Expense of public charging infrastructure and low return on investment

Survey instruments were designed to test these findings specifically in the Bay Area and include new explorations of these findings to determine how commute factors into EV adoption decisions.

Bay Area Resident Survey

The primary research conducted for this study was an overall survey of residents of the Bay Area. The identified objectives of this survey were to:

- Identify specific factors (e.g., size, maintenance, comfort) that influence consumer car-buying decisions
- Assess awareness of EV incentives, EV models and locations of EV charging stations
- Identify barriers that inhibit EV adoption
- Assess how effectively current incentive programs address those barriers

While the survey did not exclude current EV drivers, the intent was to gather perspectives of non-EV drivers. BAAQMD was also interested in understanding target populations in the Bay Area known to have barriers to adopting an EV. Those target populations were:

- Apartment dwellers
- Low-to-moderate income residents
- Residents with nontraditional commuting patterns (i.e., those who do not primarily commute by themselves in their own car)

CSE commissioned a market-research panel from the Bay Area in partnership with SurveyGizmo (panel services partner). CSE used non-probability quota sampling to gather an adequate number of respondents from each target population. A sample of 1,004 respondents were recruited to draw a reasonably sized sample and have enough responses to adequately explore differences between target populations. Quotas were established using data from the American Community Survey (ACS) specific to the nine-counties in BAAQMD's jurisdiction for each target population as well as gender. A gender quota was included to avoid over-sampling of females, who made up a disproportionate amount of potential panel respondents. Figure 2 below shows the ACS estimates used for setting survey quotas.

Figure 2: Bay Area-Specific ACS Estimates Used for Resident Survey Quotas

Criteria	ACS Estimate
Residents living in MUDs (more than one unit in their housing unit)[2]	35%
Residents with household incomes less than $100,000 per year[3]	53%
Nontraditional commuters (do not commute in their personal vehicle)[4]	35%
Males over 18 years of age[5]	49%

In addition to these quotas, screener questions were included to disqualify respondents who did not live in the nine-county jurisdiction of BAAQMD.[6] County quotas were considered but ultimately not used due

[2] American Community Survey; 2017 ACS 5-year estimates. *Selected Housing Characteristics* (DP04). https://data.census.gov/cedsci/

[3] American Community Survey; 2017 ACS 5-year estimates. *Selected Economic Characteristics* (DP03). https://data.census.gov/cedsci/

[4] American Community Survey; 2017 ACS 5-year estimates. *Commuting Characteristics by Sex* (S0801). https://data.census.gov/cedsci/

[5] American Community Survey; 2017 ACS 5-year estimates. *ACS Demographic and Housing Estimates* (DP05). https://data.census.gov/cedsci/

[6] BAAQMD does not have jurisdiction over the entire counties of Solano and Sonoma. Additional screeners were used for these counties to ensure respondents lived within a ZIP code in which BAAQMD has jurisdiction over.

to the risk of bias they would have introduced when coupled with the quotas already listed above. However, county response minimums based on county proportional population would have yielded very small N-values for smaller counties, limiting the utility of the responses collected. Therefore, CSE set a minimum of 50 responses per county to ensure that county-level responses could be meaningfully interpreted. This minimum was met with all but Napa county due to the limited number of available survey takers. Figure 3 shows how the population estimates from ACS compare to the survey sample.

Figure 3: ACS Population Estimates Compared to Survey Sample

County[7]	Over 18 Population	Percent of Over 18 Population living in the county	Complete Survey Responses	Percent of Survey Responses Collected from the county
Alameda	1,284,703	22%	170	17%
Contra Costa	862,175	15%	153	15%
Marin	207,701	4%	50	5%
Napa	110,659	2%	33	3%
San Francisco	748,311	13%	185	18%
San Mateo	601,216	10%	94	9%
Santa Clara	1,476,210	25%	175	17%
Solano	237,352	4%	77	8%
Sonoma	353,099	6%	67	7%
Total	**5,881,426**	**100%**	**1,004**	**100%**

Responses were collected between January 14, 2020 and March 8, 2020. Respondents were paid for their participation in the survey. Because panel respondents were paid, checks were conducted to verify validity of the responses. Results found to be invalid were removed and replaced. These checks included:

- The speed in which respondents took the survey and their average time per question
- Respondents who straight-lined (answered same option for multiple questions) or provided patterned responses
- Wrote gibberish in open-ended responses

After collection, survey data was cleaned. Because non-probability quota sampling was used for the survey, and county level differences in target populations exist, post-stratification weights were not

[7] BAAQMD does not have jurisdiction over the entire counties of Solano and Sonoma counties. Over 18 population statistics for these counties are estimates of the population that live within ZIP codes that BAAQMD has jurisdiction over.

used to adjust results to better represent the overall population. Modifications to the screener criteria were made to define the target populations for analysis. Respondents who lived in an apartment or condo were labeled as apartment dwellers and all other residence types were considered non-apartment dwellers. Respondents whose primary mode of commuting was not driving alone in their personal vehicle were considered nontraditional commuters. If respondent's primary mode of commute was driving alone in their personal vehicle, and they didn't use alternate commute methods more than once per week, they were considered traditional commuters. Five percent of respondents either do not work or work exclusively from home. These respondents are included in overall analysis but filtered out of analysis of commute types. Respondents who reported annual gross family income[8] of less than $100K were labeled as under $100K and respondents reporting earning over $100,000 per year were labeled over $100K. Gross family income was used as our unit of analysis based on the assumption that family income totals are more likely to be factored into your car buying decision than household income, which could include a friend or roommate.

Figure 4: Definitions of Target Populations Used in Resident Survey Analysis

Target Population	Segments	Definition
Apartment dwellers	Apartment dwellers	Live in an apartment/condo
	Non-apartment dwellers	Live in attached/detached houses or "other" residence types
Commute type	Nontraditional commuters	Most common method of commuting to work is NOT driving alone in their personal vehicle
	Traditional commuters	Most common method of commuting to work is driving alone in their personal vehicle and don't use other methods to commute more than once per week
Income	Under $100K	Self-reported annual gross family income is under $100,000 per year
	Over $100K	Self-reported annual gross family income is over $100,000 per year

Open-ended "other" responses were reviewed and re-coded as appropriate. Open-ended numeric questions (e.g., income) were reviewed and outliers or invalid responses were trimmed where appropriate. Descriptive statistics were then calculated overall and by each target population identified. Chi-square testing was conducted to determine the significance of differences on categorical question types. Open-ended numeric variables were tested for normality using Shapiro-Wilks. In all cases continuous variables were skewed, so significant differences were tested using Mann-Whitney U-tests.

[8] Gross family income on the survey was defined as all earned and unearned income, before taxes, of all family members in the household who were over 15 years old.

Significant differences (p-value: >0.05) between groups are identified using an asterisk (*) in figures or called out as statistically significant in the narrative.

Ride-Hail Driver Survey

Ride-hail drivers provide a large market opportunity for EV adoption. To better understand how BAAQMD might support the electrification of the ride-hail fleet, CSE commissioned a panel of ride-hail drivers for a survey with the following objectives.

- Understand driving patterns of ride-hail drivers
- Identify hurdles to EV adoption among ride-hail drivers
- Assess whether existing or modified incentives would influence EV adoption.

Because no reliable estimate of the number of ride-hail drivers in the Bay Area was available and the difficulty in identifying and recruiting ride-hail drivers, CSE commissioned a non-probability convenience sample of 100 ride-hail drivers. CSE also supplemented the survey responses by including a subset of the ride-hail survey questions on the resident survey and paying for targeted posts/ads to ride-hail driver Facebook groups.

Figure 5: Completed Ride-Hail Survey Responses by Collection Type

Administration Type	Completed Responses
Commissioned Panel	100
Results from Resident Survey	80
Facebook Posts/Ads	5
Total	**185**

Because only certain ride-hail specific questions were included on the resident survey, the number of responses per question varies between 105 and 185.

The same county screeners used on the resident survey were used on the ride-hail survey. Additional screeners were also used to confirm ride-hail driver status and assure respondents were active and regular drivers. Respondents were disqualified if they:

- Indicated they were not ride-hail drivers
- Were not active drivers (didn't provide ride-hail services in two weeks prior to taking the survey)
- Were not regular drivers (provide ride-hail services less than two days per week on average)

The same validity checks were conducted on the ride-hail survey as were used on the resident survey and invalid responses were removed and replaced. Responses were collected between January 15 and January 27, 2020.

After collection, survey data was cleaned. Open-ended "other" responses were reviewed and re-coded as appropriate. Open-ended numeric questions (e.g., income) were reviewed and outliers or invalid responses were trimmed where appropriate. Overall descriptive statistics were then calculated. Because this survey only explored one target population, no significance testing was conducted.

Focus Groups and Interviews

In addition to the surveys administered, CSE conducted a series of focus groups and interviews with key target populations important to accelerating EV adoption:

- MUD property managers/owners
- Vehicle fleet managers
- Car dealerships

In one way or another, each of these groups are key stakeholders in eliminating barriers to EV adoption. For each group, research objectives were created and participation criteria set. Figure 6 summarizes the objectives and participation criteria for each target population

Figure 6: Focus Group/Interview Objectives and Participation Criteria per Target Population

Target Group	Research Objectives	Participation Criteria
MUD Property Managers/Owners	• Identify common gaps in information and awareness about EV infrastructure and incentives • Identify technical needs of MUD property owners to install EV charging • Understand the barriers that property owners/managers face when considering EV charging infrastructure and how to alleviate them • Assess whether existing or modified incentives would influence their decisions to install EV charging infrastructure	• Manage or own MUD properties located in Alameda, San Francisco, San Mateo or Santa Clara counties • Is a key decision maker or influencer when it comes to major building improvements
Vehicle Fleet Managers	• Understand the barriers to converting fleets to EVs • Identify the most important factors managers consider when evaluating EV procurement • Assess the managers' knowledge of EV incentives • Assess whether existing or modified incentives would influence their decision to transition to EVs	• Manage a public of private fleet of at least five vehicles within the Bay Area
Car Dealerships	• Understand the reasons when and why sales personnel do or do not actively promote EVs • Identify effective dealership strategies for selling EVs • Assess successful methods and strategies dealers use to improve the EV buyer experience • Understand the used EV dealership perspective on how to accelerate EV adoption	• Have more than 24 estimated EV sales per year • Operate within the Bay Area

Bay Area based CSE staff recruited participants for this research. MUD property managers/owners were recruited by attending meetings for rental housing associations in San Francisco (SFAA), the East Bay (EBRHA), and Santa Clara (NARPM-SCC). Three focus groups were conducted in December of 2019. Two additional interviews were conducted with interested parties who were unable to attend a focus group. One interviewee managed low income housing and the other was an energy efficiency contractor who worked extensively in MUDs. Fleet managers were recruited via outreach to CSE and BAAQMD lists of fleet manager contacts. One focus group was conducted in December of 2019 with four attendees, and ten interviews were conducted between January 31 and February 10, 2020. Dealerships were recruited via in-person outreach or facilitated by BAAQMD through their existing partnerships. Nine dealership interviews were conducted. Figure 7 summarizes the extent of focus groups and interviews conducted.

Figure 7: Summary of Focus Group/Interview Participation

Target Group	Participants
MUD Property Managers/Owners	• Three Focus Groups (3): 14 participants • Interviews: 2 participants
Vehicle Fleet Managers	• One Focus Group: 4 participants • Interviews: 10 participants
Car Dealerships	• Interviews: 9 participants

Focus groups were conducted in-person, recorded, and included a facilitator and note-taker from CSE. Interviews were conducted via 30-minute phone interviews. They were not recorded but included a facilitator and note-taker from CSE. Scripts were created to facilitate focus groups and interviews. Both were designed to be semi-structured to allow for deviation based on the flow of the conversation. Results were categorized into themes. Dealership results were segmented into high-volume, low-volume and used dealership segments to highlight differences between dealership types.

Considerations and Limitations

- Resident survey results from ride-hail drivers were appended to the ride-hail survey for questions shared between the surveys. However, since these respondents also represented a sub-set of the overall resident survey, 80 ride-hail driver results are reported in both surveys.
- Resident survey respondents who provide ride-hail surveys were not screened with the same questions that were used on the ride-hail survey. This group included in the analysis may not represent active or regular ride-hail drivers.
- Both the ride-hail and resident surveys asked respondents about their current vehicles, however the ride-hail survey asked specifically about the vehicle they use to provide ride-hail services. The resident survey asked them to simply describe their vehicle. There is a chance that ride-hail drivers from the resident survey use a different vehicle to drive ride-hail services.
- Because both the resident and ride-hail surveys used non-probability sampling, caution should be used to not generalize the results of these surveys to the overall population of the Bay Area.

- Due to the relatively small number of focus groups and interviews conducted, caution should be taken to not generalize findings to the target populations.
- Research was conducted prior to the COVID-19 global pandemic and subsequent disruptions to everyday life and the economy. Results may not fully represent the post-COVID-19 reality in terms of vehicle market, income and commute patterns.

III. Bay Area Resident Survey

The Bay Area resident survey was fielded between January 14 and March 8, 2020. Overall 1,004 valid responses were collected. Findings can be found below, and results have been segmented by income, residence type and commute type where appropriate.

Who Participated?

In alignment with the requested target populations of interest:

- 36% of survey respondents were apartment dwellers (live in an apartment or condo)
- 60% of survey respondents reported gross family income of under $100,000 per year
- 45% of survey respondents were nontraditional commuters (primarily commute in ways other than in their personal vehicle or primarily commute via their personal vehicle but use an alternate method at least twice per week)

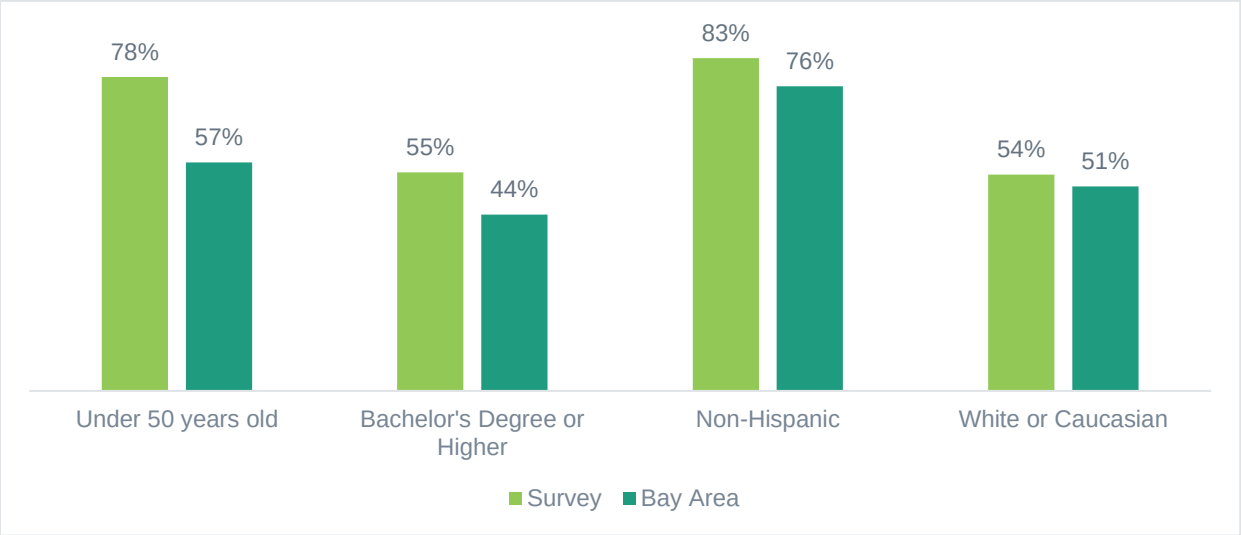
Because county was not controlled for in the survey, counties yielded different percentages of the target populations. San Francisco County yielded the highest percentages of the target populations within their sample.

Figure 8: Percent of Target Populations by County

County	Responses	% Apartment Dwellers	% Income Under $100,000	% Nontraditional Commuters
Alameda	170	39%	65%	49%
Contra Costa	153	26%	54%	44%
Marin	50	26%	58%	32%
Napa	33	15%	55%	21%
San Francisco	185	61%	69%	64%
San Mateo	94	24%	47%	37%
Santa Clara	175	39%	57%	37%
Solano	77	19%	62%	42%
Sonoma	67	21%	64%	40%
Total	**1,004**	**36%**	**60%**	**45%**

The population surveyed was more likely to be non-Hispanic, White/Caucasian, under the age of 50 years old and have a Bachelor's degree or higher when compared to the American Community Survey estimates for the Bay Area.

Figure 9: Demographic Comparisons between Survey Respondents and ACS Estimates[9]



For more context about the results of this survey, 70% of respondents lived in households of 3 or less people, 76% had two or less vehicles in their household, and 49% rented their home. The average income of survey respondents was $108,983. There were large fluctuations in income based on the different target populations. Traditional commuters, and non-apartment dwellers reported lower earned income than their counterparts.

Figure 10: Average Family Income by Target Population (N=1,004)

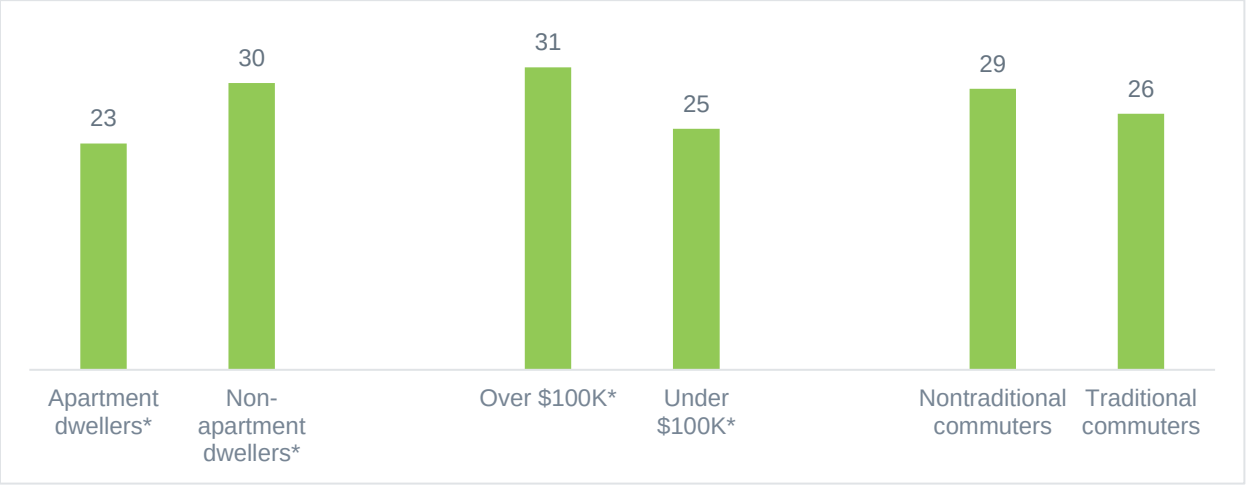
[9] American Community Survey; 2018 ACS 5-year estimates. Tables S0101, S1501, & DP05. https://data.census.gov/cedsci/

Driving Behaviors

Overall, 84% of respondents indicated that they own their own vehicle. Respondents making over $100K (92%) were more likely to own a vehicle than respondents making under $100K (78%). Apartment dwellers were also much less likely to own a vehicle (70%) than non-apartment dwellers (91%).

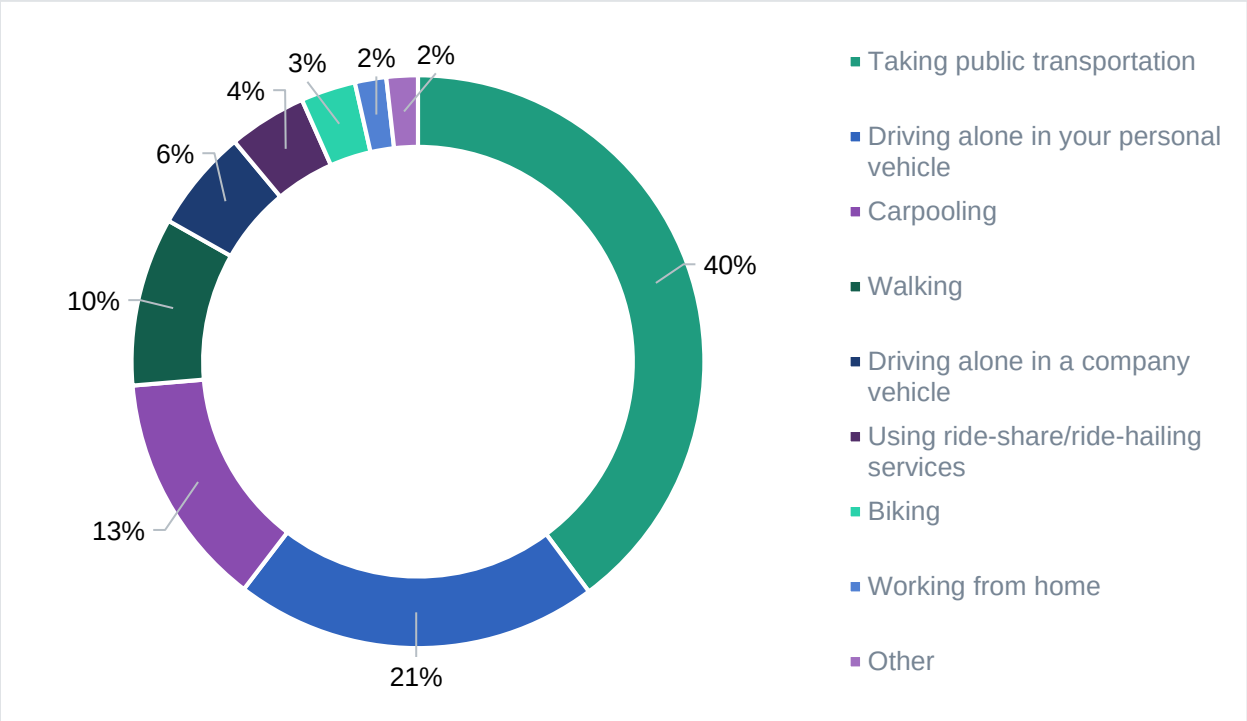
The average daily commute among survey respondents was 27.4 miles. Respondents making over $100K, non-apartment dwellers and nontraditional commuters had longer average roundtrip commutes. These differences were statistically significant between residence types and income groups.

Figure 11: Average Roundtrip Daily Commutes (in minutes) by Target Population (N=948)



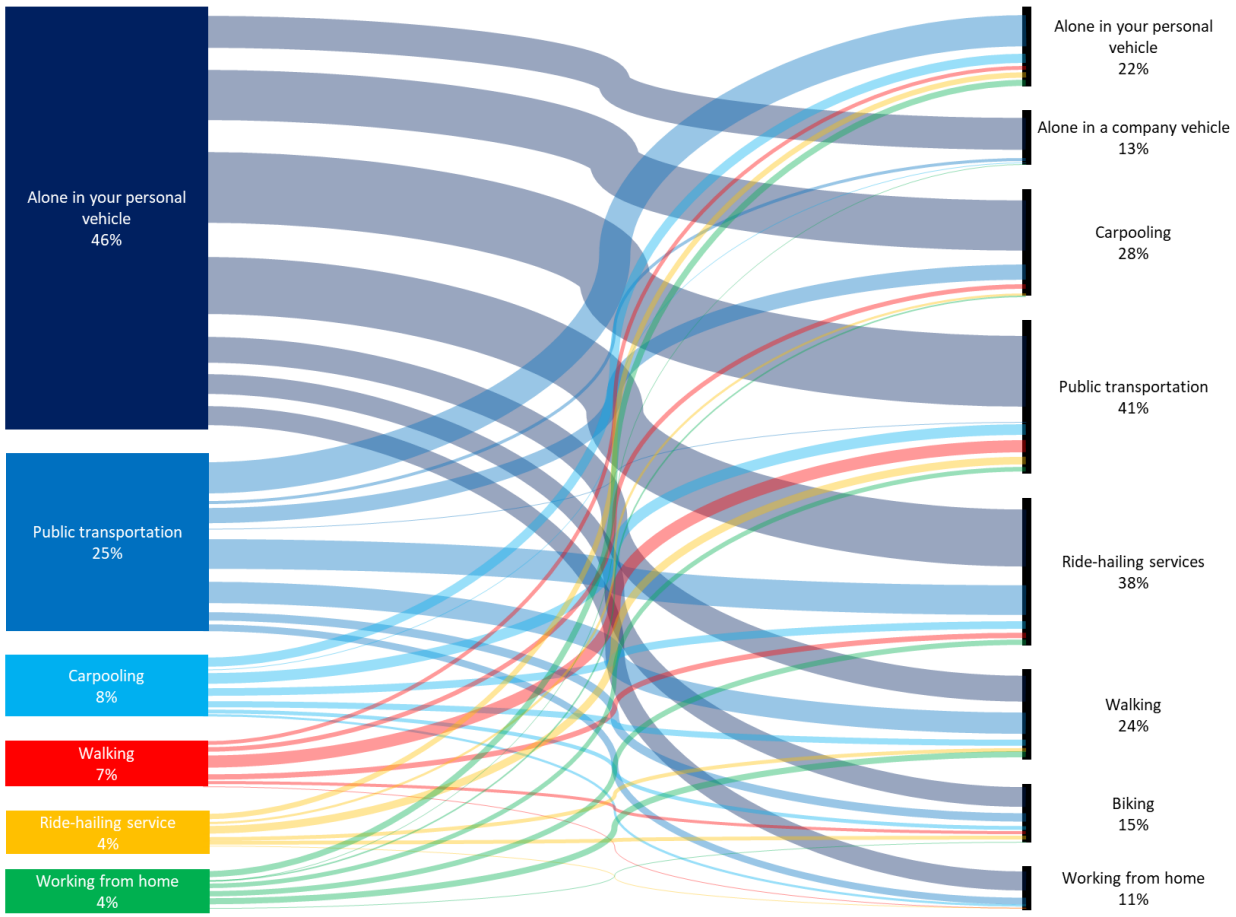
Five percent of respondents indicated they work from home exclusively or do not work. These non-commuters were not included in the analysis of traditional v. nontraditional commuters. Traditional commuters made up 50% of respondents and exclusively drive alone in their personal vehicle as their primary commute method. Nontraditional commuters made up 45% of respondents. The most common method of commuting among this population was public transportation, driving in their personal vehicle 3 or less times per week, and carpooling.

Figure 12: Primary Commute Mode for Nontraditional Commuters (N=452)



Over four in 10 (44%) commuters said they regularly commute via other methods as well as their primary method. However, of this group (427), 34% said they do not use their alternative method every week. Still, responses indicate that many commuters use multiple methods to commute. An analysis of alternate commute methods shows that many nontraditional commuters supplement their commute with their personal vehicle. Traditional commuters supplement their commute with public transit, carpooling and ride-hailing. Overall, ride-hailing and public transit are popular alternative commute methods for most all groups. In addition to figure 13 below, see Appendix A for more details on alternate commute methods.

Figure 13: Alternate Commute Methods (right) Used to Supplement Primary Commute (left) (N=429)[10]



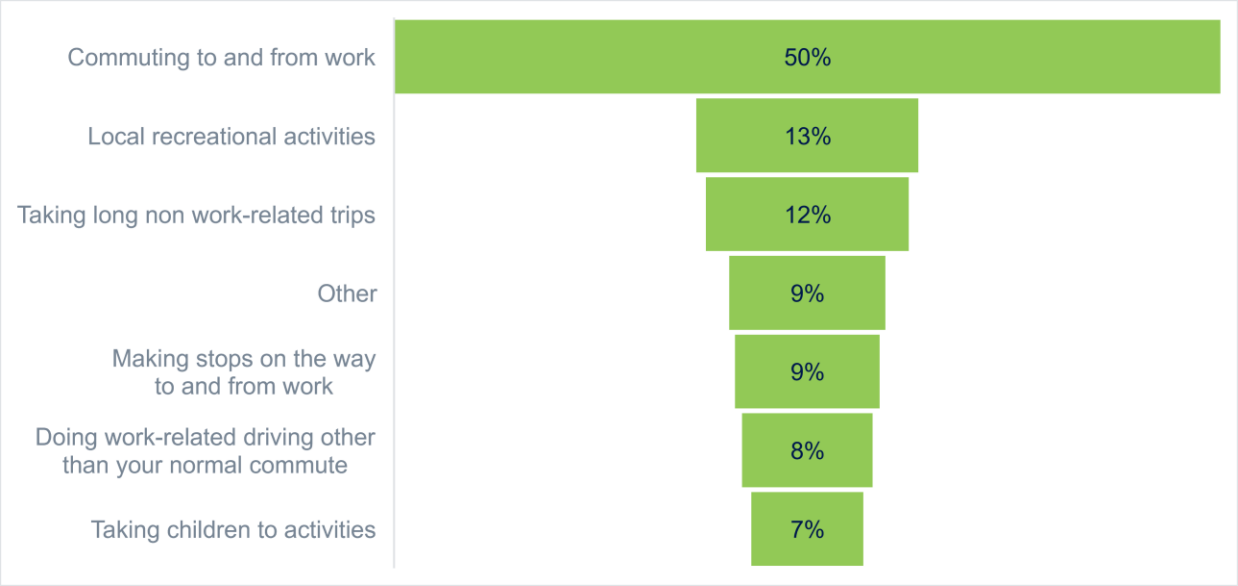
A majority of respondents (82%) commute to work between the hours of 6am-12pm and commute home from work between 3-9pm (74%). The only statistically significant difference between the time of day in which respondents commute times existed between respondents making over and under $100K. Respondents making over $100K were more likely to have a more traditional work schedule than those making under $100K.

Overall, vehicle owners spend an average of 50% of their drive-time commuting to and from work and another 25% of their driving doing recreational activities both locally and long-distance. Perhaps as

[10] Respondents could select multiple alternative methods, so percentages on right hand column do not add up to 100%.

expected, nontraditional commuters spent significantly less time in their personal vehicles commuting to work (40%) when compared to traditional commuters (58%) and more time doing non-work-related activities. Other than this, drive times were consistent across target populations.

Figure 14: Average Percent of Personal Driving Doing the Following Activities (N=832)

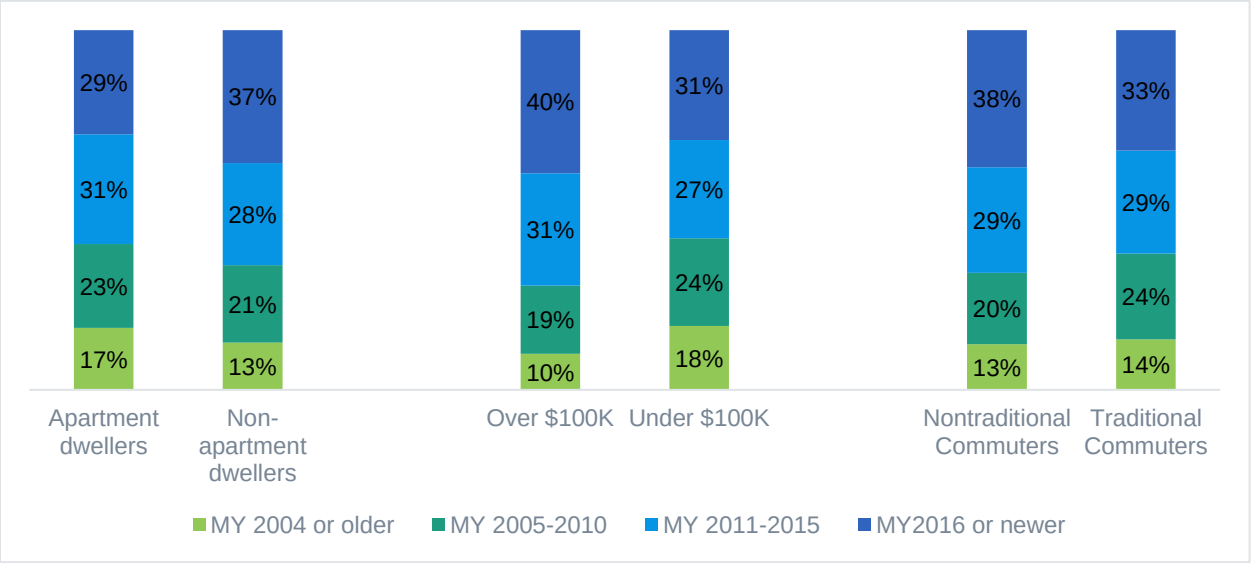


Vehicle Ownership and Factors Influencing Car Buying

As previously stated, 84% (841) of respondents indicated that they own their own vehicle. Of the vehicle owners surveyed, 7% reported owning an EV. Due to the relatively small number of EV owners in the sample, comparisons between the target populations are not reliable and so are not reported here. Overall, 82% of vehicle owners drove a gas vehicle. Nontraditional commuters (75%) were less likely to own a gas vehicle then traditional commuters (85%).

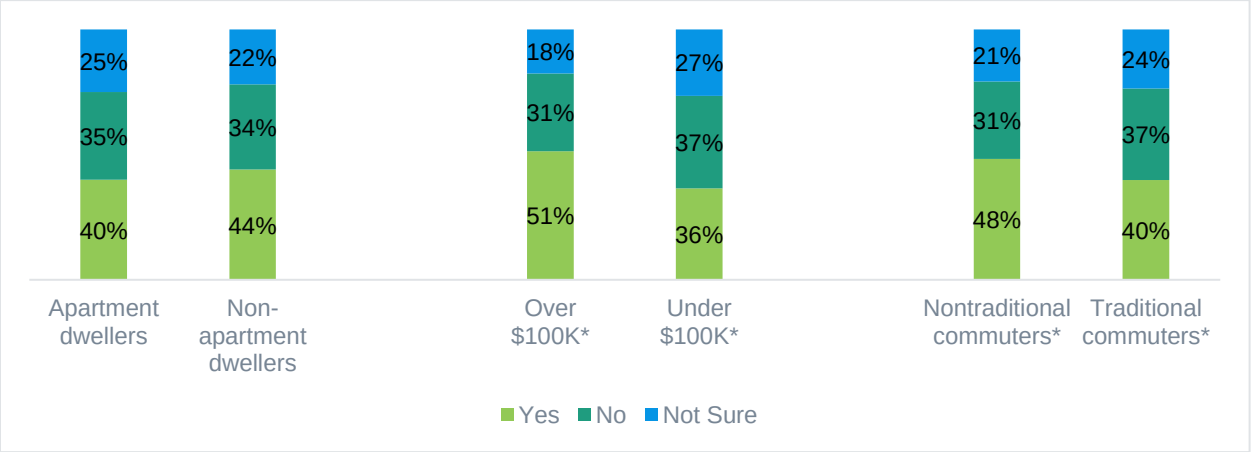
Fifty-three percent of vehicle owners drove a compact or midsize vehicle. Respondents making under $100K were significantly more likely to drive compact vehicles. Apartment dwellers were more likely to drive compact vehicles as well, although differences were not statistically significant. Approximately one-third of vehicle owners have a model year 2016 or newer (35%) or a model year 2010 or older (36%). respondents making under $100K and apartment dwellers tended to have older vehicles, while respondents making over $100K and non-apartment dwellers tended to have newer model years.

Figure 15: Age of Current Vehicle by Target Population (N=841)



Thirty-five percent of respondents plan to replace their vehicle in the next two years, 42% do not, and 23% were unsure. Respondents making over $100K and nontraditional commuters were significantly more likely to indicate they would be acquiring a vehicle in the next two years. Apartment dwellers were planning to acquire a vehicle at about the same rate as non-apartment dwellers.

Figure 16: Respondents Planning to Buy/Lease a Car in the Next Two Years (N=1,002)



Of those who said they would be getting a car in the next two years, or were unsure:

- 50% indicated they would buy a new car, and
- 71% indicated they would purchase a car instead of leasing.

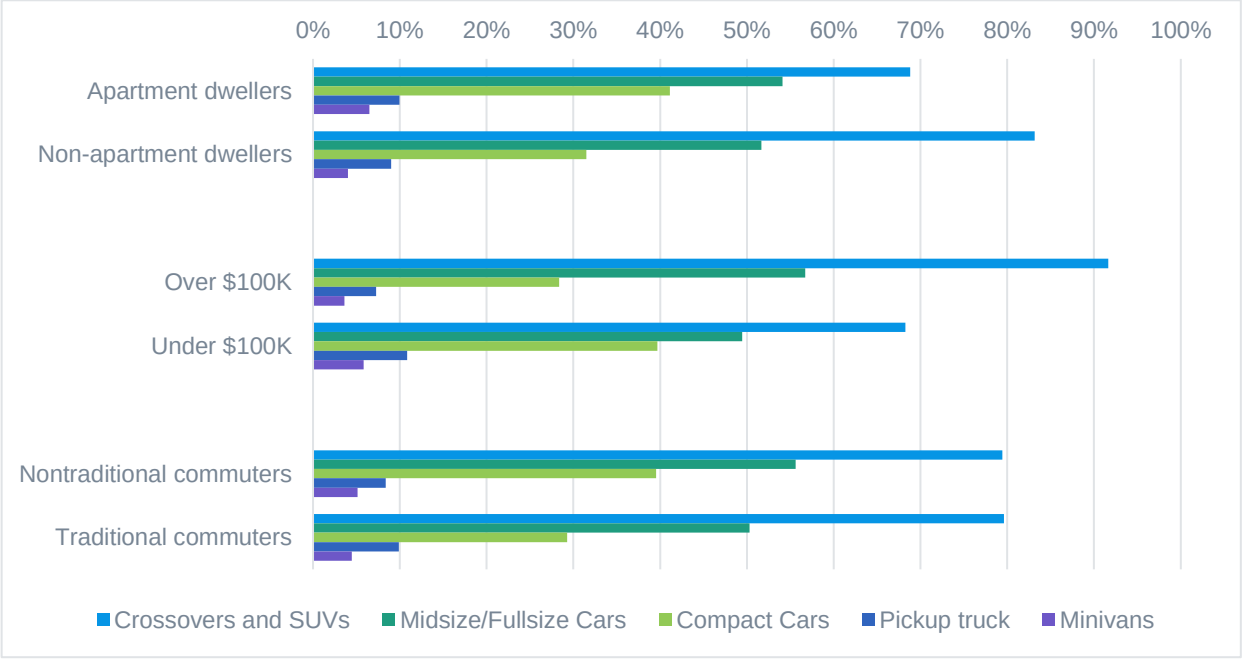
Respondents making over $100K were significantly more likely to be shopping for a new car. Apartment dwellers were more likely to be considering a used vehicle.

Figure 17: Vehicle Acquisition Types by Target Population (N=652)

Category	Segment	Prefer New v. Used		Prefer Purchase v. Lease	
		New	Used	Purchase	Lease
Overall	-	50%	34%	71%	13%
Income	Over $100K	60%	25%	75%	11%
	Under $100K	43%	41%	68%	14%
Residence Type	Apartment Dwellers	45%	40%	62%	19%
	Non-Apartment Dwellers	53%	31%	76%	9%
Commute Type	Nontraditional	50%	37%	70%	14%
	Traditional	52%	32%	73%	12%

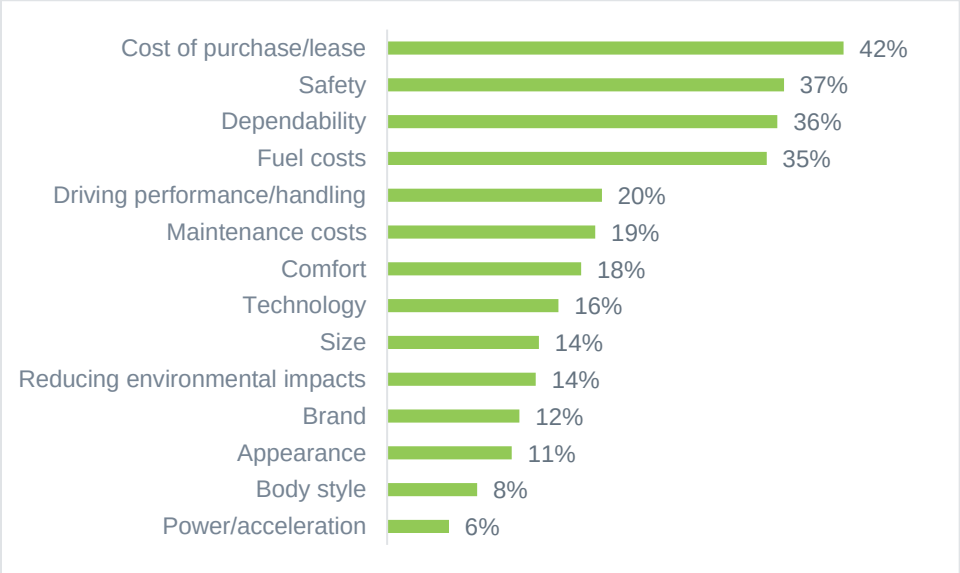
Overall, respondents preferred crossovers or SUVs for their next vehicle. Compact cars were more likely to be preferred by apartment dwellers, respondents making under $100K and nontraditional commuters. Figure 18 shows which vehicle classes respondents would consider. Note that respondents were able to choose multiple vehicle classes, so percentages do not equal 100%.

Figure 18: Vehicle Class Preferences by Target Population (N=653)



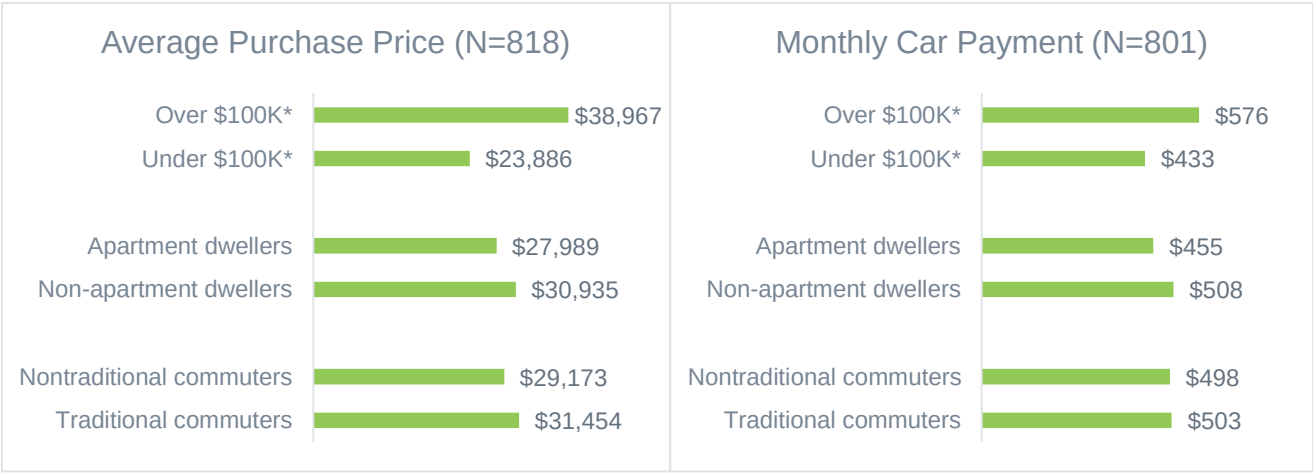
Respondents were asked what the three most important factors are when they consider which car to buy. The four most prevalent responses were vehicle cost, safety, dependability and fuel costs. Reducing environmental impacts, a commonly associated factor attributed to EV owners, was only selected by 14% of respondents.

Figure 19: Most Important Factors in Car Buying Decision (n=1,002)



Overall, respondents stated the highest vehicle price they would consider in their price range was $29,888 on average and the maximum monthly car payment they would consider paying was $489 on average. Only slight deviations in these averages existed between residence and commute types. Income differences were the most pronounced, with respondents making over $100K willing to pay more than 1.5 times more for a vehicle than respondents making under $100K and more than 1.25x more in monthly car payments.

Figure 20: Average Maximum Purchase Prices and Monthly Car Payments by Target Population



An analysis of base Manufacturer's Suggested Retail Prices (MSRPs) for EVs conducted on behalf of the Clean Vehicle Rebate Project showed that the average max price respondents making under $100K were willing to pay was below the MSRP of all available EVs. See Appendix B for more detail on EV base MSRPs

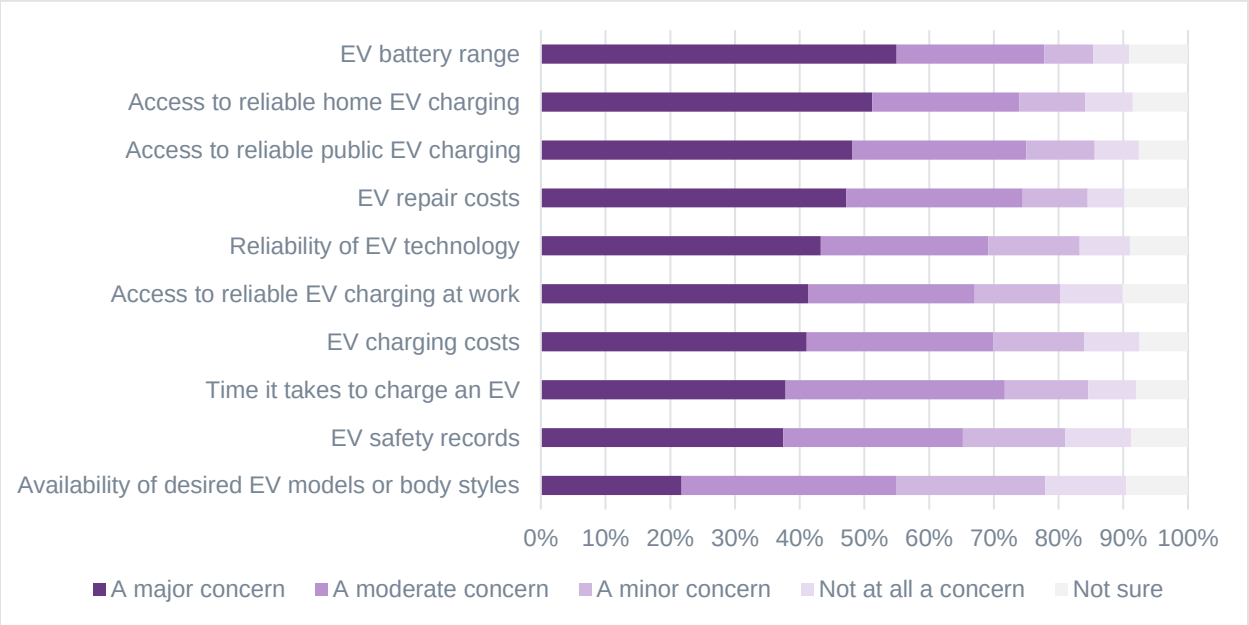
While respondents making under $100K were willing to spend less to acquire a vehicle, they were also spending a significantly higher percentage of their income on transportation costs like car payments, fuel and maintenance costs. They were spending an average of 19% on transportation costs as opposed to 14% for respondents making over $100K. Not only were respondents making under $100K spending a higher percentage of their income on transportation costs, they also spent a significantly higher percentage of their income on housing costs (40%) when compared to respondents making over $100K (30%).

Barriers to EV adoption

Only 7% of respondents indicated they owned an EV, however 40% of non-EV owners indicated they have considered getting one. Slightly more non-apartment dwellers and nontraditional commuters said they considered an EV over their counterparts, but income remained the largest differentiator, with 52% of respondents making over $100K considering an EV compared to 32% of respondents making under $100K.

The biggest concerns with getting an EV were related to range and access to charging. In addition, EV repair costs and reliability of the technology were also large concerns about EVs, most likely due to the prevailing issue of battery reliability and expense to replace.

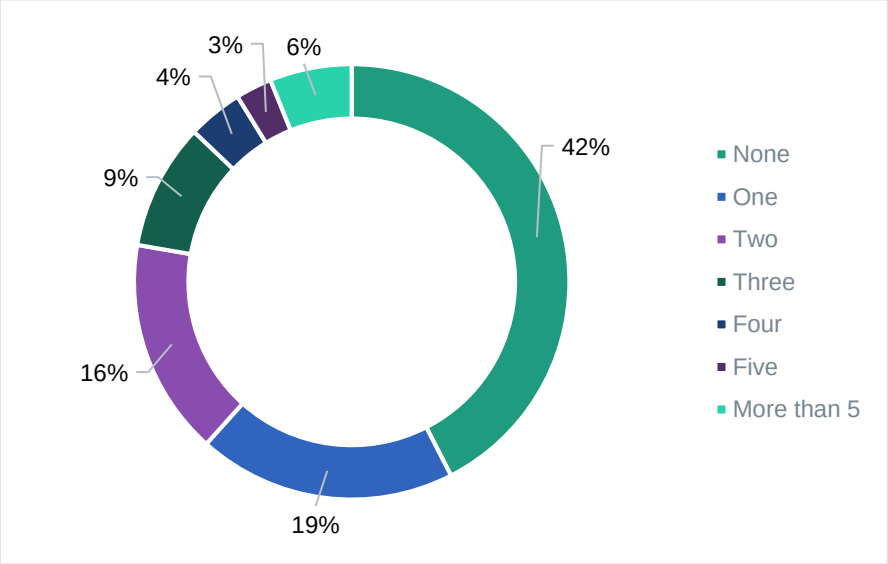
Figure 21: Biggest Concerns about Acquiring an EV (N=939)



Respondents making over $100K shared more concern in each of the areas explored. This is most likely tied to the higher level of consideration of EVs by this group. Fifty-two percent of respondents making over $100K indicated they have considered getting an EV, compared to 32% of respondents making under $100K. Traditional commuters also had a higher level of concern about EVs than nontraditional commuters. This could be due to their increased reliance on their car for their commute but could also be reflective of an environmental motivation behind non-traditional commute options. Apartment dwellers reported lower levels of concern about EVs than non-apartment dwellers. This is a bit of a surprise considering known issues with MUD charging infrastructure but could be explained by the location of sample respondents (largely San Francisco), and fewer apartment dwellers indicating they would be getting a car in the next two years. See appendix C for more details on EV concerns differences by target population

Another significant barrier to EV adoption is the lack of awareness EVs and public charging infrastructure. Four in 10 (42%) of respondents indicated they have not noticed any charging stations in their neighborhood. Respondents making over $100K were statistically more likely to notice charging in their neighborhood (62%) then respondents making under $100K (55%). More research is needed to determine if this lack of awareness is due to the lack of infrastructure in this area, or due to the failure to notice it at common places, however there is a clear perception that there is little charging infrastructure.

Figure 22: Approximately how many EV charging stations have you noticed in your neighborhood? (N=1,001)

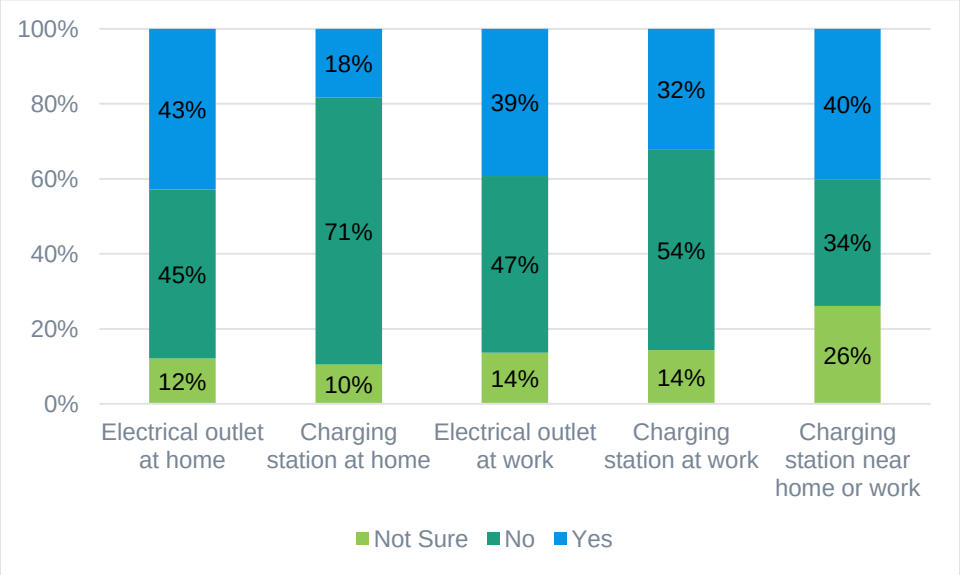


Awareness of brands that make EVs was low. Five percent (49) of respondents didn't know any EV brands. The remaining 945 respondents knew an average of 4.11 EV brands. Apartment dwellers (3.90) and respondents making under $100K (3.88) were aware of a smaller number of EV manufacturers than non-apartment dwellers (4.22) and respondents making over $100K (4.44). Some of the top-selling EV brands[11] were the most recognizable, however overall awareness of EVs remained low. While 65% of respondents knew about Tesla, no other EV manufacturer was known by more than half of the respondents.

- Tesla: 65%
- Toyota: 49%
- Honda: 43%
- Chevrolet: 33%
- BMW: 31%

Access to charging was also identified as a barrier to EV adoption. Nearly 6 in 10 (57%) do not have access to, or are not sure if they have access to, an electrical outlet at their home they can use to charge an EV. Nearly one-third (32%) have access to a charging station at work and 40% have access to charging stations near work.

Figure 23: Access to Common EV Charging Methods (N=1,001)



Respondents making over $100K were more likely to have access to all charging methods and non-apartment dwellers were more likely to have access to home charging solutions

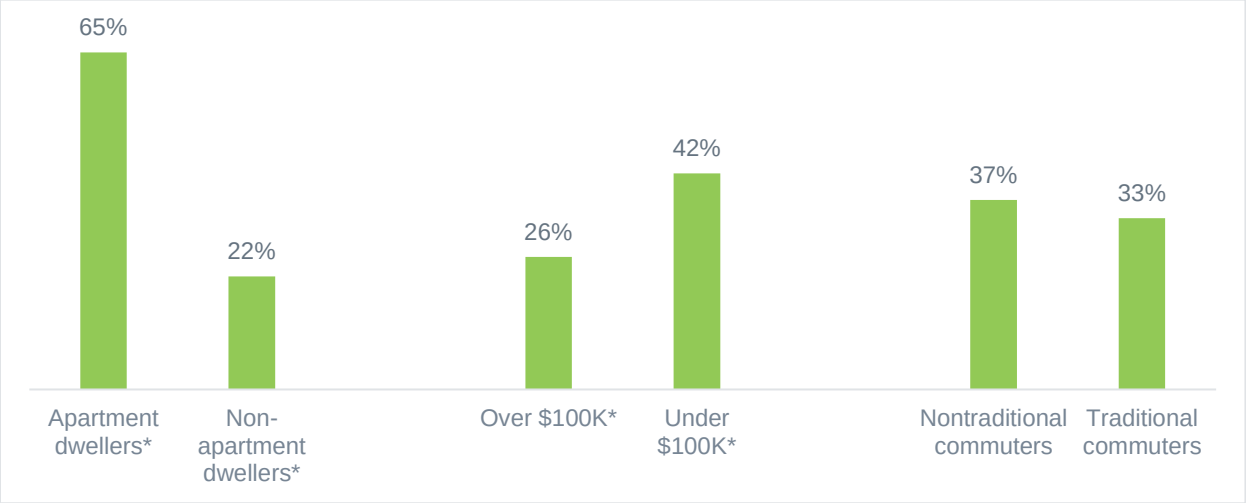
[11] EV sales Scorecard. Inside EVs. https://insideevs.com/news/343998/monthly-plug-in-ev-sales-scorecard/. Accessed 4/23/2020

Figure 24: Access to Common EV Charging Methods by Target Population (N=1,001)

Charging Method	Over $100K	Under $100K	Apartment dwellers	Non-apartment dwellers	Traditional commuters	Non-traditional commuters
Electrical outlet at home	52%*	37%	28%*	51%	42%	44%
Charging station at home	22%*	16%	15%	20%	17%	20%
Electrical outlet at work	44%	36%	38%	40%	38%	42%
Charging station at work	39%*	27%	33%*	32%	31%	36%
Charging station near home or work	46%*	36%	38%	41%	39%	42%

Sixty-five percent of respondents had access to private parking for their vehicles (either in a private garage or driveway). The remaining 35% parked in shared spaces or on the street. Perhaps not surprisingly, respondents making under $100K, apartment dwellers and nontraditional commuters were more likely to share parking or park on the street as opposed to having private parking.

Figure 25: Percent of Respondents with Shared/Street Parking by Target Population (N=841)

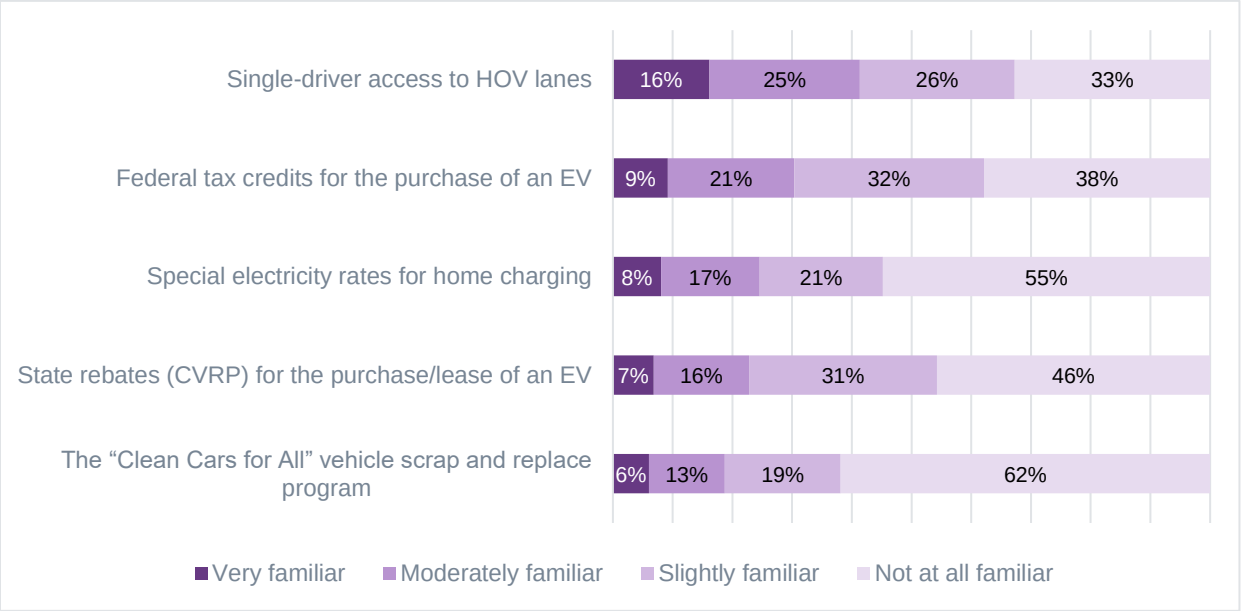


Of those who do not park in private parking, 87% do not have to pay for parking. It could be that it is included in their rent, but they do not perceive the need to pay. For those who don't own vehicles (161), 54% stated they would have to pay to park or park on the street if they were to get a car.

Awareness and Impacts of Incentives

Familiarity with both monetary and non-monetary incentives was low among survey respondents. HOV lane access was the most commonly known EV incentive among the population, followed by federal tax credits for an EV.

Figure 26: Familiarity with EV Incentives (N=998)



Again, there were higher levels of awareness of incentives by respondents making over $100K, most likely because they were more likely to have considered an EV.

Figure 27: Familiarity with Incentives by Target Population (N=998)

Moderately/Very Familiar	Over $100K	Under $100K	Apartment dwellers	Non-apartment dwellers	Traditional commuters	Non-traditional commuters
Federal tax credits for the purchase of an EV	34%*	28%	29%	31%	29%	33%
State rebates (CVRP) for the purchase/lease of an EV	27%*	20%	20%	24%	22%	25%
Single-driver access to HOV lanes	52%*	34%	37%*	44%	41%	43%
Special electricity rates for home charging	27%	23%	25%	25%	23%	28%*
The "Clean Cars for All" vehicle scrap and replace program	21%	18%	17%	20%	18%	22%*

Respondents were asked to rank from one to 10 possible EV incentive structures in order of how likely they were to influence their decision to get an EV. Overall, discounts off a new EV, tax credits, and attractive financing offers identified as most likely to influence their decision to buy an EV. Also ranked highly was discounts off home charging equipment. HOV lane access was ranked eight out of ten options.

Figure 28: Rank Sums of Incentive Types Most Likely to Influence EV Acquisition

Incentive Type	Rank Sum	N
Discounts off the price of a new EV	5,712	838
Tax credit received when taxes are submitted	5,637	851
Discounts on home charging equipment	4,980	837
Attractive financing offers available for the purchase of an EV	4,978	817
Free or reduced charging vouchers	4,861	830
Discounts off the price of a used EV	4,748	809
Discounts off the installation of an EV charger	4,609	821
Free use of HOV lanes	4,573	827
Attractive lease offers for an EV	3,493	766
Parking subsidy	3,393	789

Each target population ranked the available incentives in approximately the same order as the overall with a few exceptions. Financing offers available for the purchase of an EV was ranked ahead of home charging equipment in each of the target populations and home charging equipment was ranked lower. Used EV discounts were ranked slightly higher by respondents making under $100K and apartment dwellers

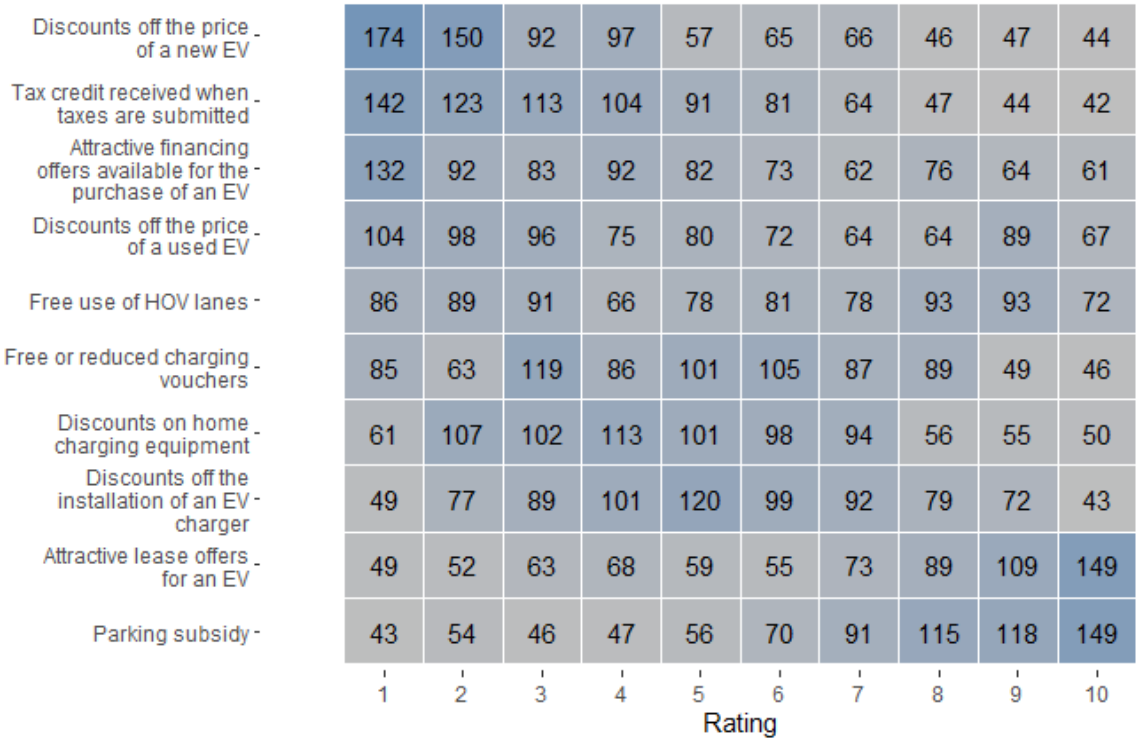
Figure 29: Incentive Rank Order by Target Population

Incentive Type	Rank Order			
	Overall	Under $100K	Apartment dwellers	Nontraditional commuters
Discounts off the price of a new EV	1	1	1	1
Tax credit received when taxes are submitted	2	2	2	2
Discounts on home charging equipment	3	4	6	5
Attractive financing offers available for the purchase of an EV	4	3	3	3
Free or reduced charging vouchers	5	6	5	4
Discounts off the price of a used EV	6	5	4	6
Discounts off the installation of an EV charger	7	7	7	7
Free use of HOV lanes	8	8	8	8
Attractive lease offers for an EV	9	9	9	9
Parking subsidy	10	10	10	10

Note: Green indicates that the target population ranked that option higher (more important) than the overall ranking. Red indicated that the target population ranked the option lower (less important) than the overall ranking.

To further analyze these incentive types, we created a heatmap that visualizes the number of times each option was ranked 1-10. When examining the data in this way, you see that while their overall ranks were lower, used EV discounts and HOV lane access were ranked number 1 more than their rank score would indicate. Furthermore, while home charging equipment was highly ranked, it was less often a respondent's first choice. The boxes with the highest numbers indicate many respondents ranked that option similarly. For example, 119 respondents ranked "Free or reduced charging vouchers" at the third most influential incentive. See appendix D for heatmaps specific to each target group.

Figure 30: Incentives Heatmap



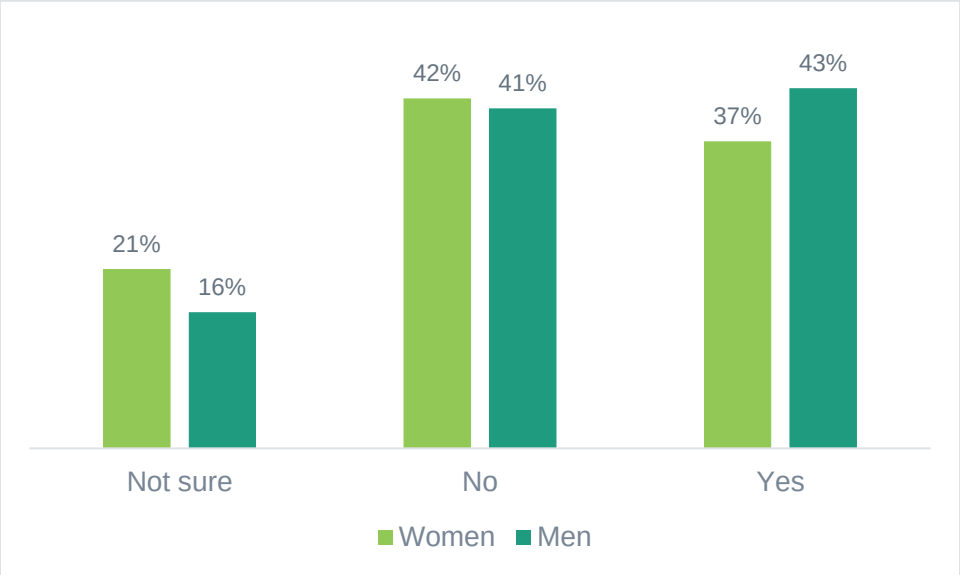
Lastly, respondents were split on the method they would want to receive a discount off the cost of an EV. Approximately half (48%) preferred to be pre-qualified for an incentive before going to buy/lease a vehicle while 46% preferred to have the discount applied at the point-of-sale. Only 6% preferred a post-purchase rebate model.

EV Interest by Gender

Women made up 51% of the survey population. While not one of the target populations of interest, findings highlighted some interesting differences between male and female respondents.

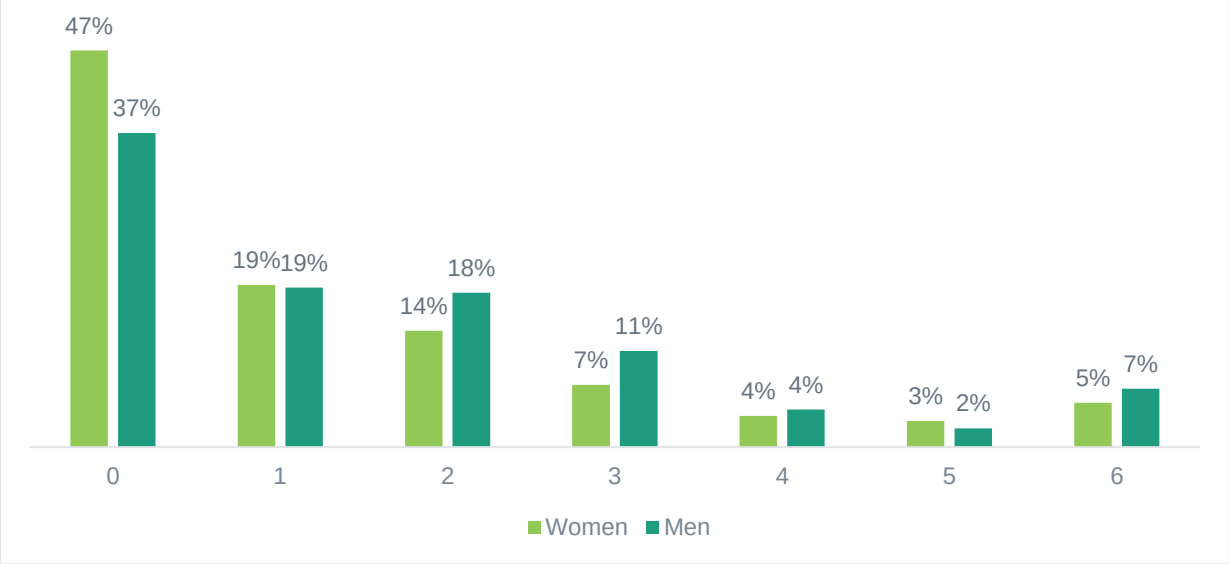
Figure 31 shows that men were more likely to have considered buying an EV than women, while women were more likely to report that they were unsure whether they would consider an EV.

Figure 31: Respondents Having Considered an EV by Gender (N=940)



In addition, women knew of an average of 3.95 EV manufacturers compared to men who knew an average of 4.27 EV manufacturers. Women also were less likely to have noticed EV chargers in their neighborhood. More research is needed to determine if this difference is a result of locational differences or is indicative of a lack of EV awareness or interest among women.

Figure 32: Approximately how many EV charging stations have you noticed in your neighborhood? (N=1,001)



The last noticeable difference between men and women was in relation to concerns about EV ownership. Women had a higher level of concern about several aspects of EV ownership. The largest

difference was with perceptions of safety, with 71% of women reporting that EV safety records were a moderate or major concern, versus 59% of men.

Figure 33: Moderate/Major Concerns with EV ownership by Gender (N=939)

IV. Ride-Hail Driver Survey

The Bay Area ride-hail driver survey was fielded between January 15 and January 27, 2020. Overall 105 valid responses were collected. In addition, 80 valid respondents from the Bay Area resident survey indicated they were ride-hail drivers and answered a series of questions related to ride-hail driving. When appropriate those results were appended to the ride-hail survey findings. In total, 185 responses are included in this analysis. Because only certain ride-hail questions were included on the resident, question n-values fluctuate between 105 and 185. Findings can be found below.

Who Participated?

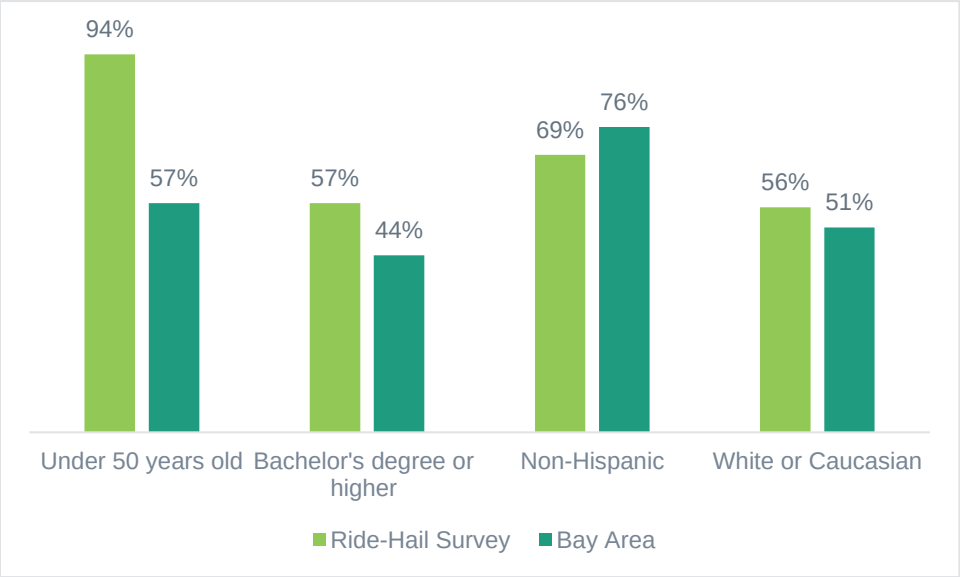
Ride-hail drivers primarily drove for Uber (41%) or Lyft (13%), and 43% drove for both companies. No specific quotas were used to assure a minimum number of responses per county due to the difficulty in reaching ride-hail drivers. Nearly three quarters (74%) of respondents lived in Alameda, San Francisco and Santa Clara.

Figure 34: Ride-Hail Survey Responses by County

County	Responses	% of Responses
Alameda	37	20%
Contra Costa	18	10%
Marin	2	1%
Napa	5	3%
San Francisco	66	36%
San Mateo	9	5%
Santa Clara	33	18%
Solano	9	5%
Sonoma	6	3%
Total	**185**	**-**

The population surveyed was more likely to be under the age of 50, White or Caucasian and have a Bachelor's degree or higher when compared to the American Community Survey estimates for the Bay Area. However, respondents were more likely to be Hispanic.

Figure 35: Demographic Comparisons Between Survey Respondents and ACS Estimates[12]



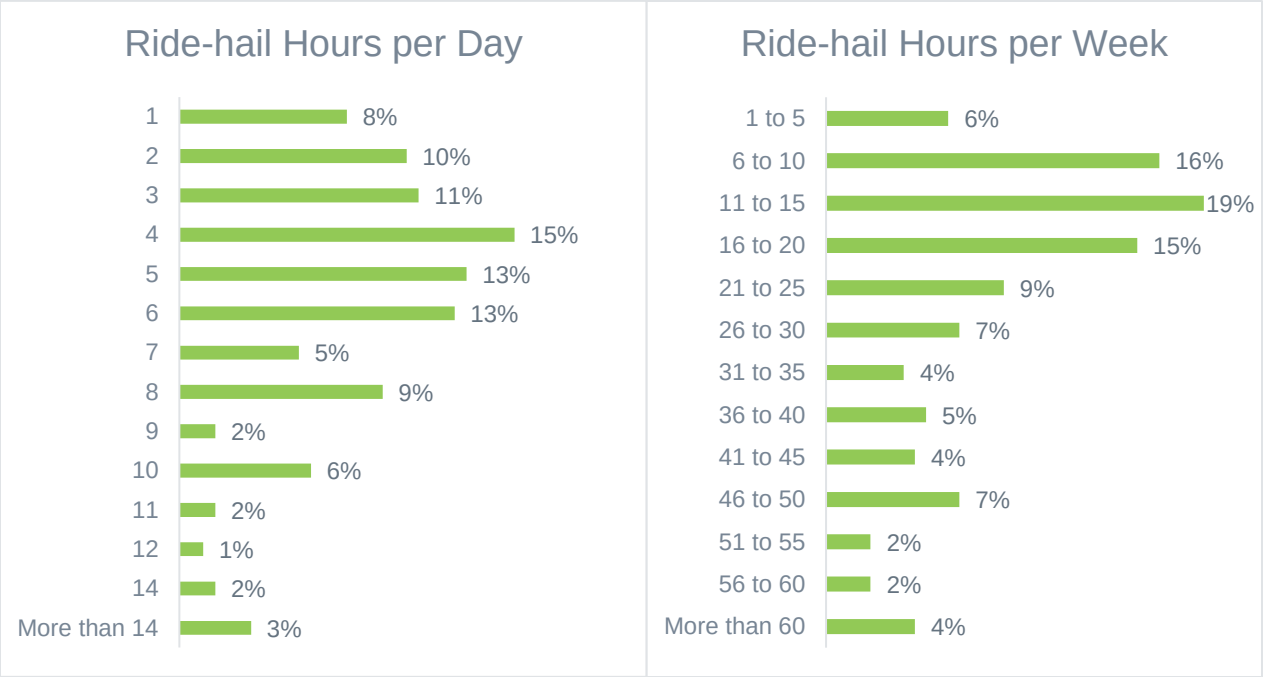
For more context, 57% of respondents lived in households of 3 or less people and 43% rented their home. When compared to the resident survey, ride-hail drivers were younger, more likely to be Hispanic, and lived in larger households. The average income of survey respondents was $96,751 with the median income being $90,000.

Ride-hail Driving Behaviors

Ride-hail survey respondents (N=105) were split 60-40 between part-time and full-time ride-hail drivers. Fifty-eight percent drive 4 days or less per week, while 42% drive 5 or more days per week. More than half (57%) drive five hours per day or less and 20 or less hours per week (56%). On average, respondents drive 228 miles per week providing ride-hail services, with three-quarters of respondents commuting less than 20 miles to where they start work. Respondents primarily provide ride-hail services in San Francisco, Oakland, San Jose, the Peninsula region and Santa Clara. Lastly, 75% of respondents have another job in addition to working as a ride-hail driver.

[12] American Community Survey; 2018 ACS 5-year estimates. Tables S0101, S1501, & DP05. https://data.census.gov/cedsci/

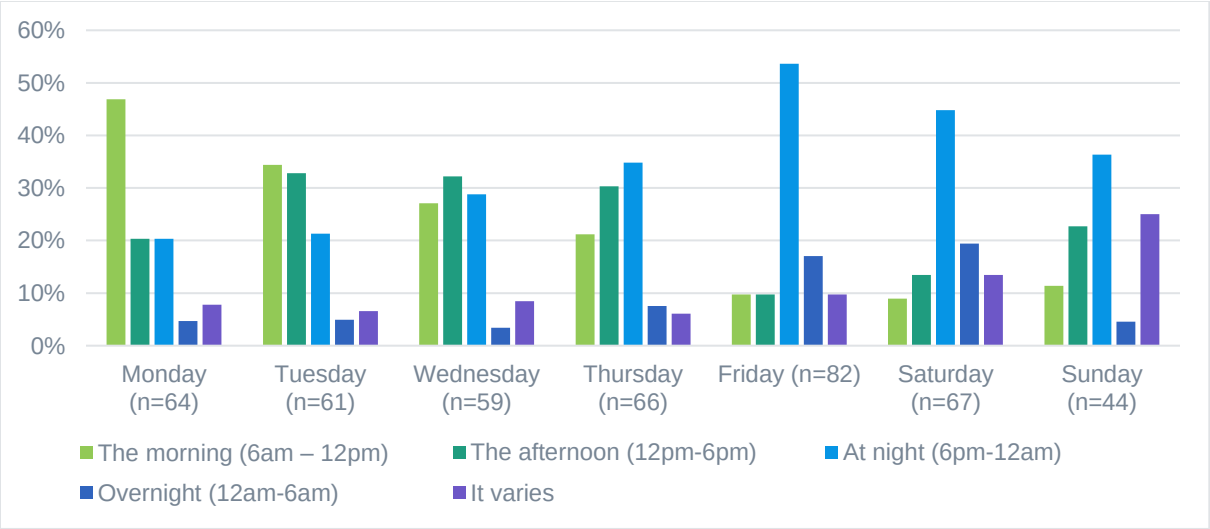
Figure 36: Ride-Hail Hours per Day and Week (N=183)



Close to 60% of respondents drive on every day of the week, except for Sunday, which had the lowest percent of respondents indicating they drive that day (42%). Friday was the most popular driving day, with 78% of respondents driving Fridays.

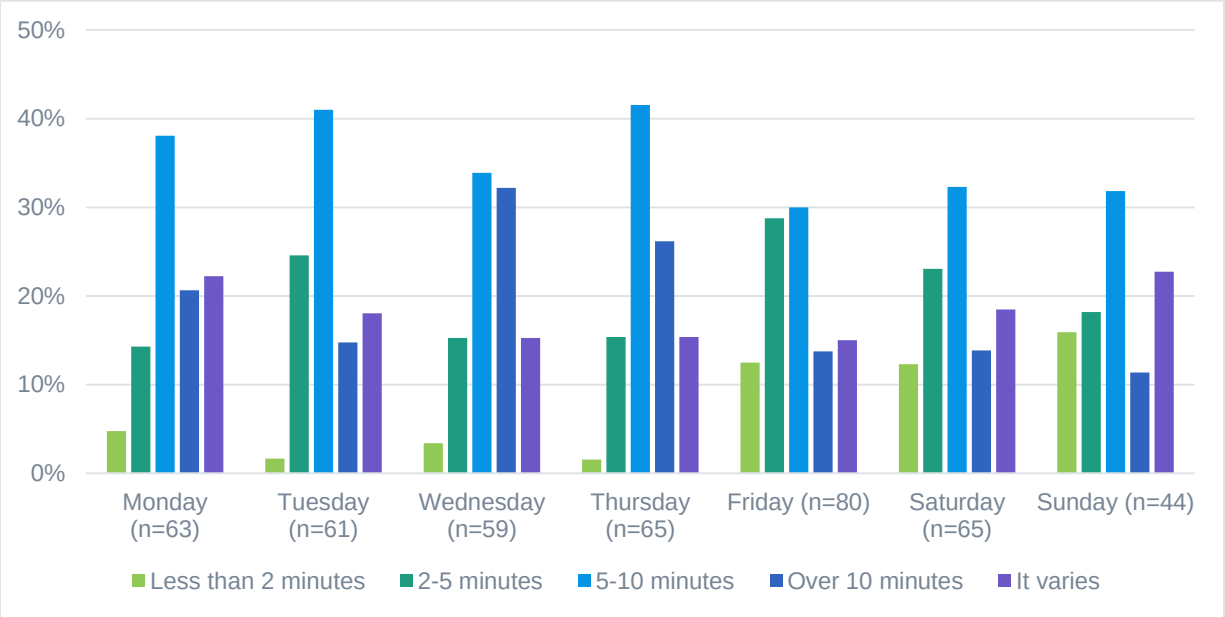
As the week goes on, the most common ride-hail shifts get later in the day. Starting Thursday, most respondents are driving at night.

Figure 37: Common Shifts of Ride-Hail Drivers per Day of Week



Similarly, wait times between rides tend to get shorter on the weekends.

Figure 38: Typical Wait Times between Rides per Day of the Week

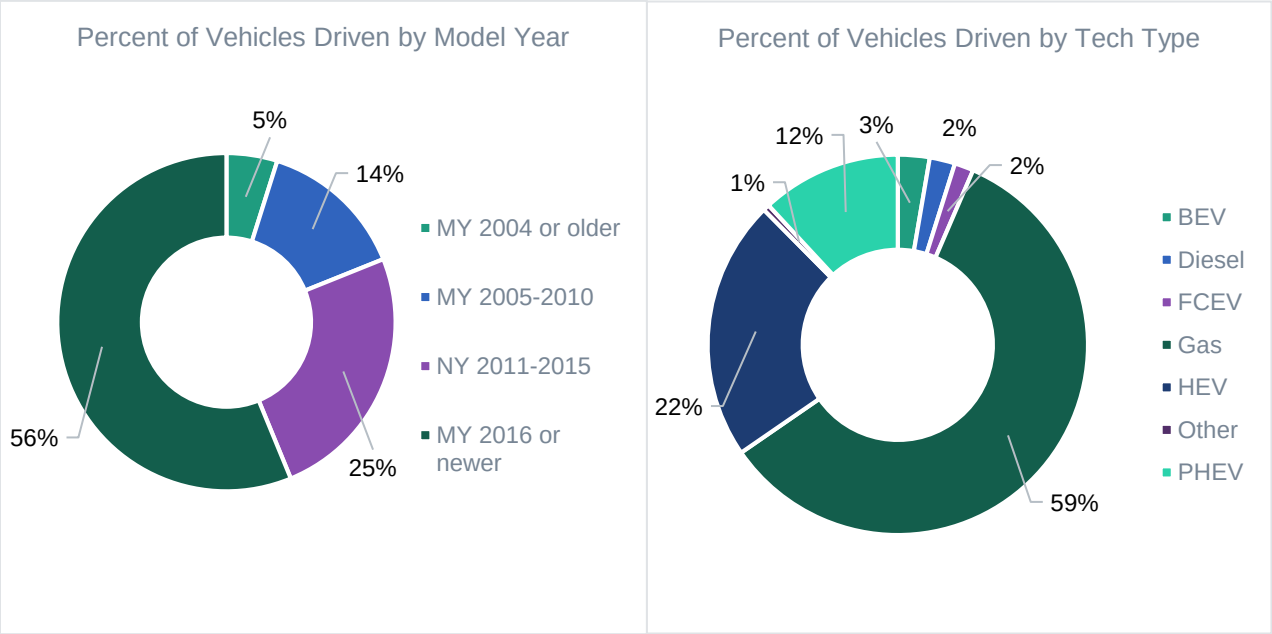


Three quarters of respondents stated they take breaks during their shift, and those breaks average 26 minutes.

Vehicle Ownership and Factors Influencing Car Buying

Two-thirds (66%) of respondents drive small to midsize cars and SUVs to provide ride-hail services and eight of 10 vehicles (81%) were model year 2011 or newer. A majority (59%) of vehicles were gas; however, a higher proportion (38%) of vehicles were clean cars including hybrids and EVs compared to the resident survey population. A higher than expected number of respondents (16%) indicated their primary vehicle or ride-hail car is an EV. In addition, nearly all (97%) of respondents purchased their vehicle, with 69% already having paid it off.

Figure 39: Model Year and Technology Type of Current Vehicles (N=185)

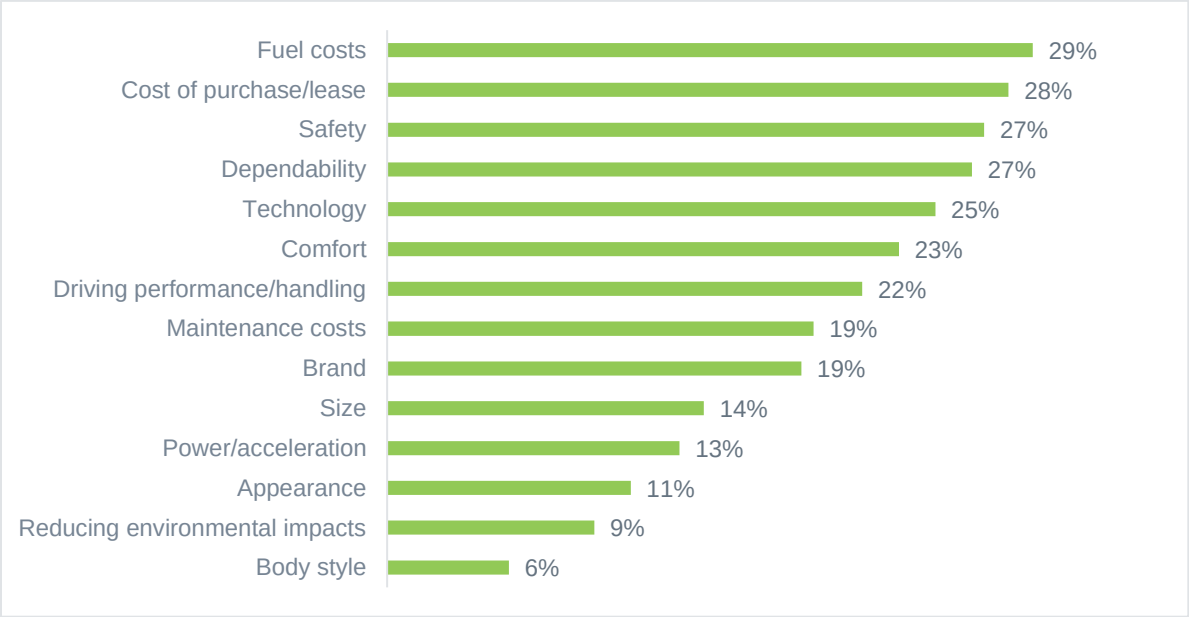


Approximately three-quarters (72%) said they plan to acquire a vehicle in the next two years. Sixty-nine percent said they would most likely acquire a new car and 77% said they would purchase as opposed to lease. Cars as opposed to SUVs were the preferred body style, preferred by over 1/3rd of respondents.

- Midsize: 39%
- Compact: 33%
- Full-size: 33%

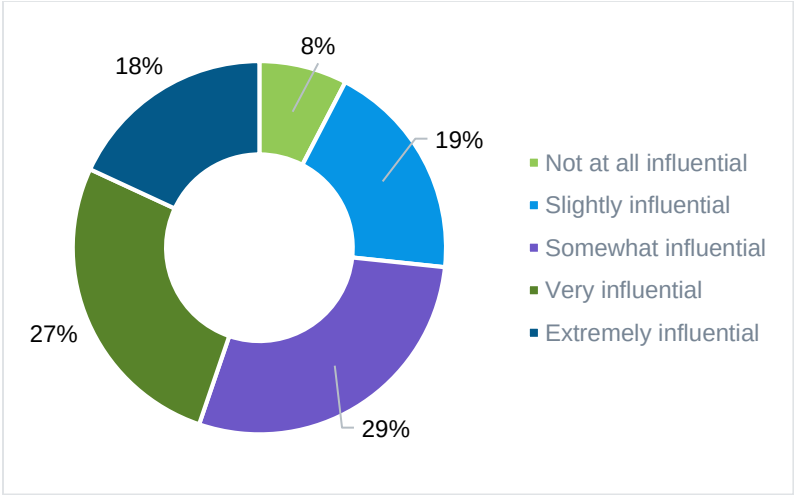
When considering a vehicle, costs were very important factors in their decision to get a car, however more creature comforts were also important like comfort and technology, most likely due to the amount of time they spend in their car and that it is used as a customer service tool. Reducing environmental impacts was low on the list.

Figure 40. Most Important Factors in Ride-Hail Drivers' Car Buying Decisions (N=181)



In addition, 73% of respondents said their out-of-pocket expenses (e.g., fuel costs, maintenance costs) of being a ride-hail driver were at least somewhat influential in their decision on a car to acquire.

Figure 41. How influential are ride-hail out-of-pocket expenses in your decision on what car to buy? (N=105)



On average, $37,320 was the maximum dollar amount they would spend on a car. Median was $30,000.

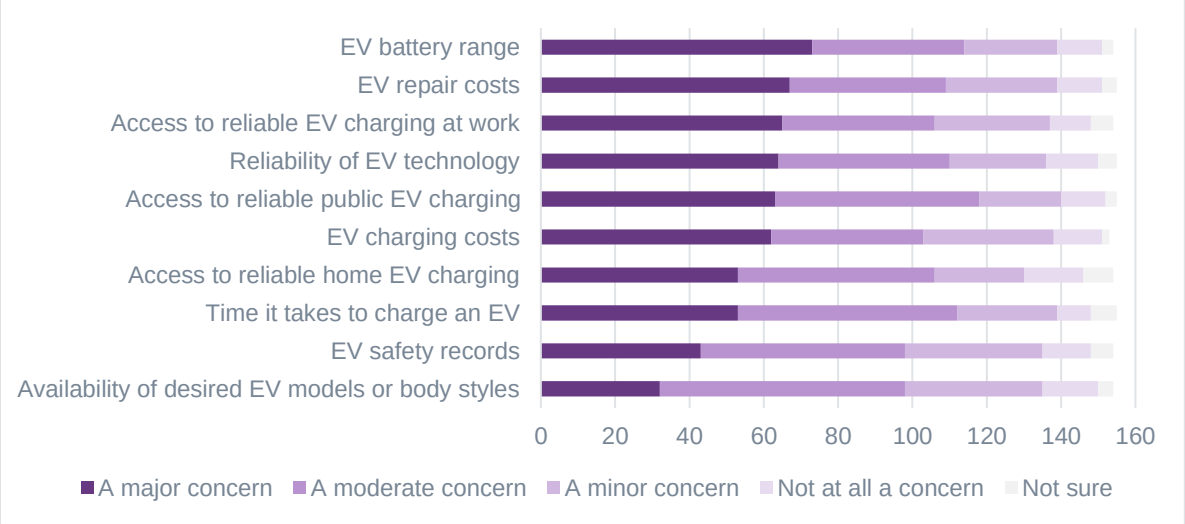
Barriers to EV Adoption

Among survey respondents, 64% said they would consider getting an EV, although awareness of brand is low. Five respondents didn't know any EV brands. The remaining 180 respondents knew an average of 3.84 EV brands. Some of the top-selling EV brands[13] were the most recognizable, however overall awareness of EVs remained low. Even Tesla, whose vehicle focus is exclusively EVs, were only known by 44% of respondents as making an EV. The top-most recognized EV brands were:

- Tesla: 44%
- Toyota: 42%
- Honda: 37%
- Chevrolet: 28%
- BMW: 27%

Concerns with acquiring an EV among the ride-hail respondents mirrored the general population surveyed on the Resident survey. Range, access to charging, repair costs and reliability of the technology were the biggest concerns.

Figure 42: Biggest Concerns about Acquiring an EV (N=155)



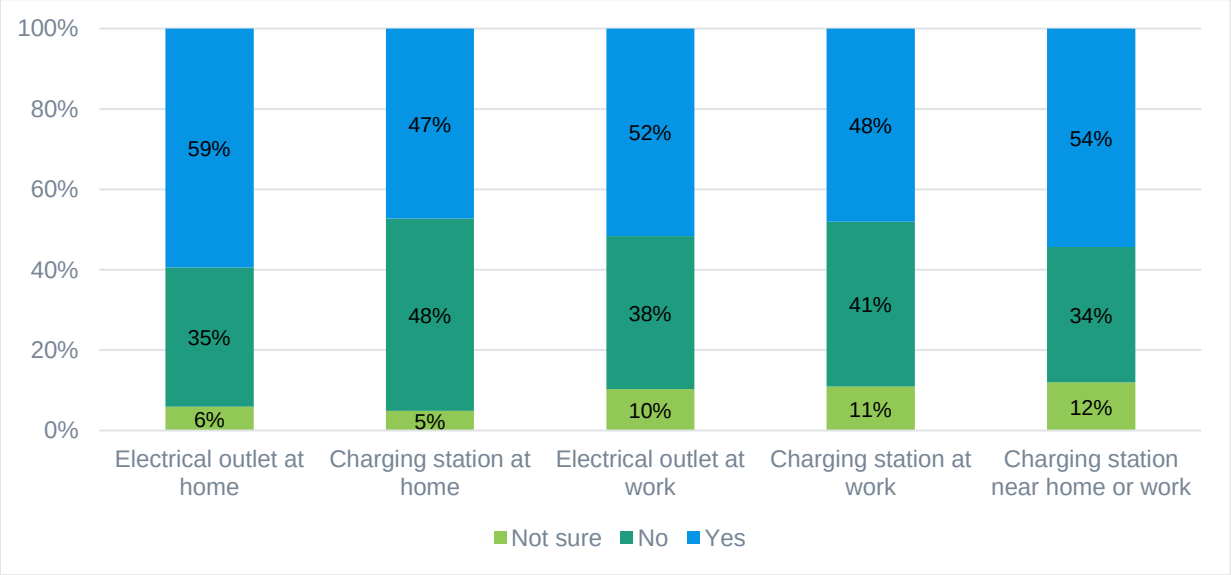
Open-ended responses confirm these concerns, with the write-in options largely identifying range, battery life, charging time and availability as major concerns with them driving an EV for ride-hail services.

[13] EV sales scorecard. Inside EVs. https://insideevs.com/news/343998/monthly-plug-in-ev-sales-scorecard/. Accessed 4/23/2020

A majority (58%) of respondents said that 230-mile range, which is available in lower-cost models, would be enough to cover a shift driving ride-hail. Only 16% said 230 miles would not be enough range to cover a shift and 12% said it would depend on the shift. Thirteen percent were unsure. This suggests a lack of awareness in range that is currently available in EVs, even at lower price points.

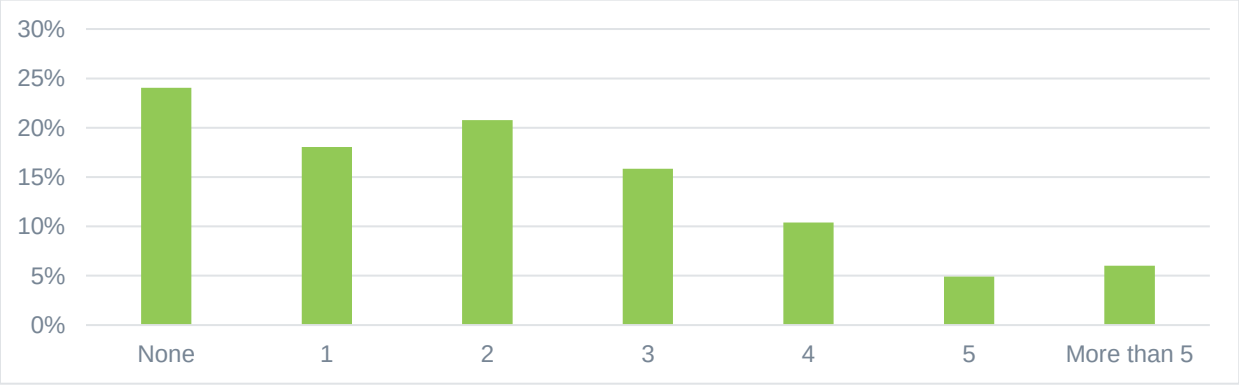
Respondents indicated that they have access to common EV charging methods. Considering a higher proportion own EVs, and the relatively small sample size, this is not surprising.

Figure 43: Access to Common EV Charging Methods (N=185)



There is also more awareness of public charging infrastructure among this group. This could also be due to a higher proportion of EV drivers in this group. However, considering access to charging is such a strong concern for ride-hail drivers, the recognition of stations may not assuage the concern that they cannot charge their vehicles in a timely enough manner to be useful.

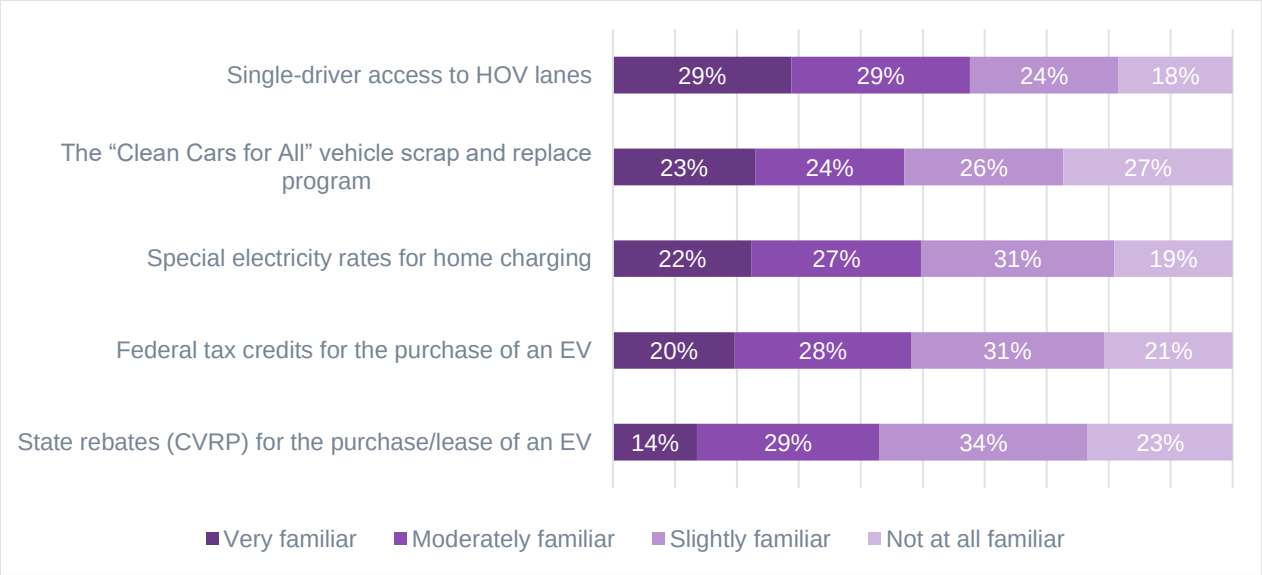
Figure 44: Approximately how many EV charging stations have you noticed in your neighborhood? (N=183)



Awareness & Impact of Incentives

Although slightly higher than the resident survey population, familiarity with incentives for EV adoption remain unfamiliar to ride-hail drivers surveyed. HOV lane access was the most commonly known incentive among this audience.

Figure 45: Familiarity with EV Incentives (N=184)



Respondents were asked to rank from one to 13 possible EV incentive structures in order of how likely they were to influence their decision to get an EV. Three additional incentive types were added to the ride-hail version of this question to include specific incentives for ride-hail driving. The added incentive types were:

- Increased number of rides from riders selecting clean rides
- An additional dollar amount per ride-hail trip
- An additional dollar amount per ride-hail mile driven

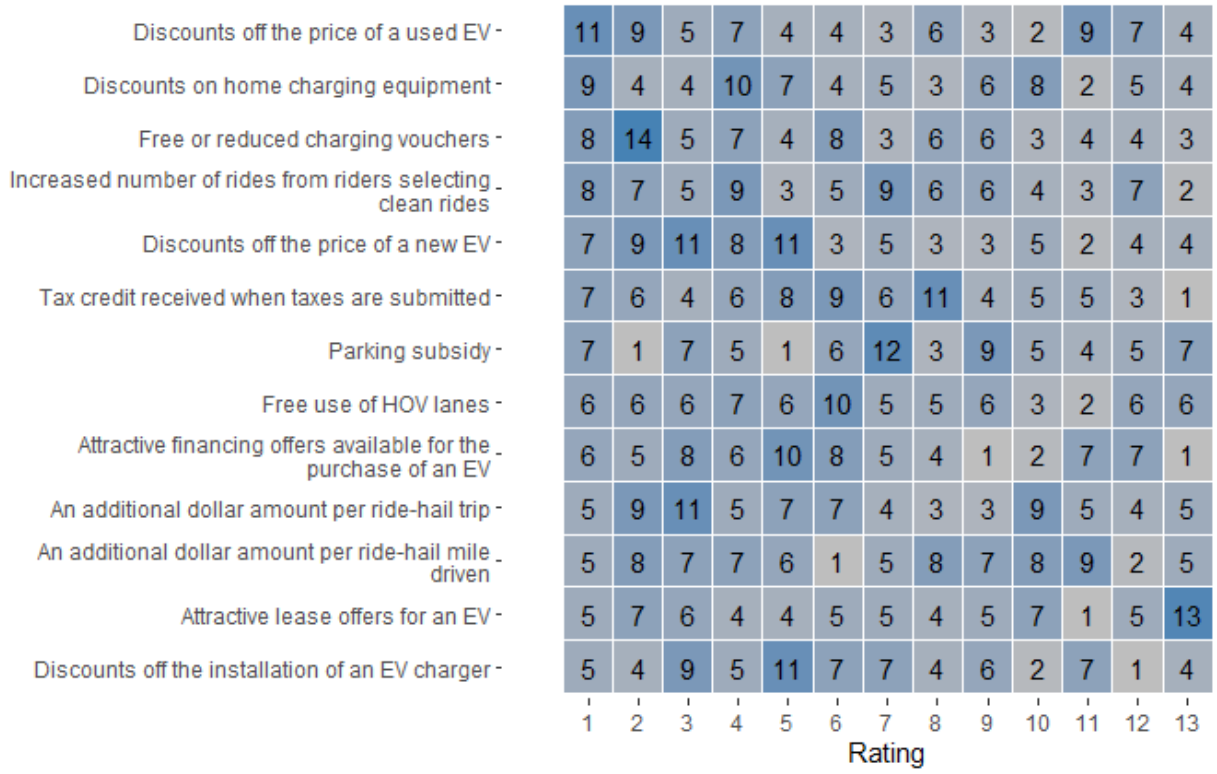
Ride-hail respondents answered quite differently than the general resident survey. While discounts off a new EV had the highest rank score – like the resident survey – it was followed by more practical incentives that would lower their driving costs (charging vouchers) and increase their revenue (additional dollar amounts per trip, allowing ride-hail passengers to select clean rides).

Figure 46: Rank Sum of Incentive Types Most Likely to Influence an EV Acquisition

Incentive Type	Rank Sum	N
Discounts off the price of a new EV	629	75
Free or reduced charging vouchers	619	75
An additional dollar amount per ride-hail trip	588	77
Tax credit received when taxes are submitted	581	75
Increased number of rides from riders selecting clean rides	570	74
Discounts off the price of a used EV	569	74
An additional dollar amount per ride-hail mile driven	556	78
Discounts off the installation of an EV charger	555	72
Free use of HOV lanes	551	74
Attractive financing offers available for the purchase of an EV	548	70
Discounts on home charging equipment	539	71
Parking subsidy	483	72

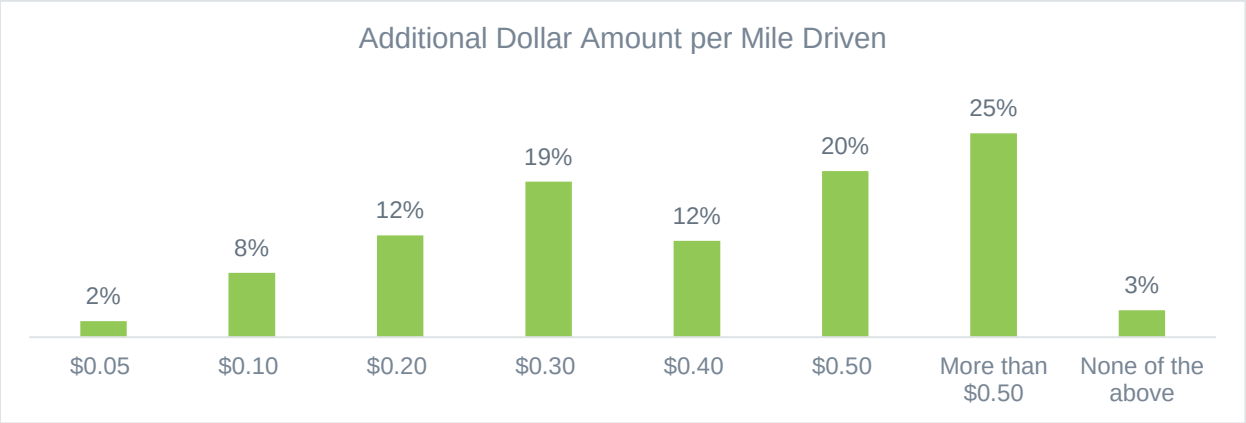
To further analyze these incentive types, we created a heatmap that visualizes the number of times each option was ranked 1-10. When examining the data in this way, you see that while their overall ranks were lower, discounts on used EV and home charging equipment were ranked number 1 more than their rank score would indicate. Furthermore, while an additional dollar amount per ride-hail trip was highly ranked, it was less often a respondent's first choice.

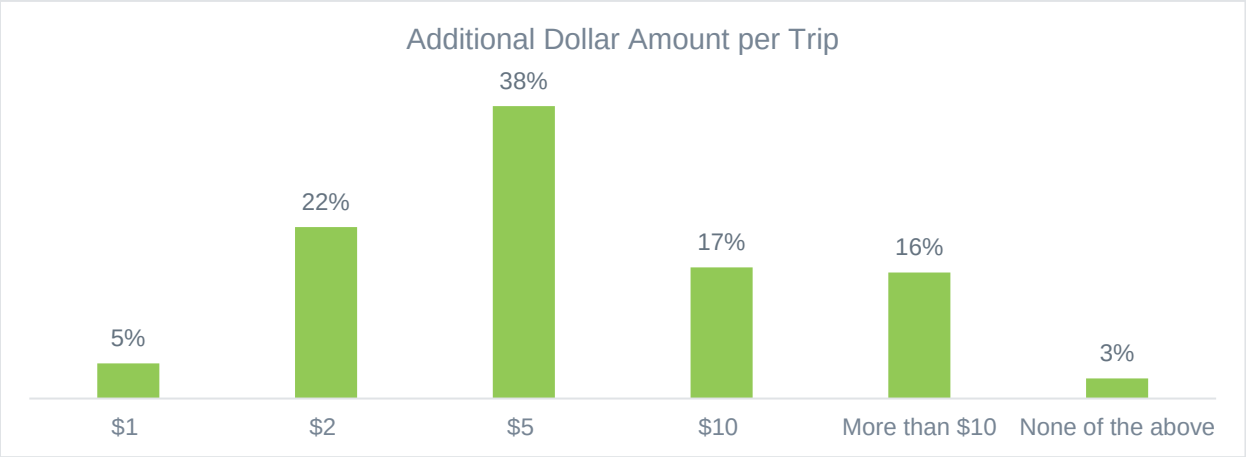
Figure 47: Incentives Heatmap



To exploring more closely the impact of per-mile and per-trip incentives might have on ride-hail drivers, we asked what a minimum per-mile and per-trip dollar amount would make them consider an EV. Overall, only 25% of respondents required more than $0.50 per mile additional earnings to consider an EV. Per-trip totals required additional dollars spent, with 71% requiring more than $5 more per ride to consider an EV.

Figure 48: Additional Dollar Amount per Ride-Hail Mile and Trip Required to Consider an EV (N=155)





V. Multi-Unit Dwelling Property Managers

As electric vehicles (EV) become more common, more EV charging stations are needed. EV adoption among multi-unit dwelling (MUD) residents has lagged due in part to a lack of charging infrastructure. BAAQMD would like to accelerate EV adoption by addressing barriers to market transformation. One of these barriers is the difficulty of getting EV charging into MUDs. Therefore, CSE conducted focus groups with MUD property managers to understand the barriers to installing charging and find ways to address these challenges.

Figure 49: MUD Focus Group Participants

Location	Participants	Date
San Francisco	6	12/4/19
Oakland	4	12/19/19
San Jose	4	12/6/19

Two additional interviews were conducted with interested parties who were unable to attend a focus group. One interviewee managed low income housing and the other was an energy efficiency contractor who worked extensively in MUDs.

Focus Group Characteristics

The housing characteristics represented at each focus group varied by location. In the San Francisco group all the participants managed properties built from the 1920s – 1960s. These properties were all rental units. Most participants in the Oakland group managed properties that were built in the 1960s or earlier; however, one participant who managed affordable housing units had a property portfolio that includes some newer units. Again, in Oakland all properties were rental units. In San Jose, two participants represented owner-occupied condos. One participant managed a mix of market rate and affordable housing.

Awareness/Knowledge

Given the nature of focus group recruitment, most participants had some level of interest in electric vehicle charging stations. Most participants did not have EV charging at any of their properties, but this varied by geography. No one in the San Francisco group had charging, one person in the Oakland group had charging, and most people in the San Jose group already had some charging.

For participants who did not yet have any charging at their properties, many had not looked for information regarding EV charging. Among those who had looked for information, the most commonly cited source of information was PG&E. Several participants also had significant knowledge around EV charging because their personal vehicle was an EV.

Motivations

Approximately half of participants have had tenants ask for charging. Even among property manager who have not had anyone ask for charging, there was a perception that EV charging would soon become a standard offering and they would be left behind if they did not offer it. One exception to this was among the managers of affordable housing. One affordable housing manager mentioned that he had installed a charging station at one of his newest properties and it was not being used at all. Another affordable housing manager expressed doubt that any of his tenants owned an EV or had any interest in EV charging.

When asked about potential benefits, the most commonly cited response was that installing EV charging would attract higher quality tenants. A few participants also mentioned that while rent control regulations prevent them from increasing rent immediately after installing EV charging stations, adding this amenity would allow them to increase rent for future tenants.

Barriers

Electrical Capacity

Many participants raised concerns about the electrical capacity at their buildings. There was a lot of uncertainty around what the cost would be if electrical upgrades were needed. Managers of older buildings agreed that their buildings were already pushing the limits of available power. They were also concerned that any electrical upgrade would trigger additional code requirements. For example, one participant mentioned the need to upgrade from fuses to circuit breakers. The only participants who had installed charging stations had done so in newer buildings.

Parking

A very strong consensus among participants in all focus groups was that tenants or condo owners would be unwilling to change parking spaces. Focus group participants in San Francisco and Oakland expressed concern that tenants would complain to the rent board if they were required to change parking spots. Participants who represented condos noted that their parking spaces were deeded, and a transfer of ownership would be difficult. Therefore, the idea of locating charging stations adjacent to each other in order to lower costs was generally not appealing to property managers.

Most participants did not have any extra spots available, so shared charging was not an option they had considered. One participant in San Jose shared that his condo did have a space available for a shared charger, but he was worried that one or two drivers would ‘hog’ that spot. However, another participant in San Jose volunteered a solution to this issue. She had installed shared chargers in a public space and had not seen issues with cars parking for long periods of time because she used a pricing scheme that charges users for additional time if they are not charging.

Billing

Most participants did not like the idea of using common area meters for charging stations. When asked whether they could pass along the electricity cost to EV owners in the form of a monthly surcharge,

participants in San Francisco and Oakland raised multiple concerns. First, they believed that it would be difficult to obtain approval of the rent board to add a surcharge to the rent. Second, even if the surcharge were to be approved, it would be difficult to change. This would present a problem if electricity rates suddenly increased.

Maintenance

Participants unanimously agreed that they would prefer not to have responsibility for maintaining any additional equipment in their buildings. In both the San Francisco and Oakland focus groups, participants mentioned the term "loss of service." They explained that once they installed EV chargers they would be required to keep them operational or face penalties from the rent board due to loss of service. One participant mentioned that he does not even like to install garbage disposals due to the additional maintenance headaches.

Some participants also raised concerns about theft and vandalism. While some property managers dismissed this concern because the chargers would be covered by insurance, others noted that their insurance has high deductibles and they would likely have to cover the cost of any theft or damage.

Other concerns

One participant mentioned that if she were to install some EV chargers, more tenants would purchase EVs and start clamoring for charging. None of the participants had conducted a survey or undertaken any steps to quantify the demand for EV charging among their tenants.

Another commonly cited concern was that participants are overwhelmed by too much information about EV charging in general, as well as the various incentive programs available.

Suggestions from Participants

Focus group participants had several suggestions for ways to facilitate EV charging in multi-unit dwellings. One participant mentioned that there are many third-party companies that will provide coin-operated laundry services at apartments and establish a profit-sharing arrangement with the property manager. He suggested that this type of business model would be ideal because the property manager would not need to deal with maintaining equipment or with loss of service complaints.

Another participant who had done significant research on EV charging suggested that metered outlets would be an effective, low-cost solution. In this scenario, tenants would provide their own connectors, thereby minimizing the amount of equipment the property manager would need to purchase or maintain. Other suggestions to minimize the cost of equipment included using wireless charging or load sharing software. Load sharing software would enable multiple vehicles to charge simultaneously at lower power, therefore reducing the need for additional electrical capacity.

Finally, there were several suggestions around providing easier access to information. Suggestions included providing a list of suggested contractors and offering technical assistance. A key desire was to have one point of contact for the entire process. On a related note, one participant suggested that statewide regulations (as opposed to the current situation where regulations vary by city) would make things easier for vendors and allow them to provide more streamlined information and services.

Discussion

Most MUD property managers had done little to no research on installing EV charging at their buildings despite agreement that EV charging would attract high-quality tenants and would eventually become a necessity. These property managers face several barriers—a lack of time to research EV charging, uncertainty about cost and scope of project (e.g., need for electrical upgrades) and a fear that chargers will become a future additional maintenance problem.

As some participants suggested, providing information and technical assistance would be valuable for many property managers. Of course, some concerns that were raised by participants do already have viable solutions. For example, a concern that drivers will park all day in front of a charger can be alleviated by an hourly rate structure. Technical assistance that includes a site walk to assess electrical capacity and provide a cost estimate could also help alleviate fears and provide momentum for many property managers.

Finally, subsidies for EV charging will be important, especially for older building that are likely to need utility service upgrades or other electrical work.

VI. Fleet Managers

Fleets play a crucial role in BAAQMD's plans to accelerate transportation electrification in the Bay Area. To understand the best ways to help fleet managers adopt more EVs, CSE conducted a focus group and several interviews with Bay Area fleet managers. CSE recruited participants from our network of fleet manager contacts as well as contacts provided by BAAQMD. In these interviews, fleet managers were asked about the current status of EVs in their fleet, what motivations they have/had to acquire EVs, and the barriers they face in acquiring additional EVs. The objectives of these interviews were to:

- Understand the barriers to converting fleets to EVs
- Identify the most important factors managers consider when evaluating EV procurement
- Assess the managers' knowledge of EV incentives
- Assess whether existing or modified incentives would influence their decision to transition to EVs

Participant Characteristics

The focus group was held on December 18, 2019, and interviews were conducted between January 31 and February 10, 2020. Figure 50 shows the breakdown of participants by agency type.

Figure 50: Fleet Focus Group/Interview Participants

Agency Type	Interviewees
Cities	6
Parks department	1
Waste management company	1
Transit agency	2
University	1

Most of the interviews were focused on cars; however, the waste management companies and transit agency were focused on heavy-duty vehicles (trash trucks and buses). Three of the other fleet managers indicated that they were mainly focused on trucks or vans.

Current EV experience

Almost all fleets with light duty vehicles had some experience with PHEVs and/or battery electric vehicles (BEVs); only one participant did not have any plug-in electric vehicles in their fleet. Five participants had at least one BEV in their fleet, and three had PHEVs. The waste management companies did not have any EV equipment, and the transit agency had hybrid diesel buses. The most common motivation cited by fleet managers was to meet city or state goals for fleet electrification, followed by a desire to reduce greenhouse gas emissions. Only one interviewee brought up financial incentives for EVs as a motivating factor and another respondent mentioned HOV stickers. When asked about benefits, several respondents emphasized that they saw huge savings on maintenance costs and appreciated the

convenience of less frequent servicing intervals. One fleet manager of a waste management company mentioned that the reduced noise of electric refuse trucks would be a big benefit.

Barriers

Interviewees were asked about several potential barriers to adding EVs to their fleets. Driver perceptions and a need to train mechanics or outsource maintenance were not seen as large barriers. The two biggest barriers faced by fleet managers are a need for additional EV infrastructure and a lack of available body styles.

Driver perceptions

None of the interviewees described driver perceptions or a need to train drivers as a barrier. One city fleet manager had held ride and drives for employees in the past, to get employees comfortable with EVs. Several interviewees indicated that their drivers adapted quickly to the EVs with minimal training, and one fleet manager mentioned that most drivers have had some experience with an EV in their personal life.

Maintenance

While a few interviewees outsourced the maintenance of their EVs, most had their EV serviced by in-house mechanics. The fleet managers reported that some training was needed for their mechanics, none of the participants described this as a major issue. One interviewee mentioned that the mechanics had expressed concerns about working with EVs due to the high voltage of the vehicles. However, he indicated that the mechanics' concerns were alleviated after they went through their training. One fleet manager mentioned that their fleet has NEVs (neighborhood electric vehicles) and they have had trouble finding replacement parts for those vehicles.

EV Charging

For most of the fleet managers who were focused on cars, EV infrastructure was the first barrier that came up. There were several facets to this concern – electrical capacity, space constraints, and overall cost. Several interviewees mentioned that they had limited electrical capacity and may need additional transformers. Space to put EV chargers was not a concern for most respondents; however, the university fleet manager described EV charging as their largest problem due to their limited parking. The shortage of available parking creates a twofold problem – first, no one wants to 'give up' a parking space by restricting it to EVs only, and second, because parking is tight, no one wants to move their car after they have found a spot. This would make it difficult for multiple EVs to share access to a charger throughout the day. Another participant mentioned that it often makes the most sense to put EV chargers right next to a building to save costs, but there will be a negative public perception if there are EV spots right by the front of a building that are sitting empty.

One interviewee brought up funding for EVSE as their biggest challenge. She pointed out that there is always a budget to replace cars, and culturally many jurisdictions are moving toward wanting to reduce GHGs, but there has never been a budget for EVSE.

Some of the interviewees who were focused on trucks or heavy-duty vehicles mentioned that the electrical capacity needed to charge these vehicles would be large and therefore expensive. In addition to the expense, obtaining service upgrades from a utility includes logistical hurdles. The transit agency fleet manager mentioned that he has been trying to talk to someone at PG&E about service upgrades but has not heard back from them. He also brought up another challenge that may be specific to buses: their mechanics would not be able to work on the buses while they are charging. He explained that their goal will be to have the buses fully charge within 4 hours, but even with that rapid charge their schedule is so tight that they anticipate having to buy additional buses to meet the needs of their fleet.

Unmet needs

Among the participants who already had EVs in their fleet, everyone was happy with the range and performance of their EVs. One focus group participant who did not yet have any EVs raised a concern that if they were to add lighting bars (for example for parking enforcement) that they would drain the battery quickly. Another participant mentioned that his city had done testing around that issue and not had any problems. This may indicate a need for more educational materials around how real-world factors such as accessories affect EV range.

Multiple interviewees mentioned concerns about emergency vehicles. One city fleet manager mentioned that while administrative police duties can be carried out with EVs, patrol units would only accept Teslas, which are unaffordable given the city's budget. Another fleet manager expressed concern that if they used EVs for emergency vehicles they would not be able to use the vehicles in the event of a public safety power shutoff or other outage.

Several interviewees mentioned that their most pressing need was for electric trucks or vans (either because their fleet had very few sedans, or because most of their sedans had already been converted to EV.) Retrofits for vans and trucks are available, and a few interviewees had some experience with retrofits. One fleet manager was able to use a retro-fitted electric F-150 as part of a demonstration project and had a good experience with it, but in general comments about retrofits were negative. Multiple people mentioned that the retrofit vehicles were unaffordable, with one fleet manager saying that the cost was 3 times that of an equivalent gasoline-powered truck. One fleet manager had a retrofit vehicle and said that it broke down often resulting in down time for the vehicle and additional hassle to get it serviced.

Incentives

When asked about incentives, almost half of the interviewees mentioned that PG&E had an incentive program to help with the cost of EV infrastructure. Most expressed vague awareness of the program. One focus group participant mentioned that they had applied to this program but that it was oversubscribed. Another interviewee said that the grant program was only available if a fleet had heavy-duty vehicles on order. Specific to heavy-duty vehicles, one fleet manager mentioned HVIP but said that it was oversubscribed. Another fleet manager brought up the Carl Moyer grant. He mentioned that it was a scrap and replace program and was complicated to qualify for.

When asked about what types of incentives would be best, most interviewees were indifferent between funding for EVs versus EV charging, but a couple respondents expressed that funding for charging would be more helpful. Not a single interviewee reported that they track spending on electricity to charge their EVs, therefore no one felt that subsidized electricity costs would be helpful. As far as logistics of an incentive program, there was universal agreement that lead times of a year or more would be helpful given that most fleets operate on a one or two-year budget cycle. One focus group participant mentioned that rebates were preferable to grants because he needed city council approval to apply for a grant.

Suggestions from Participants

When asked about ways to make it easier for fleets to adopt EVs, the suggestions general fell into two categories – information or incentives. Participants suggested a need for the following information:

- Total cost of ownership of EVs that highlights the savings on fuel and maintenance
- One source of information about cars, charging infrastructure, and funding sources
- Heavy duty
    - a tool that compares costs for renewable natural gas, diesel, and electric vehicles
    - pilot programs

Discussion

The fleet managers who participated in these interviews were very supportive of adding EVs to their fleet, and many expressed a desire to do their part for a cleaner environment. While discussing light-duty vehicles, there was almost no concern about driver apprehension around EVs nor any concern that EVs would be unable to meet fleet needs (except for emergency vehicles). For most interviewees, the biggest barrier to adding EVs to their fleet was EV infrastructure. EV charging stations represent a large upfront cost that fleets have not had to budget for in the past. Creating an EV infrastructure grant with clear rules and minimal participation restrictions could provide significant acceleration in EV adoption among fleets. In addition, some fleets currently own plug-in hybrid electric vehicles (PHEVs) but almost never charge them. Providing charging infrastructure could enable more electric vehicle miles traveled with these existing PHEVs.

For fleets with many trucks and vans, their biggest barrier is a lack of existing electric trucks. While electric retrofits for trucks and vans exist, they are extremely expensive and were not seen as a viable option by any of the interviewees. Some fleet managers expressed excitement about the upcoming electric Ford F-150. Providing significant rebates for electric trucks as they become available is likely to have a large impact for fleets.

Finally, for heavy-duty vehicles, such as buses or waste collection trucks, pilot programs may be very helpful because of the high risk associated with buying such expensive equipment.

VII. Car Dealerships

Vehicle dealers are a critical group in the Bay Area for the acceleration of EV adoption. They are often the first person to introduce EVs and let prospective consumers experience them. In addition, they often make consumers aware of rebates/incentives for EVs. We know that dealership staff have differing levels of knowledge on EVs (often exacerbated by high turnover) and commitment to promote EVs to prospective car buyers. To better understand this audience, the following objectives of these interviews were to:

- Understand the reasons when and why sales personnel do or do not actively promote EVs
- Identify effective dealership strategies for selling EVs
- Assess successful methods and strategies dealers use to improve the EV buyer experience
- Understand the used EV dealership perspective on how to accelerate EV adoption

CSE recruited sales/assistant sales managers from dealerships across the Bay Area. CSE leveraged our extensive dealer network in the Bay Area (over 250 dealerships) cultivated through our support of the Clean Vehicle Rebate Project (CVRP). We ultimately recruited nine dealerships to take part in interviews. Interviews were 30-minute-long phone interviews attended by two representatives from CSE (interviewer and note taker). They were semi-structured, meaning we used a question script that we could then deviate from as needed. Using CVRP rebate data as a proxy, we were able to estimate an average monthly sales estimate for dealerships in the Bay Area. We recruited five high-volume dealerships (average 5 or more estimated EV sales per month), three low-volume dealerships (average under 5 estimated EV sales per month), and one used EV dealership. To encourage open and honest responses to the interview, we promised participants that we would maintain anonymity, therefore the specific names of dealerships and interviewees are not provided in this report. A breakdown of details about the dealership participants can be found below:

- Counties
    - Alameda: 3
    - Contra Costa: 2
    - Marin: 1
    - Napa: 2
    - Sonoma: 1
- Vehicle Brands Represented
    - Multiple EVs: 1
    - BMW: 2
    - Honda: 1
    - Kia: 1
    - Mitsubishi: 1
    - Nissan: 1
    - Toyota: 1
    - Volkswagen: 1
- Average Monthly EV Sales
    - High-Volume Dealerships: 9 EVs per month
    - Low-Volume Dealerships: 3 EVs per month
    - Used EV dealership: 60 EVs per month

All dealerships interviewed agreed that customers who come in looking for an EV largely have general knowledge about the technology. They typically have done their research on EVs and often are aware of incentives available for their purchase. Also, they are very often committed to acquiring an EV and not easily swayed into a gas vehicle. The only way a dealership might sway someone into a gas vehicle is if there were budgetary considerations that made an EV unaffordable or they were interested in a body style not available as an EV. Dealerships may also try to move prospective gas customers to EVs based on needs assessments with the customer. If they have long commutes, or are interested in smaller commuter cars, they might encourage them to consider an EV. The questions that prospective EV customers ask are most often related to range and charging.

Low-volume dealerships did not report having specific EV sales strategies, mostly due to the low-volume of sales not warranting them. High-volume dealerships were much more likely to have a formulated EV sales strategy. Part of that strategy is to highlight incentives available. HOV lane access advertising was identified as the most popular incentive that they market. Multiple dealers indicated that the HOV lane access was more valuable than monetary incentives available. Several of the high-volume dealerships cross-trained their sales staffs on EVs and invest in billboards and other advertising to lure in EV shoppers. High-volume dealers were also more likely to offer attractive lease/purchase terms to bring down the price of EVs and develop a client base for EVs in the future. Several had more unique customer-oriented methods for selling EVs. While some of these were a dealership-wide strategy, not specific to EV sales, they proved effective at identifying prospective customers who might be able to be put into an EV. Such strategies included:

- Conducting Q&A with customers as they walk in the door and matching them with the appropriate salesperson based on personality. Creates a welcoming experience and gets a sense of what they are interested in and their driving patterns to see if an EV is a good fit.
- Providing two-week follow up visits with customers to see how they are doing and answer any questions based on their experience. Offered to all customers, but taken advantage of more by EV customers
- Test drives/demonstrations: Allows people to experience EVs as well as other experience other technologies to maximize your EV (e.g., power inverters that can use your EV to power your home during blackouts).

Despite these strategies, dealerships face several challenges to selling EVs. Both high- and low-volume dealerships cited EV inventory as the biggest challenge. Some brands were shifting production to newer models, limiting inventory of demonstration vehicles, or were competing with other dealerships for EVs. This was exacerbated (especially for low-volume dealerships) where inventory was allocated based on past sales. High-volume dealerships also expressed incentive limitations/challenges as a challenge. Restrictions on the length of time you have free HOV lane access, limitations on income and eligible vehicles for state rebates, and uncertainty about availability of rebates/text credits were all cited as issues. In addition, one dealership noted that customers expect the same monetary benefits (e.g., attractive lease terms) to purchase an EV a second time, which they are often not eligible for, increasing

the cost of their second EV and strains their ability to make a sale. Many dealerships cited external circumstances like gas price fluctuations and the recent power shutoffs by PG&E as challenges. Both high and low-volume dealerships indicated lack of understanding about EVs as another challenge, however it was articulated as “hesitancy to switch” by low volume dealerships. Lastly, several dealerships indicating a lack of public and MUD charging as challenges to selling EVs. One other commonly cited challenge was that customers are often concerned that newer/better versions of EVs will be coming out that makes them hesitant to buy the current models.

When asked what could be done to help dealerships accelerate the sales of EVs, low-volume dealerships indicated more customer rebates and investment in infrastructure as key. Most likely because marketing incentives is a bigger part of their EV sales strategy, high-volume dealerships did not cite customer rebates as the key to driving EV acceleration in interviews. They identified infrastructure investment as the biggest way to accelerate EV adoption, but also cited consumer education, extending HOV lane access times and providing dealership support as key drivers. Dealership support included both providing monetary incentives to dealers for selling EVs as well as assisting with dealer education, marketing and collateral. While most said a dealer incentive would spur sales, there was some concern shared about competing OEM incentives that dealers get to move specific stock instead of EVs. Some other, more out of the box ideas were to support outreach activities like ride and drive events and couple EV sales with free/incentivized solar panels. Other acceleration ideas were more internal, like increasing range on available vehicles, increasing inventory, and improving dealer wait times when buying a car.

Used EVs

Dealerships indicated that used EV sales were driven primarily on availability of lease returns/trade-ins. This leads to low inventory levels of used EVs if the model is too new to be available off lease return yet. While dealerships attempt to bring customers back at the end of their lease term to gain repeat customers and generate used inventory, that is not always possible. If they get inventory, it is usually priced reasonably and sell quickly. Others indicated that it is challenging to move used EVs due to range restrictions of three-year-old models or issues with battery degradation in used market. This seemed specific to certain models.

As part of these interviews, we specifically interviewed a used EV dealership that shared insights into the benefits of the used EV market. They have a different client base then a typical new car dealer. They get EV customers who have considered a new one but could not afford it or are specifically shopping for a used car but see EV price points as attractive when compared to used gas vehicles. Used EVs are also popular with tech workers in the Bay Area. Most are looking for a commuter car or a cheap car for their kids. The used EV dealership gets similar questions about EVs as new car dealers like range and battery life but are also asked about long-term reliability.

This used EV dealership provides attractive customer service options, again not specific to EVs, that help them sell more EVs. They offer online purchases that avoid the haggling and long waits at the

dealership. They also offer a five-day return policy that helps ease the risk people feel of buying an EV. They also have home delivery, which allows them to expand their customer base into territories that are farther away and offer less hassle to their customers.

Lastly this used EV dealership identified similar infrastructure investment and HOV lane access to accelerate the sale of EVs, but also found dealer education and training as key, most likely due to the number of different models sold. They also suggested removing limits on incentive dollars, providing down-payment assistance and subsidizing home charging options.

VIII. Recommendations

Based on the research findings, and the desire of BAAQMD to accelerate EV adoption in the Bay Area, CSE proposes recommendations categorized into five areas:

- Incentives to accelerate EV adoption in the Bay Area (within BAAQMD's scope)
- Raising awareness of EVs
- Facilitation and education
- Additional incentive ideas to accelerate EV adoption in the Bay Area (outside BAAQMD's scope)
- Further research

Incentives to accelerate EV adoption in the Bay Area (within BAAQMD's scope):

1) Consider modifications to the Clean Cars for All (CCFA) program

Nearly one-quarter (24%) of respondents earning under $100K per year in family income stated they drove model year (MY) vehicles between 2005 and 2010. Current eligibility to participate in CCFA requires scrapping a vehicle MY 2005 or older. Based on these findings, allowing consumers to scrap models over 10 years old, instead of 15, could increase the prospective participant pool for the program. Based on some preliminary analysis of nationwide data conducted by CSE, vehicles within these model years are generally driven more miles and tend to contribute more to the CO2 emissions than pre-2005 model years. See Appendix E for more details. These findings suggest that changing model year eligibility would not negatively impact per-vehicle air quality gains.

Also consider expanding the marketing of the home charging portion of the CCFA program. As found in this study, home charging incentives were found to be highly influential in EV purchasing decisions. More widespread awareness of the home charging option that is available through CCFA may spur participation.

2) Pilot different incentive structures and demonstration projects to encourage the sale of EVs and installation of infrastructure

Several interesting ideas were identified through this research as ways to accelerate EV adoption for multiple stakeholders. Piloting some of these incentives and evaluating their efficacy would be a good way to test new incentive structures. Some ideas include:

- A monetary incentive to dealership sales personnel for every EV sold
- Ride-hail driver incentives
    - Charging vouchers to ride-hail drivers who use EVs
    - Providing additional incentives to ride-hail drivers per trip/mile that they drive in an EV
    - Additional monetary rebates available only to ride-hail drivers on top of existing rebates
    - Incentives for offering pooled ride-hail trips
- Home charging incentives to EV owners for income-qualifying individuals

- Demonstration projects with heavy-duty EVs or EV cargo/transit vans in fleet settings to allow fleets to confirm that the electric vehicle would meet their needs before making such a large purchase
- Pilot demonstration projects of low-cost alternatives to expensive charging installations
- Pilot DC fast charger installations in busy ride-hail corridors

Raising Awareness of EVs:

1) Focus marketing resources on the benefits of EV ownership that address major concerns and important vehicle purchasing factors

This research revealed that many nontraditional commuters still supplement their commutes with personal vehicles and were more likely to acquire a car in the next two years than traditional commuters. While BAAQMD can continue to encourage the use of non-traditional methods for commuting to relieve congestion and improve air quality, these findings suggest that nontraditional commuters are still using a personal vehicle for commuting and recreation. Marketing EVs as clean option to supplement their commute or meet their needs for non-commute driving could be low-hanging fruit. Ride-hail drivers showed more of an interest in EVs and were more likely to be already driving one. While more research is needed to confirm, this suggests that some may have already analyzed the cost-benefit driving an EV or participated in local ride-hail incentives like Uber's EV Champions Initiative. Marketing the cost-benefit of EVs to ride-hail drivers and partnering the Uber/Lyft to market and create new incentives should also move the needle in ride-hail EV adoption.

Findings suggest that as awareness and consideration of EVs goes up, so do concerns. While not examined specifically in this project, it makes sense that concerns rise as people become more aware of a product and start to do some initial research. In addition, dependability and safety were two of the biggest factors in car-buying decisions. Raising awareness of EVs therefore should go hand-in-hand with education about the benefits of EV adoption including range, low maintenance and fuel savings. In addition, given the availability of 200+ mile range EVs in affordable models (e.g., Chevrolet Bolt, Nissan LEAF, Hyundai Kona), marketing how these can serve most commuter needs can spur more participation in the EV market. This can be more effective with marketing available battery warranties for both new and used EVs. This should also help spur the ride-hail market who said that these longer range BEVs can serve their ride-hail driving needs. This study did not explore EV's safety records compared to gasoline vehicles, but this provides an interesting next step in research that could inform marketing, assuming the comparison is favorable to EVs.

Marketing this information through collateral to dealerships would help address a barrier identified by dealerships about the lack of understanding of EVs.

Promoting apps and resources to find charging locations could also greatly help people recognize public charging options.

2) Market the existence of available rebates and the stackability of rebates

Findings showed that respondents making under $100K spend more of their income on transportation costs, have much less access to charging of all types (home, work, public) and are willing to spend much less on their next car than respondents making over $100K. These factors not only make it harder to purchase/lease an EV, but harder to own one. CCFA is a great resource on its own, but marketing could put a greater emphasis on stacking it with the Clean Vehicle Rebate Project (CVRP), the federal income tax credit (if applicable) and perhaps other local incentives. Coupling this marketing with educational materials to simplify the application processes for these incentives would help facilitate more participation and make more people aware of the substantial cost-savings available.

Facilitation and Education

1) Facilitate ride-and-drive events or other experiential learning opportunities for car shoppers

Dealerships interviewed identified test-drive events and demonstrations as effective tools for introducing EVs to consumers, however, some questioned the return on investment gained from doing these events. BAAQMD could assuage concerns about EV technology and affordability by hosting test-drive events either on its own or in partnership with CVRP that could serve to market incentives (including stackability) and allow consumers to experience multiple EV options at one time. We have learned in past studies conducted by CSE that a third-party entity facilitating these types of events provides credibility that dealerships are not always afforded.

2) Serve as a third-party educator to stakeholder groups about best practices for overcoming EV adoption.

BAAQMD is in a unique position to serve as a third-party entity that can educate stakeholders without being seen as trying to sell something. This could include training dealerships on the benefits of EVs and best practices for addressing prospective EV customer concerns, providing site walks of MUDs to determine feasibility and costs to install EV charging, or conducting fleet readiness assessments and identifying the right EVs for the job. By providing these services, as well as educational materials that can be used to share with decision-makers in all venues, should help alleviate concerns about selling EVs or installing chargers.

Additional incentive ideas to accelerate EV adoption in the Bay Area (outside BAAQMD's scope)

Recognizing that some findings in this report may not fall within the mission of BAAQMD, or may not be in their scope, the following is a list of incentive structures identified through this research that BAAQMD could consider sharing with Bay Area partners:

- A used EV program not contingent on scrapping a vehicle
- An incentive to decrease the cost of a purchase/lease of their second EV, which are often much less subsidized

- Charging vouchers to ride-hail drivers who use EVs
- Piloting “washing machine” style model for MUD EV charging infrastructure where MUD owners pay a fee for EV chargers but don’t have to maintain or manage them
- Pilot demonstration projects of low-cost alternatives to expensive charging installations
- Incentivize upgrading of electric panels at MUDs for buildings that do not have the electrical capacity to accommodate an EV charging station
- Incentivize the installation of charging infrastructure at dealerships to help defray the infrastructure/capitol costs of selling EVs.
- Pilot DC fast charger installations in busy ride-hail corridors

Further Research

1) Explore resale values of vehicles 10-15 years old in relation to the CCFA incentive to determine if allowing younger cars to be scrapped would be more financially beneficial than trading it in.
2) Study safety and dependability ratings comparing EVs with gas vehicles to determine if these are valid metrics that can be marketed.
3) Conduct further research on the resident survey data on maximum price respondents were willing to pay for a vehicle (e.g., comparing to common EV prices, determine how much of a vehicle would need to be incentivized, use in regressions with other data to determine causality). Following up with a revealed preference study to see what people actually paid for a car would also provide an economic indicator on the actual value of incentives to consumers.
4) Replicate this study in two years to determine how COVID-19 has impacted the economy and transportation choices in the Bay Area.

Appendix

Appendix A: Alternate Commute Table

Primary Commute Method	Respondents	Percent of respondents who use alternate commute method								
		Alone in your personal vehicle	Public transportation	Carpooling	Walking	Ride-hailing service	Work from home	Alone in a company vehicle	Biking	Other
Alone in your personal vehicle	199	-	55%	39%	20%	43%	15%	25%	15%	1%
Public transportation	107	44%	-	21%	30%	43%	10%	4%	13%	2%
Carpooling	33	39%	48%	-	30%	33%	6%	6%	18%	3%
Walking	28	18%	64%	25%	-	29%	7%	0%	18%	0%
Ride-hailing service	18	50%	61%	28%	28%	-	6%	0%	28%	11%
Work from home	17	59%	47%	12%	53%	41%	-	6%	12%	0%
Alone in a company vehicle	13	46%	46%	15%	31%	31%	15%	-	15%	0%
Biking	10	50%	40%	0%	30%	0%	10%	0%	-	10%
Other	4	25%	25%	25%	0%	50%	0%	0%	0%	-
Total	**429**	**22%**	**41%**	**28%**	**24%**	**38%**	**11%**	**13%**	**15%**	**2%**

Appendix B: Electric Vehicles by Base MSPR[14]

Electric Vehicles by Base MSRP

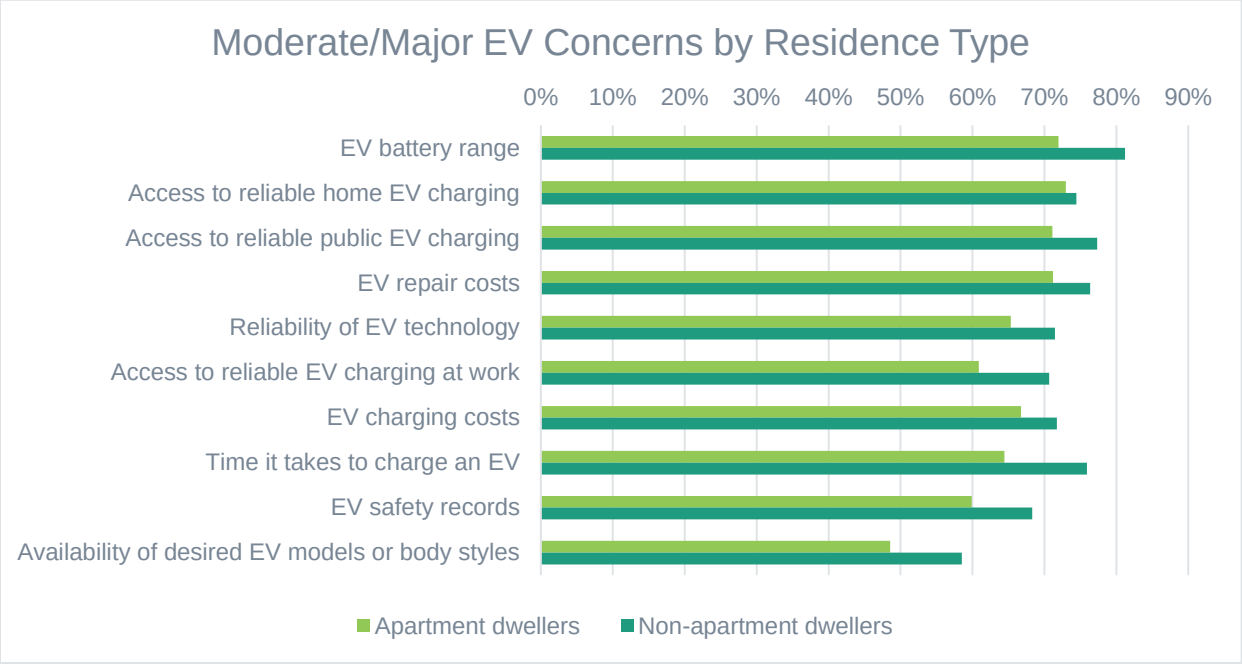
Key
> $60,000
$50,000–$59,999
$40,000–$49,999

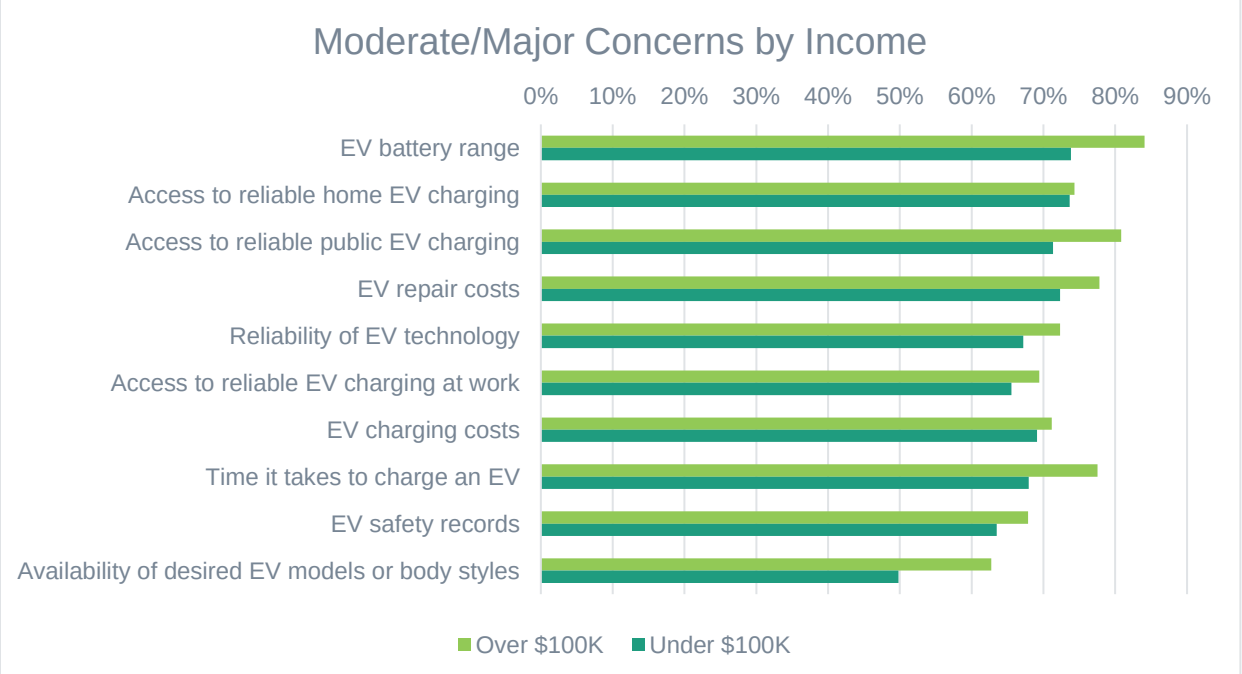
Base MSRP sources: Manufacturer websites, FuelEconomy.gov, Kelley Blue Book
Note: ZEMs, FCEVs, and discontinued PEVs not included.

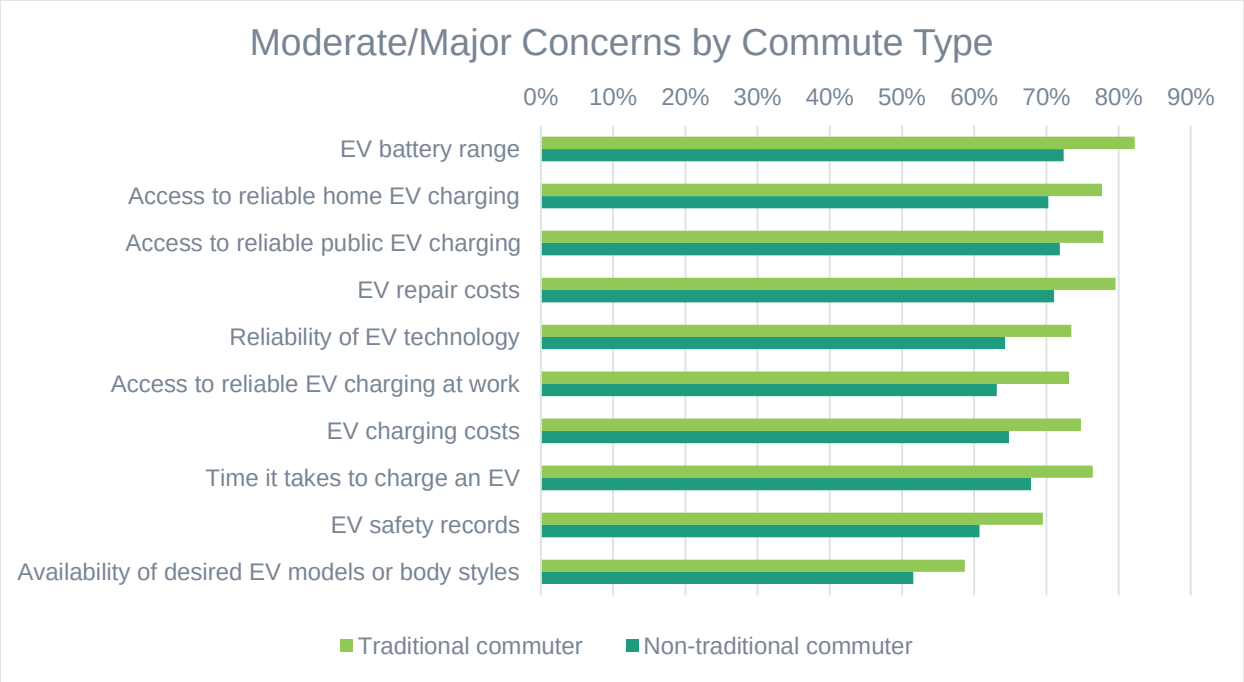
Vehicle Make and Model	Base MSRP
BMW 530e xDrive iPerformance	55700
Audi A3 e-tron	39500
BMW 530e iPerformance	53400
Volvo XC60 T8	55300
Volvo XC90 T8	67000
Volvo S90 T8	63900
Mitsubishi Outlander PHEV	34595
Toyota Prius Prime	27350
Ford Fusion Energi	34595
Kia Niro Plug-in Hybrid	28500
Hyundai Sonata Plug-in Hybrid	32400
Hyundai Ioniq PHEV	25350
Kia Optima Plug-in Hybrid	35390
Chrysler Pacifica	39995
Honda Clarity Plug-In Hybrid	33400
smart Electric Fortwo Cabriolet	28100
smart Electric Fortwo Coupe	23900
FIAT 500e	32995
Honda Clarity Electric	37540
BMW i3 REx	48300
Kia Soul EV	33950
Ford Focus Electric	29120
Hyundai Ioniq Electric	30315
Volkswagen e-Golf	30495
BMW i3s REx	51500
Nissan LEAF	29990
BMW i3	44450
BMW i3s	47650
Nissan LEAF Plus	36550
Jaguar I-PACE	69500
Chevrolet Bolt	36620
Tesla Model X	88000
Hyundai Kona Electric	36450
Tesla Model 3 (Medium-range)	47990
Tesla Model S	85000

[14] Proposed FY 2019-2020 Funding Plan: Final CVRP Supporting Analysis. https://cleanvehiclerebate.org/sites/default/files/attachments/CVRP_Projections_for_Proposed_FY19-20_Funding_Plan_v10-01.pdf. Accessed 5/22/2020

Appendix C: Moderate to Major Concerns about EVs for Target Populations

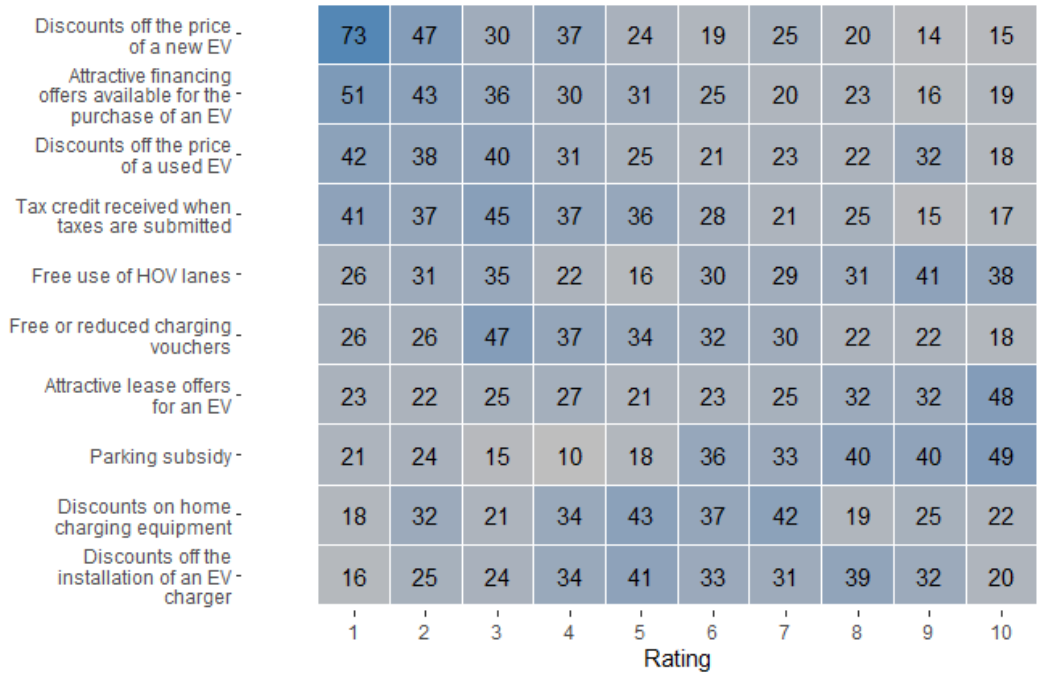




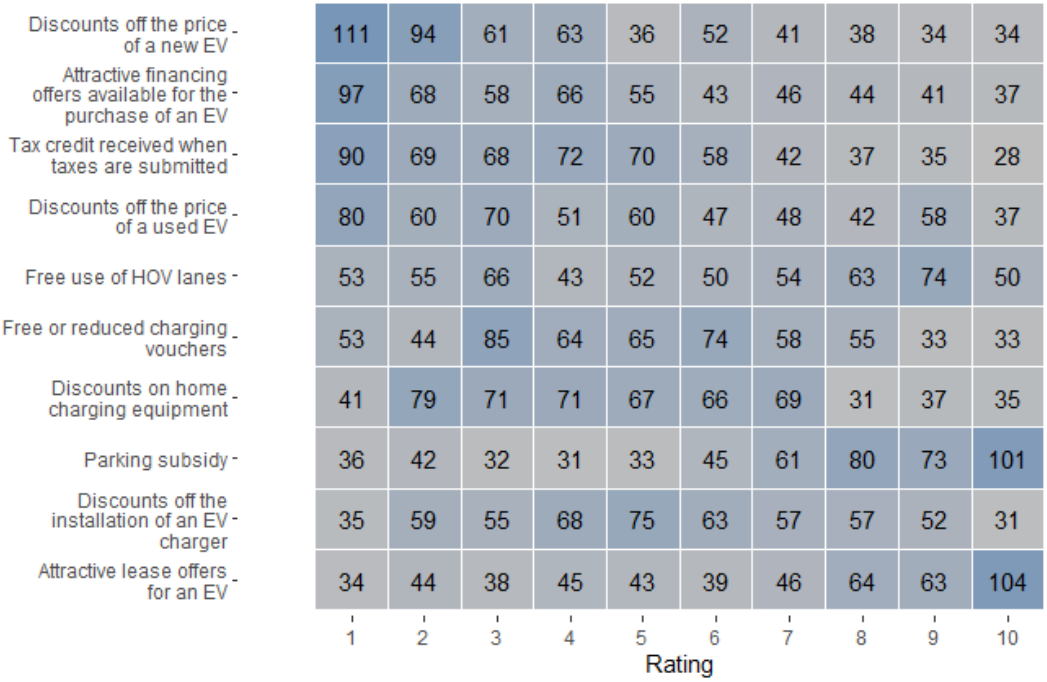

Moderate/Major Concerns by Commute Type
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
EV battery range
Access to reliable home EV charging
Access to reliable public EV charging
EV repair costs
Reliability of EV technology
Access to reliable EV charging at work
EV charging costs
Time it takes to charge an EV
EV safety records
Availability of desired EV models or body styles
Traditional commuter
Non-traditional commuter

Appendix D: Incentive Heatmaps for Target Populations

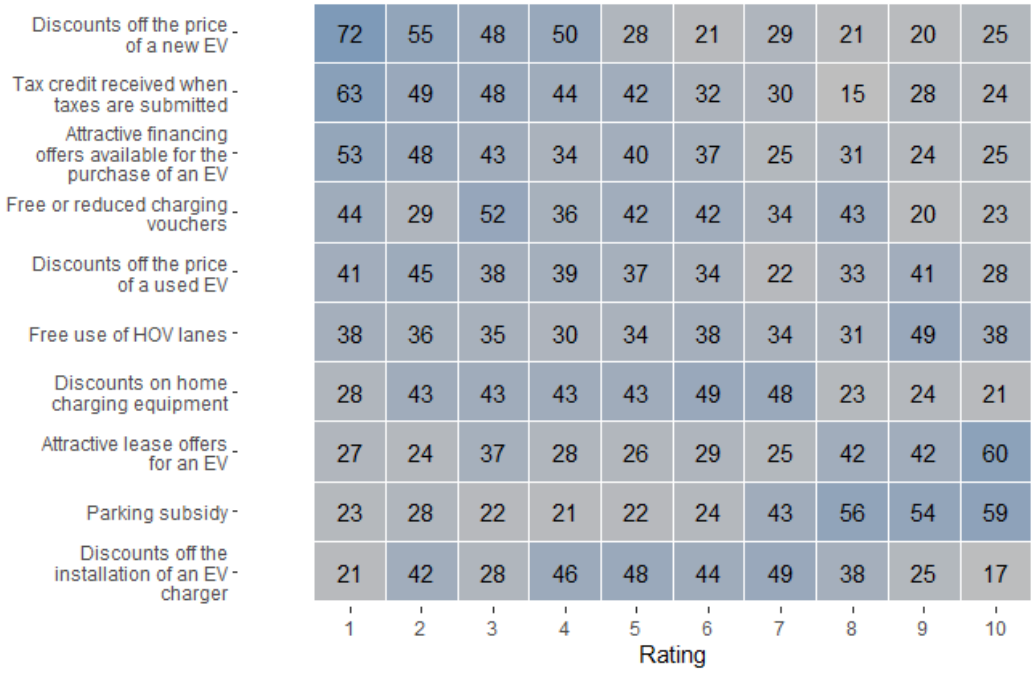
Apartment Dwellers



Respondents making under 100K



Nontraditional Commuters



Appendix E: Vehicle Miles Driven and Tons of CO2 by Model Year[15]

Figure 51: Estimate of Average Vehicle Miles Driven per Vehicle Model Year in the US

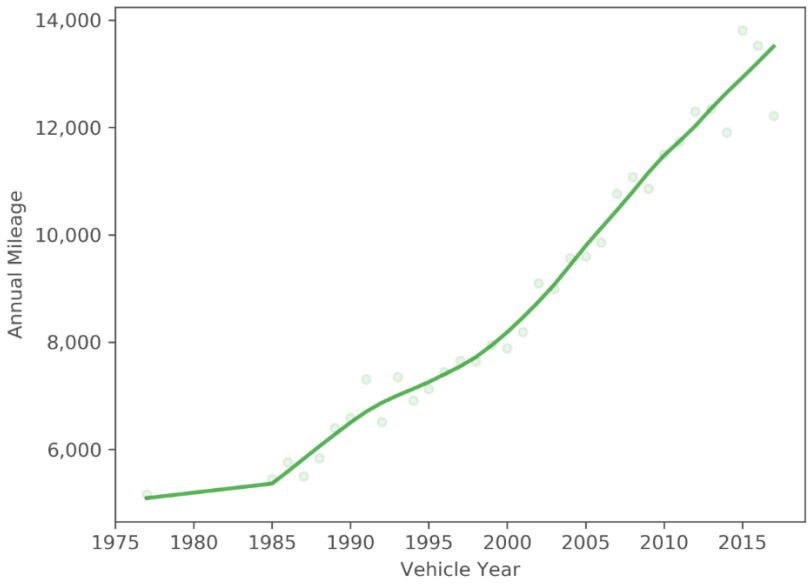
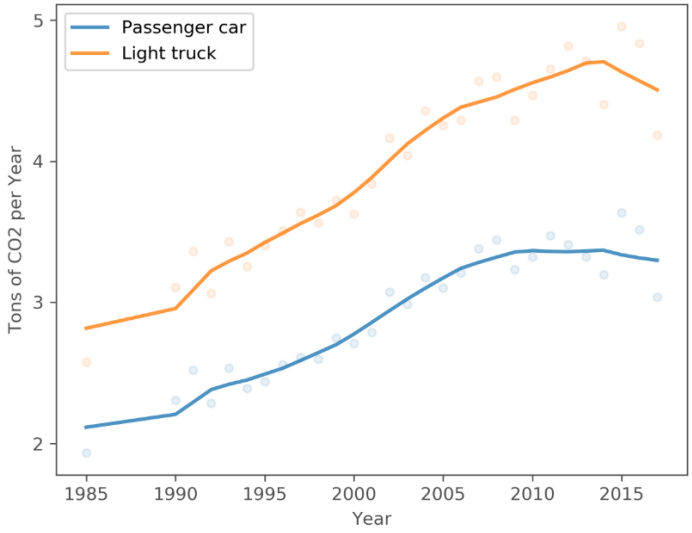


Figure 52: Estimate of Average CO2 emissions per Vehicle Model Year in the US



[15] Data used for analysis in Appendix E comes from The National Household Travel Survey (https://nhts.ornl.gov/), the Bureau of Transportation Statistics (https://www.bts.gov/archive/publications/national_transportation_statistics/table_04_23) and the US Energy Information Administration (https://www.eia.gov/environment/emissions/co2_vol_mass.php). Results are preliminary.

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