
MARCH 2021

Bay Area Air Quality
Management District



BAY AREA ELECTRIC VEHICLE ACCELERATION PLAN

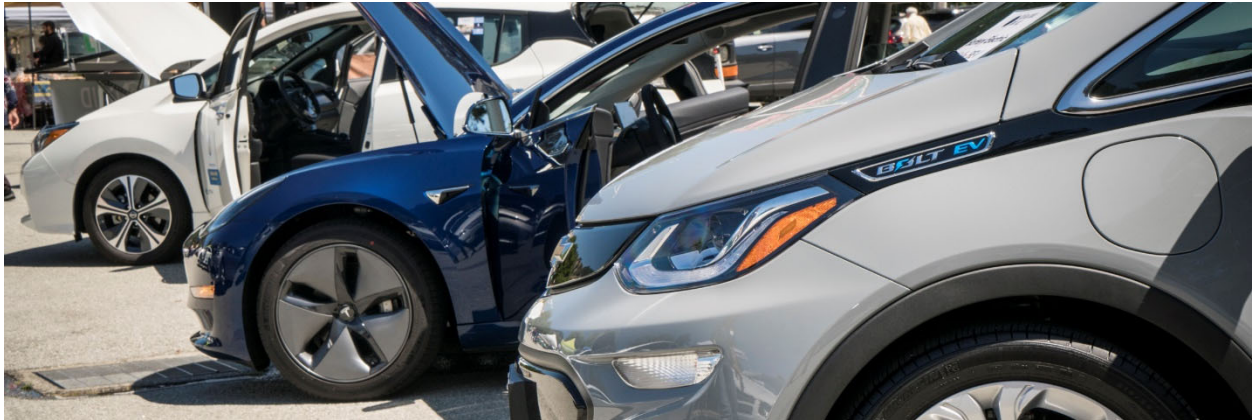
A plan to accelerate transportation
electrification in the Bay Area.



BAY AREA
AIR QUALITY
MANAGEMENT
DISTRICT

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Executive Summary

With the first introduction of commercially available light-duty electric vehicles¹ (EV) in 2010, the Bay Area Air Quality Management District (Air District) began programs to monitor the EV market and increase EV adoption in the Bay Area. To identify and prioritize EV market maturation efforts, the Air District and the Metropolitan Transportation Commission (MTC) developed and released the Bay Area Plug-in Electric Vehicle Readiness Plan in 2013². The Air District's efforts have also included development and implementation of region-wide outreach and awareness activities, supporting legislative action to accelerate EV adoption, and direct financial incentives. The Bay Area EV Acceleration Plan (Plan) aims to update and supplement the 2013 Readiness Plan, including an update on the EV ecosystem, results of our EV market research, and recommendations to address the barriers to EV adoption.

One of the greatest changes since we released the 2013 Readiness Plan is the maturation of the EV market past the “innovators” and “early adopters” technology cycle. Additionally, as EVs near cost parity with conventional cars and fighting climate change becomes a greater priority in our society, governments must adjust programs and priorities. To this end, the Air District released a Clean Air Plan in 2017³, which included a goal to increase the EV share in the Bay Area to 90% by 2050. This EV Acceleration Plan is meant to help the Bay Area achieve that goal in an equitable manner.

The recommendations highlighted in this Plan speak to the importance of addressing historic disenfranchisement in frontline communities⁴ as we pursue our aggressive EV adoption and market acceleration goals. Our analysis and suggestions related to increasing equity are

¹ EVs are defined here as Battery Electric Vehicles (BEV), Hydrogen Fuel Cell Electric Vehicles (FCEV), and Plug-in Hybrid Electric Vehicles.

² <https://www.baaqmd.gov/plans-and-climate/bay-area-pev-program/bay-area-pev-ready>

³ <https://www.baaqmd.gov/plans-and-climate/air-quality-plans/current-plans>

⁴ Frontline communities are those that experience “first and worst” the consequences of climate change. These are communities of color and low-income, whose neighborhoods often lack basic infrastructure to support them and who will be increasingly vulnerable as our climate deteriorates. These are Native communities, whose resources have been exploited, and laborers whose daily work or living environments are polluted or toxic (Ecotrust.org).

included on Page 25 in the Advancing Equity in the EV Market section in this Plan. The following five recommendations form the backbone of our strategy for increasing EV adoption and equity:

- 1. Work more closely with frontline communities to better understand their unique needs and barriers to EV adoption.**
- 2. Empower influential members of frontline communities and support them with the latest information to share with their communities.**
- 3. Focus marketing and outreach efforts on the benefits of EV ownership that address major concerns identified through surveys and highlight people of color.**
- 4. Streamline, simplify, and incentivize EV charging infrastructure and EV ready parking spaces, prioritizing installations at or near multi-family buildings.**
- 5. Identify additional funding sources from the Federal, State, and local level to support the necessary incentives for a just transition.**

The Air District and our partners collected data and resources, which have informed our development of the following goals to ensure equitable EV acceleration in the Bay Area:

- Increase Air District support for low-income and frontline communities**
- Establish an interim goal of 1.5 million EVs in the Bay Area by 2030**
- 100% of Bay Area Cities and Counties enact EV ready reach codes by 2030**
- 100% of Bay Area Cities and Counties enact EV Charging Station Permitting Streamlining procedures and policies by 2022**
- Seek more ambitious CalGreen⁵ EV ready parking space standards in the 2022 Title 24 Code Update (for both existing and new buildings)**

Transportation and air quality policy have historically exacerbated the inequities faced by communities of color.⁶ Low-income communities and communities of color continue to be disproportionately impacted by air pollution and climate change⁷ and have been left out of the EV market given the economic barriers to entry.⁸ For this reason, the vast majority of the Air District's work, funding, and policy attention related to transportation electrification must prioritize and empower our frontline communities across the Bay Area.

⁵ California Green Building Standards Code or "CALGreen" (California Code of Regulations, Title 24, Part 11), is the first mandatory green building standards code in the nation and often serves as a model for other state and local governments across the country. CALGreen currently requires 6% of parking spaces in new nonresidential buildings to be Electric Vehicle capable or "EV capable".

⁶ Reichmuth, David. 2019. Inequitable Exposure to Air Pollution from Vehicles in California. Cambridge, MA: Union of Concerned Scientists. <https://www.ucsusa.org/resources/inequitable-exposure-air-pollution-vehicles-california-2019>

⁷ Finkelstein et al. Relation between income, air pollution and mortality: A cohort study. CMAJ. 2003; 169: 397-402.

⁸ Sierra Club and Plug In America, 2018, AchiEve: Model State & Local Policies to Accelerate Electric Vehicle Adoption, <https://www.sierraclub.org/sites/www.sierraclub.org/files/blog/EV%20Policy%20Toolkit.pdf>

This Plan will support and be supported by the transportation electrification goals set out in the Metropolitan Transportation Commission's (MTC) forthcoming Plan Bay Area 2050 and the Air District intends to continue to seek out opportunities for regional collaboration to advance our shared goals.

In line with the Air District's overarching goal of imbuing all of our work with the core tenants of environmental justice, this Plan incorporates principles of equity and inclusion throughout each section, providing special attention to the unique barriers and opportunities for growth in frontline communities. In addition, we have developed a recommendations section specific to tackling the need for greater equity and inclusion in the EV market.

Background

The Air District, created in 1955 by the California state legislature, is responsible for regulating stationary sources of air pollution in the nine-county Bay Area region. As a key component of its multi-portfolio approach to improving air quality, the Air District develops and administers incentive programs to accelerate voluntary emission reductions from the transportation sector. During the past twenty years, the Air District has awarded over \$1.3 billion in incentives with an increasing amount going towards zero-emissions technologies.

The Bay Area's nine counties are home to approximately 7.6 million people⁹ and 5.3 million light duty vehicles¹⁰, with an additional 600,000 vehicles passing daily through the region from adjacent areas.¹¹ Three-quarters of Bay Area residents drive to work (64% drive alone and 10% carpool) and 12% take transit to work.¹² Tailpipe emissions from these light duty vehicles account for approximately 28% of greenhouse gas (GHG) emissions (CO₂e) and a significant portion of other pollutants (31% of carbon monoxide and 12% of nitrogen oxide) in the Bay Area. These types of air pollutants increase respiratory ailments like asthma and bronchitis, heightens the risk of life-threatening conditions like cancer, and burdens our health care system with substantial medical costs.¹³

In addition to alternative transit modes that include walking, biking, mass transit, and shared transportation, wide-scale adoption of EVs and electrification of all types of transportation are essential to achieving local, State, and Federal emission reduction targets for greenhouse gases and criteria pollutants. California has set a goal of 5 million EVs sold by 2030 and to phase out sales on conventional vehicles by 2035, and the Air District has set a target of 90% of vehicles in the Bay Area being zero emissions by 2050. The Bay Area and California also share the goal to

⁹ United States Census Bureau, American Community Survey, Demographic and Housing Estimates, 2017

¹⁰ California Department of Transportation: Estimated Vehicles Registered by County, 2017

¹¹ California Department of Transportation: Annual Traffic Volume Reports (1992-2015)

¹² United States Census Bureau, American Community Survey, 2016

¹³ Union of Concerned Scientists, Vehicles, Air Pollution, and Human Health, <https://www.ucsusa.org/resources/vehicles-air-pollution-human-health>

cut greenhouse gas emissions to 80% below 1990 levels by 2050. Rapid growth in the EV market, especially for BEVs, will be a significant part of achieving these goals.

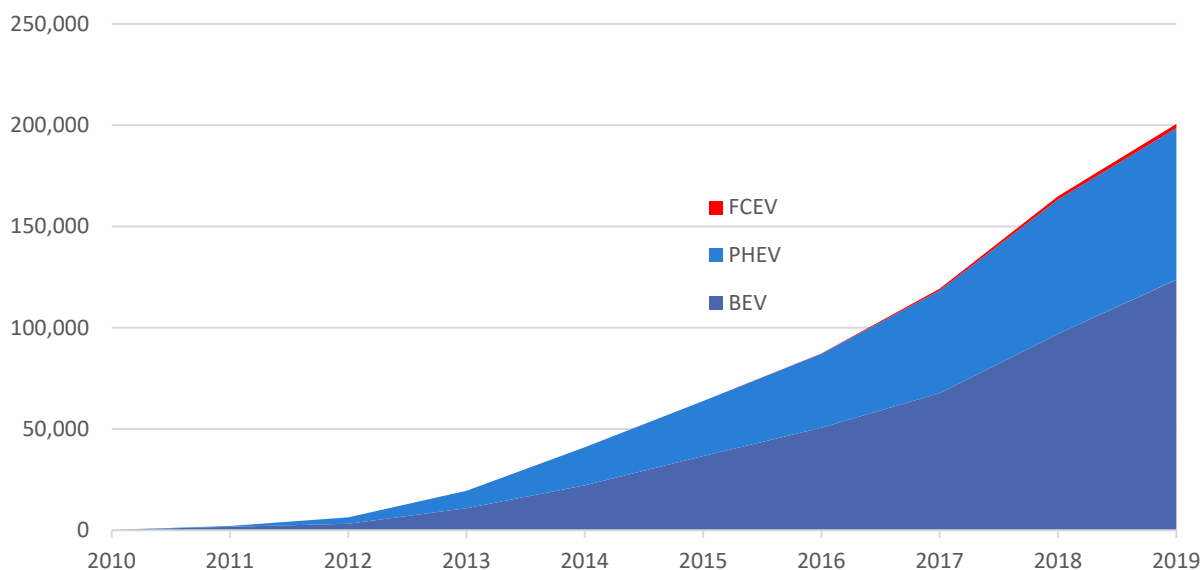
One of the current unknowns is the impact the COVID-19 Pandemic, resulting Shelter in Place orders, and shifts towards remote work will have on transportation in the Bay Area and beyond. Our hope is that remote work and flexible commute options become a mainstay in the workforce, curtailing an increase in single occupancy vehicle sales and trips, as well as reducing traffic congestion, maintaining air quality improvements, and reducing climate impacts. This report is meant to serve as a long-range planning and strategy document, and therefore assumes a worst-case scenario where travel behaviors return following the proliferation of viable vaccines.

Current Bay Area EV Ecosystem

EV Adoption and Sales

California Department of Motor Vehicles (DMV) registration data shows that the Bay Area had 200,645 electric vehicles as of August 2020, representing 3.6% of the region's light duty fleet (Figure 1). As of August 2020, BEVs accounted for 62% of all EVs registered in the Bay Area, PHEVs made up 37%, and FCEVs made up 1%. Compare that to the number of new car sales in Q1-Q3 of 2020 with 77% BEVs, 22% PHEVs, and 1% FCEVs, it is clear the BEVs are growing in prominence, with the Tesla Model 3 making up the vast majority of new sales. As the EV market matures, used EV sales will be an important metric to track; however, such information was not available at the time this publication was finalized.

Figure 1: BEVs, PHEVs, and FCEVs Registered in the Bay Area



Compared to the entire California EV market, the Bay Area is home to a larger share of BEVs and smaller share of PHEVs. Of the entire EV fleet in the Bay Area, Tesla accounts for almost 40% of all registered EVs, followed by Chevrolet with 17%, and Toyota with 10%.¹⁴ Figure 2: Number of EVFigure 2 shows two heatmaps of the State and Bay Area in terms of EV adoption, clearly showing that while Santa Clara clearly leads regionally for the most EV's per county, Los Angeles County leads the State in terms of EV adoption.

Figure 2: Number of EVs in California and Bay Area Counties¹⁵

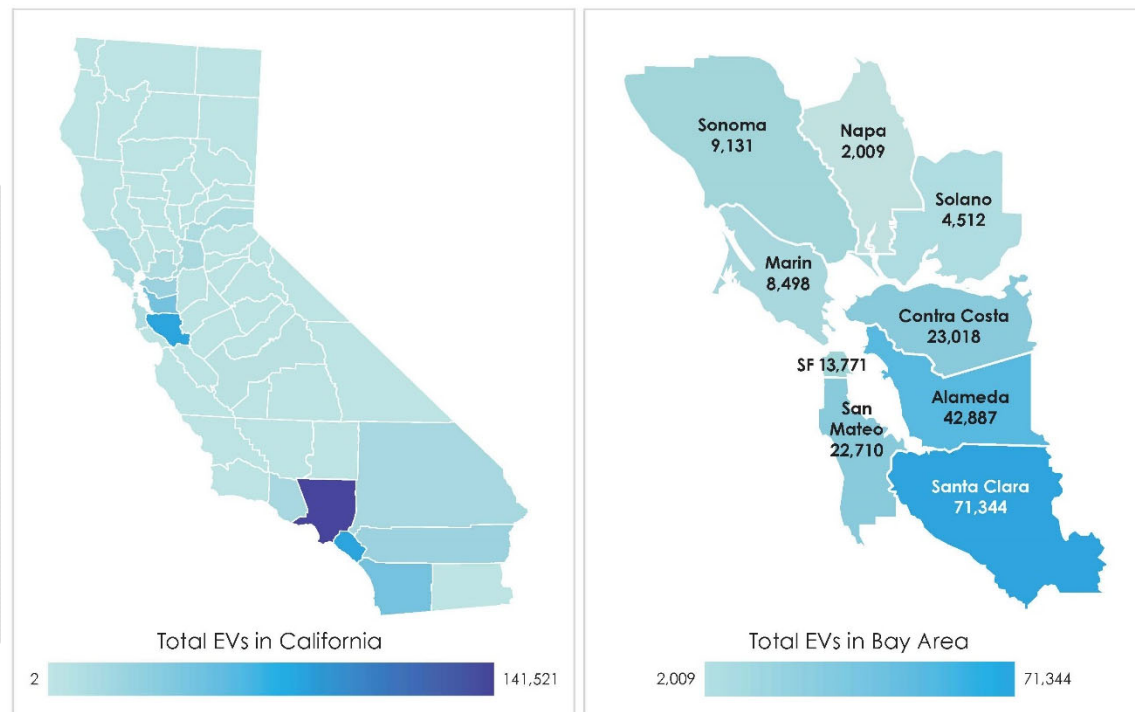
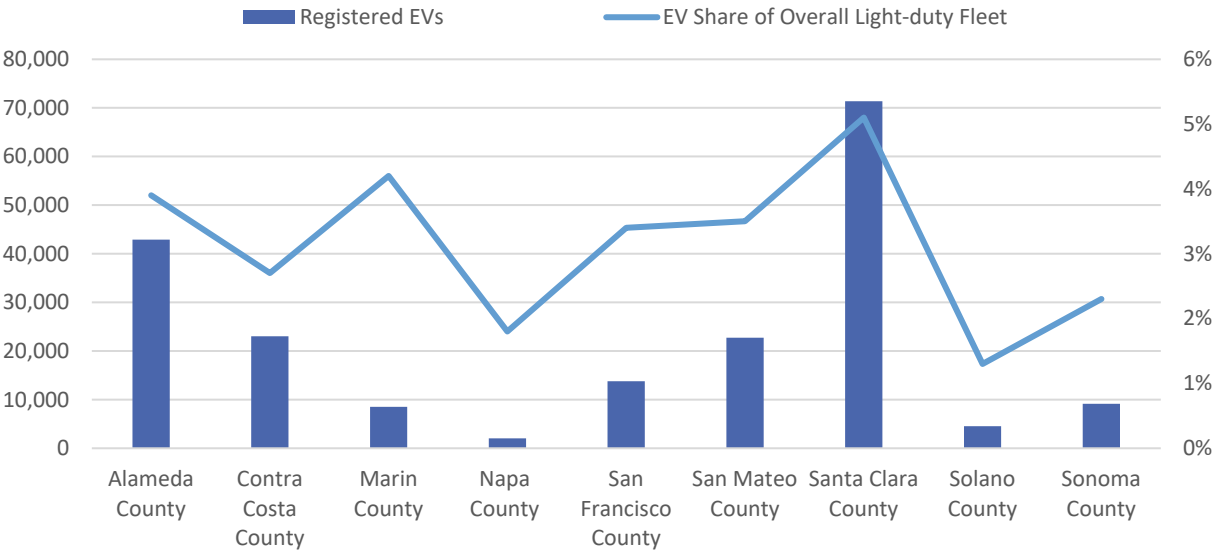


Figure 3 shows the number of EVs registered by Bay Area County and the relative share of EVs in that County's overall light-duty vehicle fleet (i.e. internal combustion and electric vehicles). Santa Clara County continues to lead the region in both raw number of EVs as well as EV share of their overall light-duty vehicle fleet.

¹⁴ California Energy Commission, *Zero Emission Vehicle and Infrastructure Statistics*, data last updated August 28, 2020, www.energy.ca.gov/zevstats

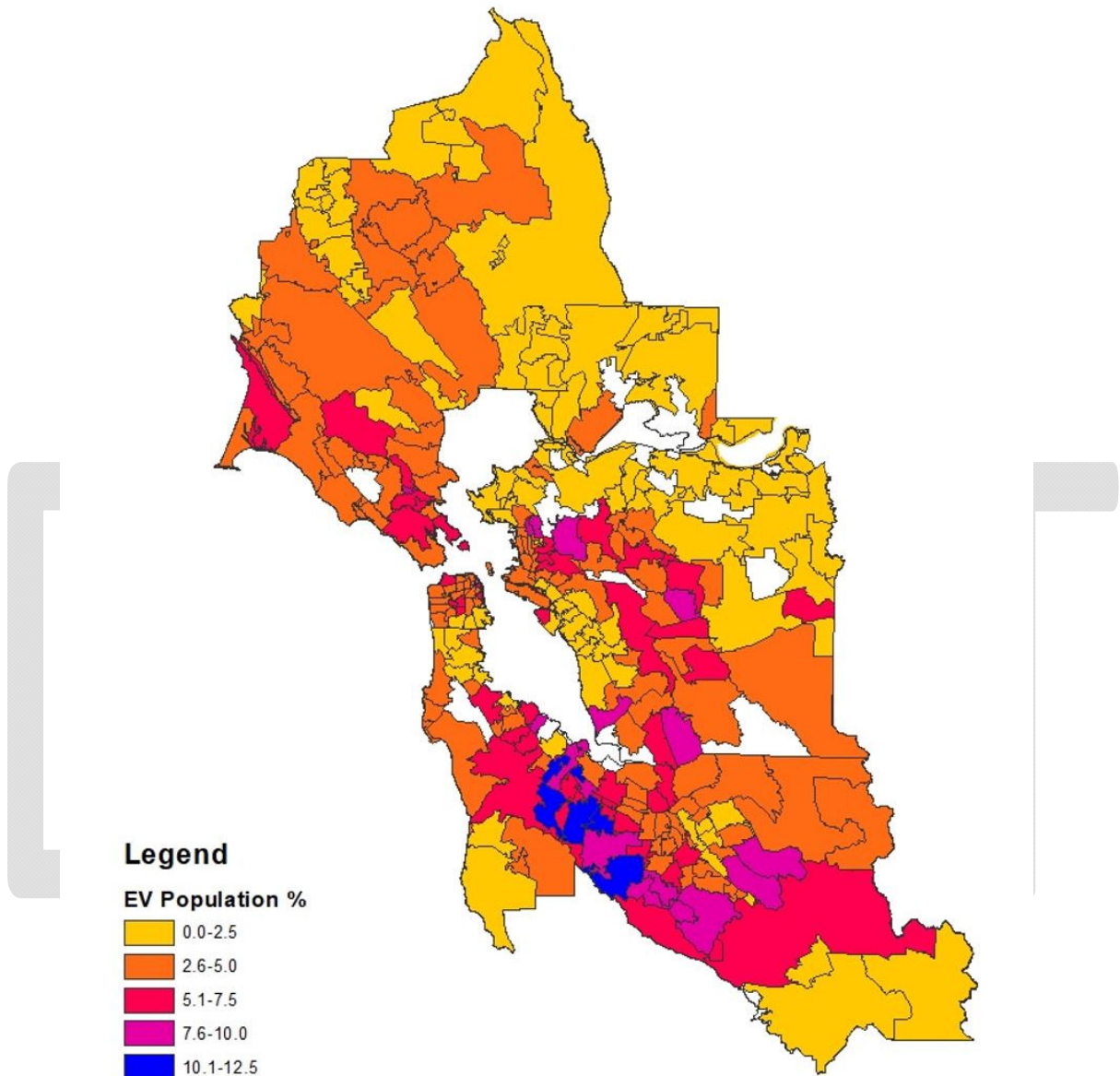
¹⁵ *Ibid.*

Figure 3. County DMV EV Registrations and Corresponding Share of EVs in the Overall Vehicle Fleet



A more granular display of EV registrations across the Bay Area is shown in Figure 4, which is a heat map of EV registrations by zip code. It is clear that parts of Dublin, Fremont, Cupertino, and San Jose are hotspots of EV ownership.

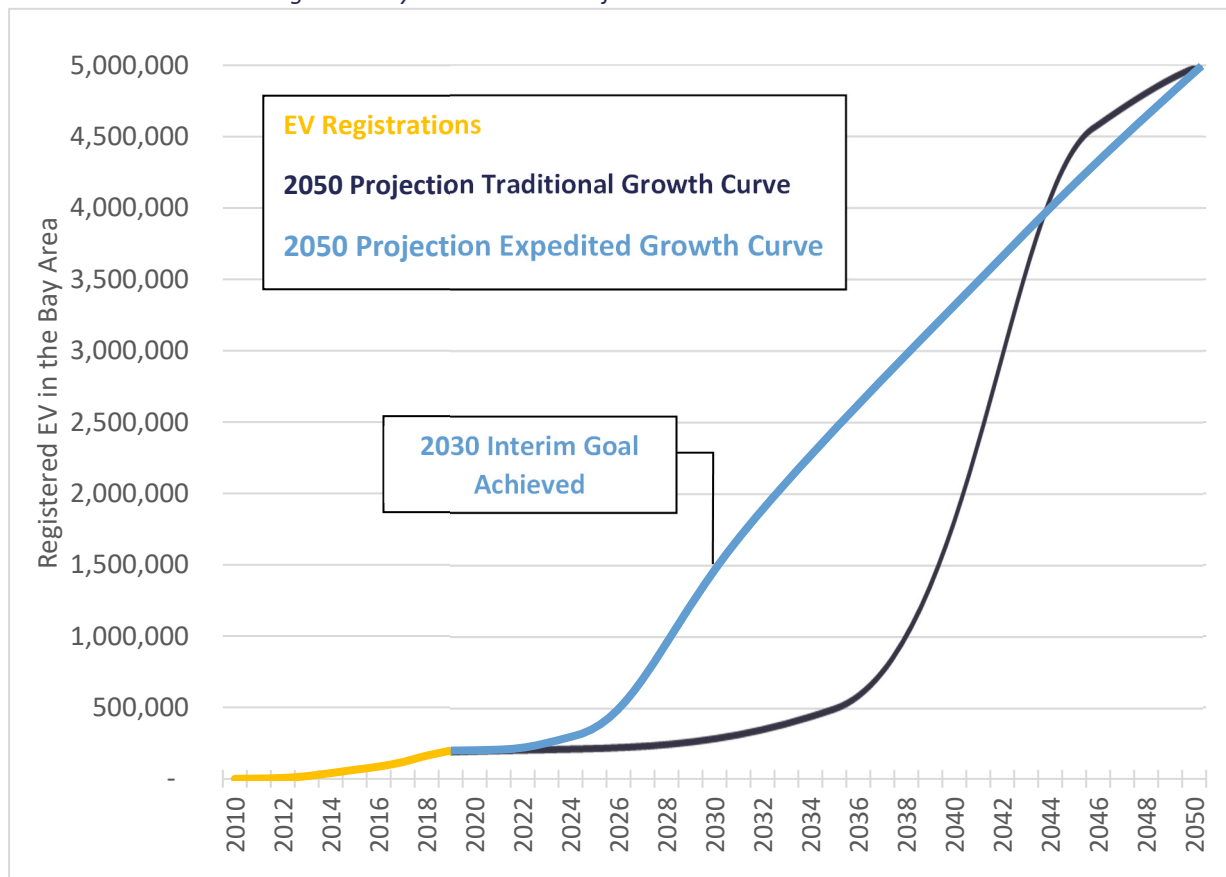
Figure 4. Bay Area EV Registrations by Zip Code



While the Bay Area has seen astonishing growth in EV registrations over the past ten years, Figure 5 provides two potential pathways to reaching the Air District's 2050 goal of EVs accounting for 90% of the fleet (or roughly 5 million EVs). The graph shows historic share of EVs in the Bay Area based on DMV data through 2019, then charts two different trajectories (i.e. traditional and expedited) to reaching our 2050 goal. The projections assume EVs achieve cost parity with internal combustion engine (ICE) vehicles in 2024, resulting in varying degrees of impact based on the projection trajectory (traditional assuming economic stagnation and only a slight uptick in new EV sales as charging continues to be a large barrier to adoption, and expedited assumes consumer demand increases as price outweighs range anxiety). The graph also considers the enactment of a ban on new ICE vehicle sales in 2035 as outlined in Executive

Order N-79-20¹⁶. While these projections use basic estimates for the actual EV share increases, they show two different paths the Bay Area EV market might take to 2050.

Figure 5. Bay Area EVs and Projected Increase to Meet 2050 Goal



Charging Infrastructure

The availability and accessibility of EV supply equipment (EVSE) is a critical factor influencing the number of people who switch to EVs.¹⁷ Publicly accessible EV chargers are needed to support the growing number of EV drivers, especially for long-distance trips and for drivers that do not have access to private home chargers.

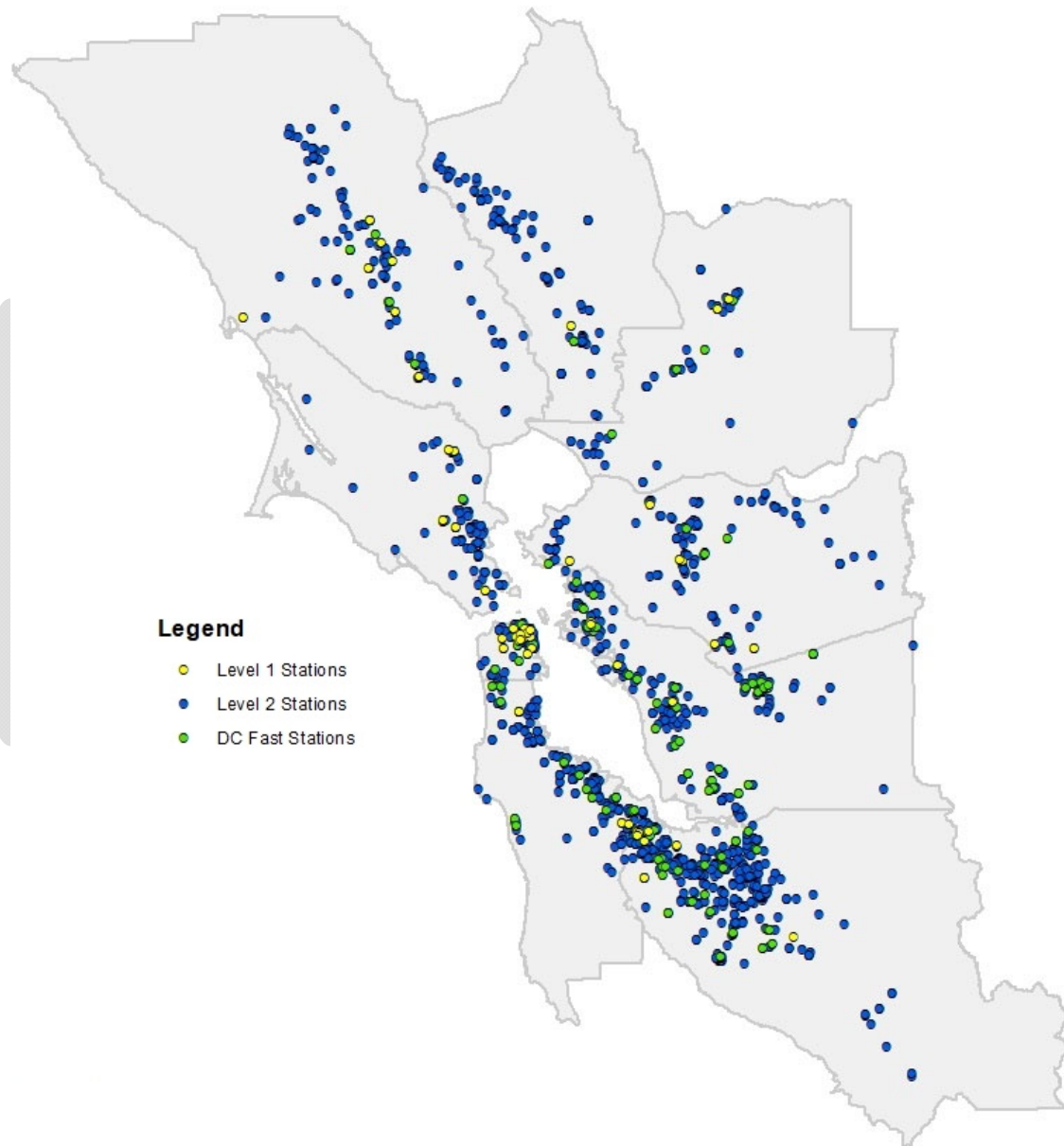
As of June 2020, the Bay Area was home to around 9,500 publicly available charging ports, including both Level 2 and DC Fast (Figure 6). The National Renewable Energy Laboratory (NREL) EV Infrastructure Projection Tool estimates that by the start of 2019, we needed 20,000

¹⁶ CA Executive Order N-79-20, <https://www.gov.ca.gov/wp-content/uploads/2020/09/9.23.20-EO-N-79-20-Climate.pdf>

¹⁷ Hauke Engel, Russell Hensley, Stefan Knupfer, and Shivika Sahdev, McKinsey & Company, 2018, Charging Ahead: Electric Vehicle Infrastructure Demand, <https://www.mckinsey.com/~/media/McKinsey/Industries/Automotive%20and%20Assembly/Our%20Insights/Charging%20ahead%20Electric-vehicle%20infrastructure%20demand/Charging-ahead-electric-vehicle-infrastructure-demand-final.pdf>

publicly available charging ports (Public L2 and Public DC Fast) here in the Bay Area to support EV Drivers, following the 1.5 million California wide ZEV's by 2025 target set by Governor Brown.

Figure 6. Bay Area EVSE Station Locations¹⁸



Additional charging stations will be needed to accommodate future growth in the EV market, especially to achieve the ambitious Bay Area goals and to accommodate a wider range of Bay Area residents. There have also been anecdotal reports that current charging stations are often full, which indicates that additional charging station capacity is needed even for the current

¹⁸ Department of Energy, Alternative Fuels Data Center, Station Locator, www.afdc.energy.gov/stations

number of EV drivers. NREL and California Energy Commission (CEC) developed a computer simulation tool, Electric Vehicle Infrastructure Projection (EVI-Pro), which uses the results of a state-wide transportation habits survey to quantify the charging infrastructure needed to ensure that future EV drivers can meet their transportation needs. This analysis accounts for shifts in vehicle and charger technologies, user demographics, market adoption conditions, the shared-use of chargers, and travel and charging preferences.¹⁹ Over 20,000 public charging ports are estimated to be needed in 2019 (9,100 workplace L2, 8,400 public L2, and 3,300 DC Fast). However, according to the Alternative Fuels Data Center (AFDC), the Bay Area is home to just 9,500 EV charging ports, less than half of what is required according to EVI-Pro. To stay on track with our goals, by 2025, the Bay Area is estimated to need about 40,000 public charging ports (17,000 workplace L2, 17,000 public L2, and 6,000 DC Fast).

Widespread charging infrastructure will be key to overcoming current and future barriers to electric vehicle adoption. An individual or household's need for public charging infrastructure is related to home type, with drivers in single-family homes being much more likely to have home charging than those in apartments or multi-unit dwellings. Electric vehicle owners so far tend to live in single-family homes.²⁰ To extend the EV market beyond those living in single-family homes, we will have to expand charging available at multi-unit dwellings and public charging infrastructure. In the Bay Area, over one-third (36%) of housing units are in multi-unit dwellings.²¹ Installing charging infrastructure has been more challenging for multi-family housing, requiring away-from-home charging options for a significant portion of the Bay Area population. The need for drivers to take longer-distance trips and with a wide range of transportation patterns also requires public charging.

While tools such as the AFDC EV charging map and EVIP-Pro are useful for assessing generalized information about charging, identification of specific geographic and technological gaps will require tools with greater accuracy and granularity. Currently, all data on AFDC's website are self-reported by station hosts, and therefore miss a large segment of the charging market (i.e. residential and workplace charging). Our projections for EVSE needs are only as good as the data we have on existing EVSE.

To support our desired EV adoption goals as quickly as possible, the Bay Area should be the most straightforward place in the country to install EVSE. There are three major EVSE policy accelerators that if achieved will help us achieve this goal:

- 1) Adoption of ambitious and equitable CALGreen building code updates,
- 2) The passage of local EVSE reach codes, and

¹⁹ *California Plug-In Electric Vehicle Infrastructure Projections: 2017-2025*, California Energy Commission, March 2018.

²⁰ *Quantifying the electric vehicle charging infrastructure gap across U.S. markets*, the International Council on Clean Transportation, January 2019.

²¹ *American Fact Finder*, United States Census Bureau, January 2019.

3) Local EVSE permit process streamlining.

CALGreen Codes

CALGreen, the state green building code (California Code of Regulations, Title 24, Part 11), sets requirements for installing EV Capable infrastructure in new residential and nonresidential buildings. The current CALGreen code requires that new construction of multi-unit dwellings (MUD) include EV Capable infrastructure in at least 10% of parking spaces, rounded up, meaning that they have raceway and panel capacity installed. Additionally, CALGreen requires that about 6% of parking spaces in new nonresidential buildings must be EV capable. CALGreen only applies to new constructions, meaning that existing buildings post a significant gap in this policy approach.

Local Reach Codes

In addition to the mandatory codes, CALGreen has two tiers of reach codes that enable cities to adopt requirements more ambitious EV Capable codes of 15% and 20% of parking spaces. There are also two tiers of voluntary CALGreen reach codes for commercial buildings that increase the EV Capable levels to about 8% and 10% respectively.²² These readiness requirements do not require placing a charger in the space immediately but avoid most of the costs that would have been required to retrofit electrical infrastructure, ease the process of installing a charger later, and ease nonfinancial barriers such as gaining landlord or HOA approval.²³

In addition to the CALGreen reach codes, local jurisdictions that wish to increase their ambition can adopt codes that address existing buildings, similar to codes adopted by the City of Menlo Park²⁴, the City and County of San Francisco²⁵, and the City of Burlingame²⁶. Local governments are critical to enacting these types of market accelerators. As part of local reach code enactment, local agencies should ensure that permitting and inspection staff are trained to implement these codes and are bought into the idea of an electrified future for their jurisdiction.

Permit Streamlining

California's EVSE permit streamlining law (AB 1236 Statutes of 2015, Chapter 598) was enacted to address mutual frustration: electric vehicle charging station providers wanted to speed the permitting process; and cities and counties often needed better information from applicants and/or a directive to create streamlined processes.²⁷ To help address these frustrations, AB

²² The Governor's Office of Business and Economic Development (GO-Biz), Electric Vehicle Charging Station Permitting Guidebook, July 2019. <https://static.business.ca.gov/wp-content/uploads/2019/12/GoBIZ-EVCharging-Guidebook.pdf>

²³ *Ibid.*

²⁴ <https://www.menlopark.org/DocumentCenter/View/18835/H5---CD---EV-chargers---18-193>

²⁵ <https://sfenvironment.org/green-building-ordinance-sf-building-code>

²⁶ https://www.burlingame.org/departments/sustainability/green_building.php

²⁷ The Governor's Office of Business and Economic Development (GO-Biz), Electric Vehicle Charging Station Permitting Guidebook, July 2019. <https://static.business.ca.gov/wp-content/uploads/2019/12/GoBIZ-EVCharging-Guidebook.pdf>

1236 establishes permitting process and communication requirements for cities and counties. As shown in Figure 7, several Bay Area jurisdictions have fully streamlined their EVSE permitting process, however several regions have not yet started the process.

Figure 7. Bay Area Progress Towards EVSE Permit Streamlining (as of November 2020)²⁸



While the three tools mentioned above are critical to the maturation of the Bay Area EV market, reaching our 2035 and 2050 goals in an equitable manner will be key.

Insights from Market Research and Surveys

In August 2019, the Air District contracted with the Center for Sustainable Energy (CSE) to study vehicle market stakeholders in the Bay Area to understand their barriers to EV adoption. Using

²⁸ <https://business.ca.gov/industries/zero-emission-vehicles/plug-in-readiness/>

a mixed-method approach, CSE analyzed these consumer and business perspectives on EV adoption and infrastructure across the Bay Area.

The mixed-method approach incorporated both central market actors and periphery market actors (residents, ride-hail drivers, multifamily property owners, fleet managers, and car dealerships). Responses for the resident survey were collected between January 14 and March 8, 2020. Responses for the ride-hail driver survey were collected between January 15 and January 27, 2020. Three focus groups were conducted in December of 2019 with multifamily property managers. Two additional interviews were conducted with multifamily property managers who were unable to attend a focus group. Fleet managers participated in a focus group on December 18, 2019, and several interviews were conducted between January 31 and February 10, 2020. Nine dealership owners and/or managers were interviewed in early 2020.

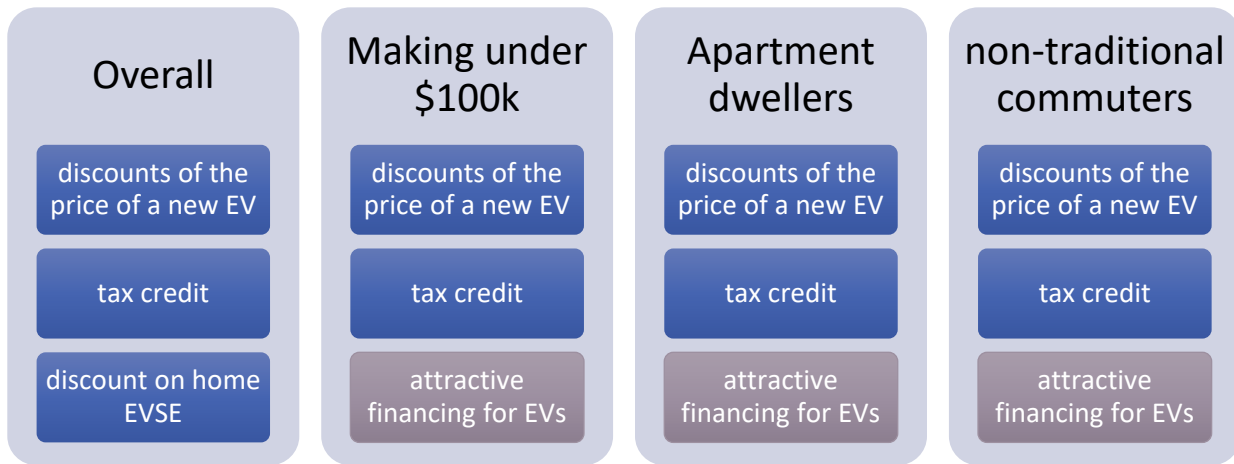
Over 1,100 survey responses were collected along with information from focus groups and interviews, adding 40+ stakeholders. Target response rates were put in place for apartment dwellers, residents making less than \$100,000 a year, and residents with nontraditional commuting patterns given our interest in lowering barriers to EV adoption for those groups. 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.

Bay Area Residents

Overall, 7% of respondents already owned an EV and 40% of non-EV owners have considered one. 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.

To understand the appeal of various types of incentives, respondents were asked to rank possible incentives 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 (see Figure 8). While commonly considered an effective incentive for EV buyers (and identified as important by dealerships), respondents ranked high-occupancy vehicle (HOV) lane access eighth out of ten options.

Figure 8. Top Three Incentives Types



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 (i.e., those who do not primarily commute by themselves in their own car) had newer vehicles, owned a lower proportion of gasoline vehicles, and a higher proportion of clean vehicles (e.g., hybrids, BEVs, and PHEVs). 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 resident sample. 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 when compared to respondents making less than \$100k. 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 Drivers

The rationale behind survey ride-hail drivers (e.g. drivers on Uber or Lyft platforms) is that ride-hailing trips are higher polluting per passenger than average passenger car travel due to

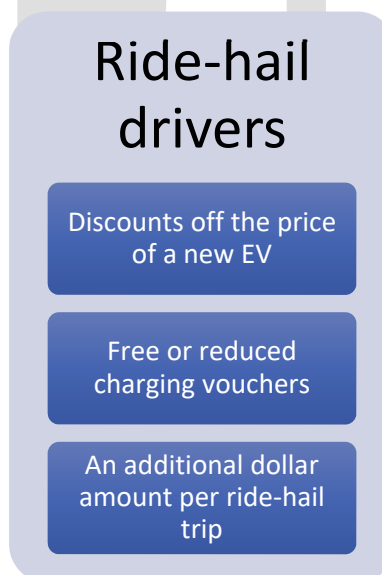
deadheading^{29,30}. Additionally, many ride-hailing trips replace near zero-emission trips on public transit or walking, and therefore generate additional emissions. As such, ride-hailing EVs contribute to reduced emissions more than traditionally owned/driven vehicles.

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. Most 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. Ride-hail drivers reported owning newer vehicles that they have already paid off, most likely due to company requirements. Surprisingly, 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 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 (see Figure 9), ride-hail respondents ranked discounts off of a new EV the highest—as in the resident survey—however it was followed by incentives that would lower driving costs (charging vouchers) and increase driver revenue.

Figure 9. Top Three Incentive Types



Multi-Unit Dwelling Property Managers

Most multifamily 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

²⁹ Trips made by a ride-hailing vehicle when there are no passengers in the vehicle are called deadheading trips or empty trips.

³⁰ Bloomberg Law, California Moves to Regulate Climate Impact From Uber, Lyft, January 23, 2020, <https://news.bloomberglaw.com/environment-and-energy/california-moves-to-regulate-climate-impact-from-uber-lyft>

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 carpool 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 carpool 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 multifamily 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.

Accelerating EV Adoption

In mid-2019, the Air District conducted a series of meetings around the Bay Area with EV market stakeholders. These meetings included representatives from government organizations, Community Choice Aggregators, EVSE technology and software companies, automotive manufactures (or original equipment manufacturers, OEMs), colleges, school districts, ride-hailing companies, and elected officials. Staff collected input from these participants on the type of information and data that would be useful for their work to accelerate EV adoption in

the Bay Area. Additionally, the Air District asked participants what tools and resources are currently lacking that if developed, would help accelerate EV adoption.

The results of these meetings, combined with the results of the survey and market research discussed above, informed the following sections on Barriers to EV Adoption and Recommendations for Moving Forward. The following sections aim to articulate the barriers to EV adoption, identify solutions to those barriers, and prioritize and suggest responsibility for implementing those solutions.

Barriers to EV Adoption

Vehicle technology	• EV range • Battery degradation (esp. used market) • Lack of diversity in model styles (e.g. low or no supply of pick-up trucks, SUVs, minivans EVs)
Charging	• Not enough public charging locations • Low grid capacity in certain areas/properties • Uncertain availability of clean energy to get to zero emissions for EV charging • Restrictive facility configurations at multifamily buildings • Cost allocation to customers at multifamily buildings is complicated with EVSE and electricity meters • Varied permitting requirements for EVSE installations • Inaccurate public EVSE locations, not one centralized site, drivers must use multiple sources • We need more DC Fast chargers than we thought because fast chargers are needed to serve multifamily buildings residents, long-distance travelers, EVs with larger batteries that take longer to charge • Need to balance DC Fast with L2 charging needs for PHEV/used/multifamily drivers • Non-standard charging ports • Gas stations need to add EVSE, but no real support for them
Economics	• Purchase price of EVs compared to traditional gas vehicles • Complicated incentives (cars and EVSE) • Difficult to calculate longer term cost savings of EVs • Work-from-home electricity use make EV rates less financially attractive • Diminishing government budget revenue putting grant programs at risk • Public DC Fast charging is too expensive • COVID impact on economy and future commuting patterns
Perceptions and Behavior	• Dealership EV knowledge is low • Misinformation about EV technology

- Perception that EVs are only for the wealthy
- Outreach in the age of shelter in place
- Lack of consistent equity data and metrics to track market trends
- Low use of smart charging (i.e. off-peak)

Recommendations

Based on our market research, stakeholder outreach, and discussions with market experts, we have developed the following recommendations that aim to address the most pressing and persistent barriers to EV adoption in the Bay Area. For each recommendation we have identified an organization or group of organizations that have or should take on responsibility for implementing the recommendation. Realizing even a handful of the recommendations below will help the Bay Area reach our EV adoption goals and continue to lead the State and the Nation in advancing innovative and equitable transportation electrification programs and policies.

Policy and Legislation	
Recommendation	Responsibility
1. Seek more ambitious CALGreen EV ready parking spaces standards in the 2022 Title 24 Code Update (for both existing and new buildings)	1. California Department of General Services, Air District, Community Choice Aggregators (CCA), Non-profit Organizations
2. Support legislation that encourages additional grant funding and streamlining of grant programs to avoid duplication and unnecessary administrative costs	2. Air District
3. Streamline permit process and requirements for EVSE	3. Governments, CA Governor's Office of Business & Economic Development (GO-Biz)
4. Workforce training investments to retrain auto body workers	4. Governments, GO-Biz, California Community College Districts
5. Train and prepare the emergency response community to address and mitigate EV related hazards	5. CA Governor's Office of Policy and Research (OPR)
6. Develop a through web resource for EV related plans, materials, data, and grants for the Bay Area community.	6. Air District
7. Support CARB's challenge of the Trump Administration's actions that:	7. Air District

• revoked California’s Clean Air Act waiver for its GHG and ZEV light-duty standards, • issued a regulation that those standards are preempted by the Energy Policy and Conservation Act (EPCA), and • significantly relaxed the federal light-duty vehicle GHG and fuel economy standards	
8. Support CARB and CPUC development of Clean Mile Standard regulation for transportation network companies (TNCs)	8. Air District
9. Support the development of CARB Advanced Clean Cars II regulation	9. Air District
10. Support State government implementation of Executive Order N-79-20	10. Air District
Financial Incentives and Rebates	
Recommendation	Responsibility
1. Seek additional funding sources for Bay Area EV programs from the State and Federal government.	1. Air District, MTC
2. Link EV and EVSE incentive programs for multifamily residents to ensure charging access	2. IOUs, CCAs, Air District, CARB, CEC
3. Explicitly allocate resources to provide technical assistance and time to develop authentic relationships with specific communities in all grant programs	3. Governments, IOUs, CCAs, Air District, CARB, CEC
4. Provide training for incentive program staff on how to bring a racial equity lens into their work	4. Governments, IOUs, CCAs, Air District, CARB, CEC
5. Develop a wealth-based system for determining eligibility, rather than an income-based system.	5. CARB, CEC, GO-Biz
6. Set minimum deployment commitments for EVSE programs in frontline communities	6. Governments, CCAs, IOUs

7. A monetary incentive to dealership sales personnel for every EV sold to income qualified customers	7. Governments
8. Support a universal incentive application to determine an individual's eligibility across several EV programs	8. CARB, Air District, CCAs
9. Home charging incentives for income qualified EV owners	9. IOUs, Air District, governments, CCAs
10. Incentivize multifamily EV charging infrastructure where multifamily owners pay a fee for EV chargers but do not have to maintain or manage them	10. EVSE OEMs, governments, CCAs
11. Incentivize upgrading of electric panels at multifamily buildings for buildings that do not have the electrical capacity to accommodate an EV charging station	11. IOUs, CCAs
12. Build in time to assess existing incentives and shift/update those programs as market matures	12. Governments, IOUs, CCAs, Air District
13. Encourage State incentive programs to support all charging levels to fit with the varied use cases of EV drivers	13. Air District
14. Encourage managed charging software at public and multi-family charging locations	14. Air District
15. Offer zero interest loans and/or loan guarantees for individuals with low/poor credit	15. Governments, NGOs, financial institutions
Recommendation	Responsibility
Outreach and Education	
1. Coordinate with other grant programs on applicant demographic data to identify underserved groups	1. Governments, IOUs, CCAs, Air District, CARB
2. Work more closely with communities to better understand their unique needs and barriers to EV adoption	2. Governments, IOUs, CCAs, Air District, community-based organizations (CBO)
3. Conduct outreach and education in various languages	3. Governments, IOUs, CCAs, Air District, CBOs

4. Use community specific cultural media channels to share information (e.g. Spanish language radio, etc.)	4. Governments, IOUs, CCAs, Air District, CBOs
5. Acknowledge that EVs have been associated with gentrification while sharing information about incentives for income qualified residents	5. Air District, Governments, IOUs, CCAs
6. Aim to hire from within the community when recruiting staff or consultants to conduct stakeholder engagement (e.g. case managers, call centers, etc.)	6. Governments, IOUs, CCAs, Air District, CBOs, MTC
7. Focus marketing resources on the benefits of EV ownership that address major concerns and important vehicle purchasing factors	7. Governments, IOUs, CCAs, Air District, CBOs, CARB
8. Market the existence of available rebates and the stackability of rebates	8. Governments, IOUs, CCAs, Air District, CBOs, CARB
9. Partner with CBOs when delivering messages and rolling out grants	9. Governments, IOUs, CCAs, Air District, CARB
10. Provide materials about EV benefits in ride-hail EVs	10. Governments, CCAs, Air District
11. Provide technical assistance to gas stations to install EVSE, particularly in frontline communities	11. Governments, IOUs, CCAs, Air District, CBOs, CARB, CEC
12. Utilize permitting databases to reach gas stations and share factsheets on EVSE installations	12. Air District, CARB
13. Empower influential members of frontline communities and support them with the latest information to share with their communities	13. Governments, IOUs, CCAs, Air District
14. Provide briefings to elected public officials aimed at educating them and their staff about the relevant EV issues, policies, and programs	14. Air District, CBOs
15. Build strategies to increase <i>word-of-mouth</i> lead generation into program outreach plans	15. Governments, IOUs, CCAs, Air District, CBOs
Recommendation	Responsibility
Charging	
1. Develop a more accurate count of public EVSE in CA	1. CEC, CARB, California Public Utilities Commission (CPUC)

2. Develop an estimate of home chargers in California to assess the share of EV drivers that charge at home versus on the go or at work.	2. CEC, CARB, IOUs, CCAs, EVSE OEMs
3. Collect and showcase the range of charging solutions available in California, with the aim to showing the varied use cases EVSE OEMs can support	3. CEC, CARB
4. Assess viability for alternative charging modes (e.g. battery swapping)	4. CEC
5. Increase EVSE signage along major highways	5. Caltrans
6. Utilities provide grid side asset details to streamline identification of multifamily properties that would be least expensive to install EVSE	6. IOUs, CCAs

Advancing Equity in the EV Market

Air pollution from mobile sources disproportionately impacts residents in frontline communities that live near major roadways and high traffic commercial hubs. For this reason, low-income residents stand to benefit the most from the cleaner air that comes along with transportation electrification, as well as the cost-saving benefits of driving an EV.³¹ In California as a whole, African Americans are exposed to 43% more micro particulate pollution (PM2.5) from vehicles than white residents; and Latinos are exposed to 39% more; and Asians 21% more than white Americans. Households earning less than \$20,000 per year are exposed to 10% more PM2.5 than the state average, and 25% more than the wealthiest Californian households.³² Additionally, both low-income and communities of color have faced numerous challenges to participating in the nation's economic and technological transitions, from the homeownership push that produced redlining of African American and Latino neighborhoods to the digital revolution that opened a still-gaping divide.³³

Below are several recommendations aimed at increasing equity and inclusion in the EV market, with greater attention to the actions governments and grant administrators can take to

³¹ The Greenlining Institute, Electric Vehicles for All: Equity Toolkit. <https://greenlining.org/resources/electric-vehicles-for-all/>

³² Union of Concerned Scientists, *Inequitable Exposure to Air Pollution from Vehicles in California* (2019), <https://www.ucsusa.org/resources/inequitable-exposure-air-pollution-vehicles-california-2019>

³³ The Washington Post, *Redlining was banned 50 years ago. It's still hurting minorities today*, <https://www.washingtonpost.com/news/work/wp/2018/03/28/redlining-was-banned-50-years-ago-its-still-hurting-minorities-today/>

expedite this necessary shift. Many of these recommendations are based on the Air District's experience administering grants, developing and implementing outreach strategies, and working with CBOs to advance clean transportation, but this is by no means an exhaustive list.

Prioritize funding for low-income households. Incentives play a vital role in the acceleration of transportation electrification. Within the EV market, early tax incentives have traditionally benefitted innovators and early adopters. Low-income households are typically the last to adopt new technologies³⁴, which are usually cost prohibitive. This is still true today in the EV market, most low-income households were left behind as new, cleaner vehicles are inaccessible financially for reasons such as low/no access to credit, being unbanked, etc. Further, the longer commute times within this community mean that early EV models, which tend to have shorter ranges, were unattractive due to range anxiety.³⁵

Recently, however, there has been a much-needed shift to equity focused incentives. Programs such as the Clean Vehicle Assistance Program, Drive Clean Assistance Program, MCEv, Drive Forward Electric, California Vehicle Rebate Project, and Clean Cars for All (CCFA)³⁶ provide EV incentives that focus on low-income consumers. Additionally, providing loans and/or loan guarantees to residents with low or poor credit is key to supporting greater access to the EV market. In order to shift from innovators and early adopters to the late majority and laggards of the technology adoption cycle, incentives must continue to be prioritized for low-income households.

Incentive programs must coordinate and align program requirements. As more federal, state, and local incentives become available, it becomes increasingly difficult for consumers to understand and navigate these programs. This is particularly important as we strive to serve non-native English-speaking communities. Program eligibility requirements should be aligned to avoid confusion and can help lessen the administrative burden of income verification. Program administrators should work to build off one another. For example, if one program verifies applicant income, other programs can accept proof of enrollment in that program as income verification. The key is to avoid duplication and find efficiencies wherever possible. This reduces both the workload for program administrators and barriers to participation for consumers. Coordinating also helps with outreach and marketing, making it easier for consumers to combine or stack funding.

Provide multilingual and multicultural education, marketing, and outreach. The lack of consumer awareness and knowledge around EVs and charging technology continues to be a primary barrier to widespread adoption. Education, marketing, and outreach must not only be

³⁴ Pew Research Foundation, Digital divide persists even as lower-income Americans make gains in tech adoption, <https://www.pewresearch.org/fact-tank/2019/05/07/digital-divide-persists-even-as-lower-income-americans-make-gains-in-tech-adoption/>

³⁵ *Ibid.*

³⁶ Funded by the Transportation Fund for Clean Air, California Climate Investments, and the VW Settlement Agreement. More information can be found at www.baaqmd.gov/cleancarsforall

available in multiple languages but must also be done in a way that conforms to the cultural norms and experiences of the communities being targeted. Language and cultural barriers limit accessibility of incentives to underserved communities of color and must be prioritized in order to limit the challenges and barriers of EV adoption.

For example, Clean Cars for All launched using several ride-and-drive events in DACs given the success of such events in the early years of EV outreach work. However, despite using several communication channels, offering free food and entertainment, the events attracted very low numbers of attendees. We used an approach that worked for educating early adopters, which are inherently a different type of consumer. Our challenge was discovering what types of events and outreach our frontline communities would respond well to and what messages were most effective. Once we came to this understanding, we shifted our focus and communicated with potential grantees through social media and encourage all of our early grantees to share the program information with their friends and family. As of November 2020, roughly 60% of our grantees hear about the program from friends or family members.

Invest in developing relationships with communities to increase participation. There are often sentiments of government distrust among frontline communities, particularly undocumented workers³⁷. Working with trusted non-government agencies (NGOs) and CBOs can help bridge the gap between government and underserved communities to build trust and drive participation in incentive programs. Additionally, working with CBOs allows for better targeting of incentives to residents that are truly in need of assistance. As trust is built and participation grows, our experience has shown that word of mouth will become a major driver for outreach and participation.

Prioritize point-of-sale incentives. How an incentive is applied plays an important role in the accessibility of those funds, especially for low-income consumers. Incentives that are upfront can be accessed immediately, while an after-purchase incentive requires the customer to pay the money upfront and wait for reimbursement. In the case of EVs, many low-income residents are not able afford the higher upfront costs of EVs or qualify for a large enough loan to access these incentives. For residents that intend to cover the entire cost of their EV with the grant, an after the purchase rebate can force some grantees into even greater financial difficulty, negating some if not all of the benefits of participation.

Equity metrics must be clearly defined and (the right) data should be collected early and often. When demographic and socioeconomic metrics, baselines, and goals are clearly defined, progress can be measured and analyzed to identify areas of success and areas that need improvement. Collecting data early and often allows data collection to be segmented so

³⁷ California Energy Commission, Low-Income Barriers Study, Part A: Overcoming Barriers to Energy Efficiency and Renewables for Low-Income Customers and Small Business Contracting Opportunities in Disadvantaged Communities, https://assets.ctfassets.net/ntcn17ss1ow9/3SgKkJoNlvtS2nYVPAOmGH/fe590149c3e39e51593231dc60e0eeeff/TN214830_20161215T184655_SB_350_LowIncome_Barriers_Study_Part_A_Commission_Final_Report.pdf

applications aren't lengthy and overwhelming. The data can be used to identify underserved or underrepresented communities where more support and targeted outreach may be needed and can also help inform policy changes.

Air District Investments in Advancing Equity in the EV Market

The Air District has endeavored to integrate the recommendations above into existing grant programs. Below is a summary of what we have accomplished to date.

The Air District's Clean Cars for All Program (CCFA)³⁸ provides qualifying low-income residents up to \$9,500 for scrapping an older vehicle and switching to a clean transportation option. Participants have the option to purchase or lease new and used PHEVs, BEVs, FCEVs, or receive a "mobility options" prepaid card for public transit, e-bikes, and car-sharing. There is an additional rebate of \$2,000 to purchase and install a home EV charger. The incentive funding is based on participants' income levels and which clean transportation or vehicle option they select. CCFA conducts stakeholder engagement and outreach to frontline communities, contracts with case managers to support participants through the application process, and developed partnerships with dealerships, vehicle scrappers, and community-based organizations across the Bay Area.

In 2021, CCFA added an additional \$500 incentive for grantees that purchase or lease an EV that are enrolled in one of the following low-income programs:

- Bureau of Indian Affairs (BIA) General Assistance
- CalFresh/Supplemental Nutrition Assistance Program (SNAP)
- CalWORKS (TANF) or Tribal TANF
- Cash Assistance Program for Immigrants (CAPI)
- Free or Reduced National School Lunch Program
- Head Start Income Eligible (Tribal Only)
- Low Income Home Energy Assistance Program (LIHEAP)
- Supplemental Security Income (SSI)

WIC - Women, Infants, and Children Supplemental Nutrition Program This funding was added to help grantees with the greatest need lower their financial burden to purchase a car, particularly used EVs that average \$19,000.

Since CCFA launched in March 2019, we have received over 2,000 applications and as of November 2020, 1,337 residents have been awarded grants totaling over \$10 million. Of the residents awarded CCFA grants, 60% make less than \$30,000 a year and 67% do not own their home. The average new EV price is \$37,000, the average used EV price is \$19,000, and several

³⁸ Funded by the Transportation Fund for Clean Air, California Climate Investments, and the VW Settlement Agreement. More information can be found at www.baaqmd.gov/cleancarsforall

grantees have purchased used EVs under \$10,000 (resulting in no or very little out of pocket costs).

In addition to vehicle incentives, the Air District has offered the Charge! Program since 2016, which provides funding to offset the cost of purchasing and installing public EV charging infrastructure. Charge! has supported the deployment of over 2,900 publicly accessible Level 2 and 121 publicly accessible DC Fast charging ports at over 363 locations in the region.

For many EV owners, private charging located in their place of residence offers the convenience to reduce range anxiety (the fear of running out of fuel). However, for the approximately 36% of Bay Area housing units are multifamily buildings, home charging is not an option.³⁹ The Air District is committed to making EVs accessible to everyone, and adequate EV charging is a key component of that effort. For this reason, additional funds are allocated to projects at multifamily buildings, which encounter significant challenges to EV charger installation and operation.

The Air District's Community Health Protection Program (AB617) is an important companion effort for achieving the overall goals and specific equity measures in this Plan, and we will work through our communities' AB617 Steering Committees to collect ongoing input on implementation efforts.

The Air District will continue to seek funding for these grant programs and will encourage other public agencies to transition incentives to serve residents and businesses in frontline communities that are disproportionately impacted by air pollution.

³⁹ American Fact Finder, United States Census Bureau. January 2019. Available online: <https://data.census.gov/cedsci/table?q=Housing&g=0500000US06001,06013,06041,06055,06075,06081,06085,06095,06097&tid=ACSDP1Y2016.DP04&hidePreview=true>

Conclusion

The transportation sector continues to be the largest source of our greenhouse gas emissions and contributes to depressed health outcomes in frontline communities that are disproportionately impacted by such pollution. The Air District will seek to review and update this Plan's equity outcomes and recommended adjustments as warranted, including strategies to further expand infrastructure for hydrogen fuel cell vehicles. The Air District is committed to securing cleaner air and access to clean vehicles and clean transportation options for all residents in our jurisdiction. Programs that provide support to residents that are low-income, and people of color are critical to meeting our ambitious transportation electrification goals. The Air District will utilize our position as a regional agency to motivate state and national leadership and support local action to encourage EV adoption in our communities.

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