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# City charging infrastructure needs to reach 100% electric vehicles: The case of San Francisco

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## Introduction

Cities in the United States are increasingly setting ambitious vehicle electrification targets to achieve their air quality and climate change mitigation goals. Although electric vehicle (EV) uptake across U.S. cities in 2019 is still in its early stages, cities aim to greatly accelerate electrification. Several cities have set goals to increase EV uptake. Houston aims for EVs to make up 30% of new vehicles sold in 2030.[1] In Memphis, the city has set a goal of EVs making up 30% of total vehicle travel by 2035.[2] Seattle and Sacramento have set goals of EV's making up 30% of vehicles owned by 2030, and 35% of total vehicles by 2025, respectively.[3] Complete electrification goals include Denver's

1 Evolve Houston, "Electric vehicle roadmap" (2019), https://www.evolvehouston.org/

2 City of Memphis, "Memphis Area Climate Action Plan", (2020), https://shelbycountytn.gov/DocumentCenter/View/37431/Memphis-Area-Climate-Action-Plan-2019-FINAL_4_JANUARY-2020

3 Seattle Office of Sustainability & Environment, "2017 Drive Clean Seattle Implementation Strategy" (2017), https://www.seattle.gov/Documents/Departments/Environment/ClimateChange/Drive_Clean_Seattle_2017_Report.pdf; City of Sacramento, "Electric vehicle strategy" (2017), https://www.cityofsacramento.org/-/media/Corporate/Files/Public-Works/Electric Vehicles/EVStrategy_171206_FINAL_DRAFT_CityOfSacramento.pdf

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and Los Angeles' for 100% zero emission vehicles across the entire vehicle stock by 2050 and San Francisco's for 100% of new vehicles by 2030.[4]

Achieving widespread EV adoption requires increased charging infrastructure deployment to improve EV functionality and convenience for EV drivers. Home charging currently provides the majority of EV charging energy demand. It is usually the least expensive charger type to install and charge from. However, moving beyond early adoption to the broader market means providing more charging options for drivers. For example, drivers without home charger access, such as those in apartments or without designated off-street parking, require more conveniently placed charging elsewhere.

To support continued EV growth, charging infrastructure will have to keep growing and evolving to meet city needs. There is a correlation between the uptake of EVs and public charging infrastructure growth in U.S. cities; the markets with the most EVs tend to have the most comprehensive charging infrastructure.[5] To sustain continued growth in EV adoption, government agencies can proactively plan their infrastructure to match vehicle electrification goals. Although each plan needs to be tailored to the unique local circumstances, there are generally applicable steps. The initial steps include gathering data on EV adoption, baseline infrastructure deployment, and charging behavior to analyze the charging infrastructure required to support their EV plan. The subsequent steps include identifying infrastructure gaps, developing policies to fill the gaps, reevaluating early deployment lessons, and continually examining updated data.[6]

This working paper provides the first such analysis for a U.S. city to quantify its charging needs to support a 100% EV sales goal. The analysis quantifies charging infrastructure needs at the zip code level for San Francisco to meet the city's goal of reaching 100% EV sales by 2030. It estimates the public, workplace, and home charger needs for passenger vehicles from 2020 through 2050 as the fleet continues to turnover to electric after the 100% EV sales phase in. It also considers additional city-level interventions aiming to reduce the personal vehicle travel demand and assesses their impacts on the charging infrastructure needs. In addition, the analysis also estimates, with less granularity, charging infrastructure for growing electric ride-hailing and urban delivery truck fleets.

## Analysis

Adapting an approach applied in a previous study,[7] we assess the public Level 2 charger and direct current (DC) fast charger needs based on San Francisco's goals for EV market growth through 2050. The EV stocks, informed by the EV uptake rate and the vehicle stock-turnover model, are used as a primary input to the analysis. Charging behavior in early EV markets and assumptions regarding increasing average charger utilization are

4 City and County of Denver Department of Environmental Health & Southwest Energy Efficiency Project, "Opportunities for vehicle electrification in the Denver Metro area and across Colorado" (2017), https://www.denvergov.org/content/dam/denvergov/Portals/771/documents/EQ/EV/EVFinalReport.pdf; Los Angeles Mayor's Office of Sustainability, "L.A.'s Green New Deal" (2019), https://plan.lamayor.org/sites/default/files/pLAn_2019_final.pdf; San Francisco Mayor's electric vehicle working group, "Proposed electric vehicle roadmap for San Francisco" (2019), https://sfenvironment.org/sites/default/files/fliers/files/sfe_tr_ev-roadmap.pdf

5 Peter Slowik and Nic Lutsey, *The surge of electric vehicles in United States cities*, (ICCT: Washington DC, 2019), https://theicct.org/publications/surge-EVs-US-cities-2019 and Anh Bui, Peter Slowik, & Nic Lutsey, *Update on electric vehicle adoption across U.S. cities*, (ICCT: Washington DC, 2020), https://theicct.org/publications/ev-update-us-cities-aug2020

6 Dale Hall and Nic Lutsey, *Electric vehicle charging guide for cities,* (ICCT: Washington DC, 2019), https://theicct.org/publications/city-EV-charging-guide

7 Michael Nicholas, Dale Hall, and Nic Lutsey, *Quantifying the electric vehicle charging infrastructure gap across U.S. markets*. (ICCT: Washington DC, 2019), https://www.theicct.org/publications/charging-gap-US

primary inputs used to estimate the numbers of home, public, and workplace chargers needed across the city. The following summarizes the key methodological steps, including how city interventions are investigated to quantify their impacts on charging needs.

## EV fleet composition

Figure 1 shows the EV adoption trends and EV stock in the city, and the estimated stock by 2050 accounting for fleet turnover and considering the city's goal of 100% EVs sales by 2030. The projected annual vehicle registration data is based on Department of Motor Vehicle data and trends through 2019.[8] The city goal reflects a rapid increase in EV share of new vehicles; resulting in the increase of the city's registered EVs from about 20,000 in 2020, to 180,000 in 2030, to 350,000 in 2040, and to 370,000 in 2050. This trend, based on the underlying vehicle retirement characteristics, results in 39% of the city's light-duty vehicle stock being electric in 2030, 92%, in 2040, and 96% in 2050. The city's new EVs include both battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs), with a shift from new sales being 75% BEV in 2019 to 100% BEVs in the mid 2030s. This city EV path amounts to a substantial acceleration compared to the fastest path publicly discussed by California state regulators.[9] The San Francisco metropolitan area is assumed to lag the city EV trend by several years.

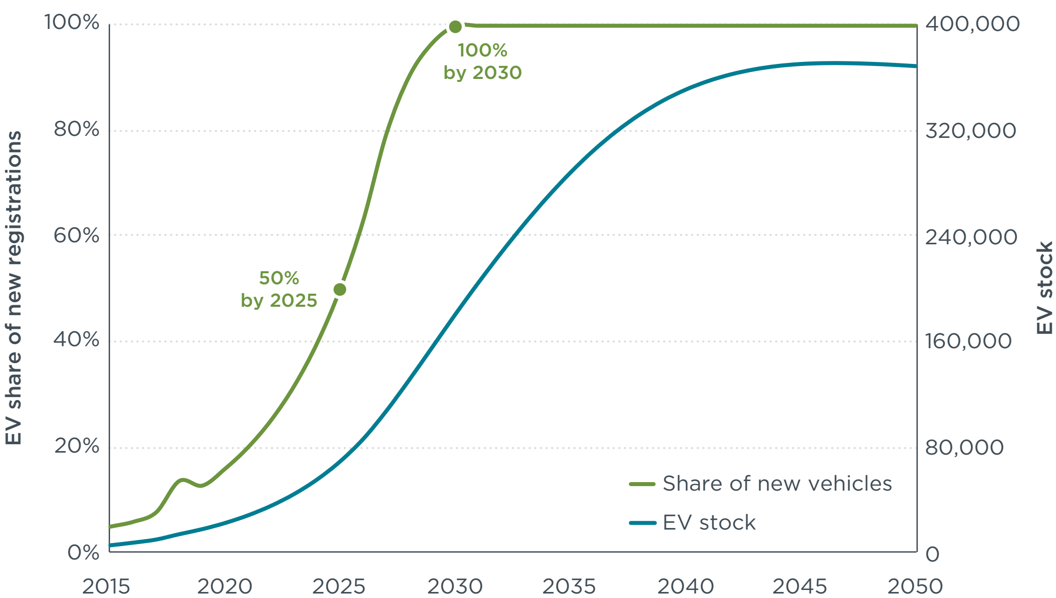


**Figure 1.** Assumed San Francisco new vehicle EV share and total EV stock from 2015 to 2050.

Several additional assumptions are important in the vehicle stock turnover model, which accounts for new vehicles entering the fleet, and older vehicles retiring. Projections assume a city-wide 1% annual decline in the absolute number of new light-duty vehicle sales, reflecting the recent trend in the data. Although zip code level EV shares differ across San Francisco through 2019, all the zip codes are assumed reach 100% new electric vehicle sales by 2030. Relative differences between vehicle ownership per capita

8 California Department of Motor Vehicles, Vehicle fuel type count by zip code (May 28, 2020), https://data.ca.gov/dataset/vehicle-fuel-type-count-by-zip-code

9 California Air Resources Board, "Advanced Clean Cars II Regulations: Informational Update" (May 28, 2020), https://ww3.arb.ca.gov/board/books/2020/052820/20-5-3pres.pdf

by zip code remain identical to 2018 across all years, reflecting general density, housing, and parking patterns across the city.

Additional local inputs are critical in establishing the baseline charging needs by zip code. Local job and population growth were provided by the city, and housing characteristics, and vehicle ownership are from the American Community Survey.[10] These are integrated in future zip code-level trends. The EVs in each zip code have varying reliance on public chargers as determined by their home charger access. The home charger access is informed by the EV owners' housing characteristics (i.e., detached, attached, and apartments) and we assume EVs are universally adopted by new vehicle buyers across different housing types going forward. In the model, this means by 2040, the percentage of new EV owners by housing type ultimately resembles the percentage of the residents by housing type in each zip code.

## Charging energy demand

The total energy demand of each type of charger is calculated as the product of the total number of EVs applicable for the given charger type, charging events per vehicle per day based on a California survey,[11] and the assumed energy consumption per event.[5] Public charger energy demand and home charging demand increase with the growth in EVs registered in each zip code. The workplace charging demand increases with the number of commuter EVs going into each zip code, which includes both intra-city commuters and those commuting into the city from outside of the city.

Several additional factors account for commuter patterns. Based on the California survey, 80% of EV drivers in San Francisco are assumed to be vehicle commuters in 2020. The percentage of EV drivers that commute gradually decreases through 2050 and approaches the percentage of all drivers that commute with their vehicles—including both internal combustion engine and electric vehicles—which was approximately 42% in 2017.[12] Approximately 26% of the city's commuters travel to work somewhere outside of the city.[13] Based on this number and the American Community Survey's data on commute modes, we estimate 5.4%, or approximately 23,000, of the light-duty vehicles in the city commute out of the city for work. From the same sources, 68,000 light-duty vehicles are estimated to commute into San Francisco for work daily. These commuter light-duty vehicles coming into San Francisco represent approximately 15% of the 440,000 vehicles traveling into San Francisco for any purpose daily. Both the intra-city and out-of-city commuters are allocated to the zip codes according to the city's job distribution, including future job projections from the Land Use Allocation data provided by city officials. The intra-city commuter vehicles follow the city EV adoption rate, and the out-of-city commuter EV share lags the city EV share by several years.

Charging events per day varies among drivers with different EV technologies (i.e., plug-in hybrid or full battery electric) and their access to home charging based on their

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10 American Community Survey, accessed March, 2020, https://www.census.gov/programs-surveys/acs.

11 Gil Tal, Jae Hyun Lee, & Michael Nicholas, *Observed charging rates in California*. (University of California, Davis, Davis, CA: 2018). https://itspubs.ucdavis.edu/publication_detail.php?id=2993

12 Calculated using commute mode reported in the 2017 American Community Survey data and the vehicle sales data. The change of the percentage of EV owners that commute with EVs year-to-year is related to the EV adoption rate (i.e., percentage of EVs in the overall LDV fleet). It is calculated by assuming that as EV adoption rate reaches 100%, the EV drivers commute with EV reach 45%—the percentage of current vehicle owners that commute with their vehicles. The percentage of EV owners commuting with EVs each year is interpolated based on the initial year's EV adoption rate.

13 San Francisco Municipal Transportation Agency, "2015 Transportation Fact Sheet", (2015), https://www.sfmta.com/reports/2015-transportation-fact-sheet

housing characteristics.[5] Across the years, charging events per day stays constant and the energy consumption per event increases by 9% in 2050 compared to that in 2020, accounting for an incremental increase of electric crossover and sport utility vehicles in the EV stock over time.

## Charging infrastructure: Public, home, and workplace chargers

The public charging infrastructure needs, including public Level 2 and DC fast chargers, are projected by dividing the daily energy demand projections by the daily maximum amount of energy supplied by the chargers. The utilization rate in terms of charging hours per day of public Level 2 chargers linearly increases from three hours a day in 2020 to plateauing at eight hours a day in 2025 and thereafter. The utilization rate of DC fast chargers increases from two hours a day in 2020 to also plateauing at eight hours a day in 2025 and thereafter. There is little evidence that chargers currently meet such high average utilization. Eight hours of utilization is based on idealized charger usage in a dense urban EV market—where a maturing charging infrastructure network has co-evolved with vehicles, moving from basic geographic coverage toward capacity-serving. Higher charging utilization can be facilitated by charging coordination among EV drivers and charging providers, pricing, transparency about which chargers are in-use or available, and synergies with regard to the charging patterns and behavior among private EV drivers and ride-hailing drivers. Lower charger utilization than what is assessed here would require greater infrastructure deployment.

The public Level 2 chargers are assumed to have constant 6.6 kilowatt (kW) power across all years. The average charging power of DC fast chargers are assumed to increase linearly from 50 kW in 2020 to 115 kW in 2035, accounting for improved on-vehicle and charging equipment technologies. This is an advanced and rapidly improving network moving toward faster charging, and power capacity in many cases could be 150 kW or more. Greater charging power would require less charging infrastructure deployment, and vice versa.

Home chargers needed by zip code are estimated from the total number of EVs with owners that have access to home chargers, divided by the average number of vehicles in a vehicle owning household to account for EVs in the same household sharing a single charger. Workplace charger projections are calculated based on the total workplace charging events per day required by the intra-city and out-of-city commuters. Ten percent of all commuters with an EV are estimated to have had access to workplace chargers in 2017 and the percentage grows to 14% in 2050. The total workplace chargers needed is based on each workplace charger supporting 1.5 charging events a day.

## City-level interventions

In addition to the central analysis presented above, three city-level interventions are investigation to determine their effect on EV charging infrastructure needs. The three interventions are: 1) a sustainable trip goal (i.e., shifting commutes from personal vehicles to transit and pedestrian modes), 2) congestion pricing (i.e., reduced vehicle travel to a portion of the city with a pricing mechanism), and 3) deploying curbside chargers (i.e., equipping city parking with EV chargers). The three interventions reflect how cities are simultaneously seeking to meet their EV goals while also developing roadmaps for other goals related to mode shift, demand shifting, and parking.

We assume San Francisco's goal of 80% sustainable trips by 2030[14] is achieved by all of the zip codes, with each zip code experiencing a constant annual growth rate from its own 2018 sustainable mode share percentage, as calculated using the American Community Survey. As an example, increasing sustainable trips from 60% to 70% leads to a reduction in vehicle trips from 40% to 30% of all trips, resulting in a 25% overall reduction in vehicle trips. That reduction in vehicle trips is assumed to be uniform across the entire vehicle fleet, meaning the EV charging demand is reduced by the same magnitude. The charger projection reduction, as a result of the sustainable trip increase, is calculated as the daily EV charging energy consumption reduction in kilowatt-hours (kWh) divided by the daily maximum energy the chargers can provide in each year. For home chargers, the charging energy demand reduction is also included, but the home charger units are not reduced as EV owners are assumed to still install home chargers when possible, regardless of the reduction in vehicle trips.

For congestion pricing, we assess a hypothetical congestion pricing scheme starting in 2030 that introduces a price on trips entering the downtown core in northeast San Francisco.[15] Although the pricing scheme details are not further specified, it is assumed to reduce the traffic in the congestion-priced zone by 15%, based on the goals and metrics identified in San Francisco County Transportation Authority's Congestion Pricing Study.[16] Like the sustainable trips, congestion pricing also impacts the EV charging demand and subsequently the EV charger projection. For the non-commuter trips originating from each zip code, only the portion of trips going into the congestion-priced zones are reduced by 15%. The portion of the trips going into these zones is determined based on the traffic movement between the zip codes. In lieu of more detailed travel pattern data, traffic movement based on the distribution of the city's jobs in each zip code are used as a proxy. All commuter trips going into the applicable congestion priced zip codes is reduced by 15%.

Curbside chargers are treated as a city intervention because their deployment requires policy and coordination among agencies. The assessment of curbside chargers assumes that 10% of all on-street parking spaces near apartment buildings are fitted with curbside chargers by 2050. By doing this, we consider these curbside chargers as mainly serving residential charging demand. The annual number of parking spaces with curbside chargers installed increases at the same rate as the EV stock share; reaching 1.5%, or 300 chargers, by 2025 and 4.1%, or 800 chargers, by 2030. The number of parking spaces near the apartment buildings is determined based on the parking inventory data,[17] land use data,[18] and American Community Survey data.[19] The daily usage of each curbside charger is assumed to increase from once per day in 2020 to

14 San Francisco Municipal Transportation Agency, "San Francisco Transportation Sector Climate Action Strategy," 2017, https://www.sfmta.com/sites/default/files/reports-and-documents/2017/12/cap_draft_full_doc-accessible-1.01.pdf

15 In the following ZIP codes: 94102, 94103, 94104, 94105, 94107, 94108, 94109, 94111, and 94133, corresponding to the neighborhoods of Civic Center / Hayes, South of Market, Financial District, East Cut / Rincon Hill, South Park / Potrero / Dog Patch, Chinatown / Nob Hill, Polk Gulch / Russian Hill, Embarcadero / Financial District, and North Beach, respectively

16 San Francisco County Transportation Authority, "San Francisco Downtown Congestion Pricing Study Goals and Evaluation Metrics, (2020), https://www.sfcta.org/sites/default/files/2020-05/Downtown-Congestion-Pricing_FINAL-Goals-and-Evaluation-Metrics_2020-05-28.pdf

17 On-street parking based on parking census, updated August 24, 2020, https://data.sfgov.org/Transportation/On-street-Parking-based-on-Parking-Census/9ivs-nf5y

18 Land Use (updated September 6, 2019), https://data.sfgov.org/Housing-and-Buildings/Land-Use/us3s-fp9q

19 The average units in each housing type (i.e., detached, attached, and apartments) are from the land use data, which has the zoning type (e.g., residential, commercial) and residential unit counts by parcel. Using the average units in each housing type, the amount of detached, attached, and apartment buildings in each zip code are estimated from the total residential units. Then parking spaces are allocated to each building type according to the percentages of each type of the building in each zip code.

twice daily in 2050. Curbside charging events provide 13.5 kWh for BEVs and 7 kWh for PHEVs initially and increase incrementally over time. This curbside energy consumption represents a case where the curbside chargers are used like home chargers but shared among drivers without home charger access, leading to a higher energy per event compared to home chargers. Energy demand supplied by curbside chargers is assessed to offset the demand on public chargers.

## Ride-hailing and urban delivery trucks

In addition to private passenger vehicle charging, the infrastructure needed to support electric ride-hailing vehicles and the delivery truck fleets in the city is also estimated. Truck and ride-hailing infrastructure needs are adapted from previous ICCT work and briefly summarized here.[20]

For the ride-hailing charging infrastructure analysis, we estimate the BEV ride-hailing fleet and the charging demand for the San Francisco metropolitan area and assess the additional chargers needed. In 2018 there were 600,000 ride-hailing vehicles in California.[21] With an assumed constant annual growth rate of 2%, we estimate 74,000 ride-hailing vehicles in San Francisco metropolitan area in 2020. The percentage of BEVs in the ride-hailing fleet is higher than the San Francisco Metropolitan area BEV stock percentage, representing a more aggressive electrification of the ride-hailing fleet. The energy demand of the fleet is calculated based on the EV miles to be supplied by DC fast chargers as determined by the driver types. These numbers are adapted from ICCT's electric ride-hailing fleet charging infrastructure report,[22] as shown in Table 1, and we assume the BEV efficiency of 3.73 miles per kWh with 0.5% annual efficiency improvement to 2050. We note that the exact composition of the ride-hailing fleet and breakdown of driver types in the future is highly uncertain given emerging labor policies in California in 2020.[23]

**Table 1.** Ride-hailing driver type distribution and daily miles to be supplied by DC fast charger.

| Driver type | Driver breakdown | Average daily miles supplied by DC fast chargers | Percentage of daily miles supplied by DC fast chargers |
|---|---|---|---|
| **Part-time with home charging** | 41% | 3 | 20% |
| **Part-time without home charging** | 53% | 14 | 100% |
| **Full-time with home charging** | 3% | 32 | 29% |
| **Full-time without home charging** | 3% | 121 | 100% |

We develop a scenario where the majority of the ride-hailing DC fast charging demand is supplied within the city. As a frequent origin and destination for ride-hailing trips and

20 Michael Nicholas, Peter Slowik, & Nic Lutsey, *Charging infrastructure requirements to support electric ride-hailing in U.S. cities* (ICCT: Washington DC, 2020), https://theicct.org/publications/charging-infrastructure-electric-ride-hailing-us-032020 and Dale Hall & Nic Lutsey, *Estimating the infrastructure needs and costs for the launch of zero-emission trucks,* (ICCT: Washington DC, 2019), https://theicct.org/publications/zero-emission-truck-infrastructure

21 California Air Resources Board, "SB 1014 Clean Miles Standard 2018 Base-year Emissions Inventory Report," (2019), https://ww2.arb.ca.gov/resources/documents/2018-base-year- emissions-inventory-report

22 Michael Nicholas, Peter Slowik, & Nic Lutsey, *Charging infrastructure requirements to support electric ride-hailing in U.S. cities* (ICCT: Washington DC, 2020), https://theicct.org/publications/charging-infrastructure-electric-ride-hailing-us-032020

23 See for example California Assembly Bill AB-5 of 2019, AB-5 worker status: employees and independent contractors, https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201920200AB5, and California General Election November 3, 2020 Proposition 22, Exempts app-based transportation and delivery companies from providing employee benefits to certain drivers, https://voterguide.sos.ca.gov/propositions/22/

a key potential charging hub, 10% of the total energy demand of the ride-hailing BEV fleet is at San Francisco international airport (SFO). Of the remaining charging demand, 70% is assumed to occur in San Francisco city and 30% occurs in the San Francisco metropolitan area. Shifting to relatively greater charging demand outside of San Francisco city would require fewer DC fast chargers within the city, and vice versa. The DC fast chargers projected in the central case for the city's LDV fleet are assumed to support about 45 minutes of ride-hailing BEV charging a day, in addition to the private passenger EVs charging of about eight hours a day in 2025. The additional charging time is converted to energy transferred based on the average charge rate of the given year. The remaining BEV charging demand unfulfilled by the public DC fast chargers already projected for the city is then supplied by additional ride-hailing-dedicated DC fast chargers. We also assume the DC fast chargers at SFO are used by ride-hailing BEVs exclusively.

For the delivery truck fleet, we estimate the growing annual portion of the trucks that are electric and the associated depot and ultra-fast chargers needs using the ratio from ICCT's zero-emission truck charging infrastructure report.[24] In 2016, there were an estimated 3,700 Class 6 trucks in San Francisco.[25] We assume the truck fleet grows 1% a year and the percentage of fully electric trucks in the fleets follows the city's EV stock percentage. Different truck deployment stages have different charger-to-truck ratios. The ratios are based on the findings in ICCT's zero-emission truck charging infrastructure report, as shown in Table 2. We assume the city's electric truck deployment stages with the following timeline: initial deployment from 2016 to 2025, mid-term deployment from 2026 to 2035, and long-term deployment from 2036 to 2050. Finally, we project the delivery truck charging demand based on assumptions regarding the battery capacity, the truck energy efficiency, the route distances, and the charging pattern.[26] All the energy charged overnight at the depot is categorized as depot energy consumption and all the remaining energy need is categorized as ultra-fast charger energy consumption.

**Table 2.** Charging infrastructure needed for electric truck fleet at different deployment stages.

| | Initial deployment | Mid-term deployment | Long-term deployment |
|---|---|---|---|
| **Timeframe** | Until 2025 | 2026 - 2035 | After 2035 |
| **Depot chargers per truck (350 kW)** | 1 | 0.67 | 0.5 |
| **Ultra-fast chargers per truck (50kW)** | 0.14 | 0.04 | 0.02 |

## Results

The charging needs analysis results are summarized and presented in several different ways. Charging needs are first summarized on a citywide level to convey the scale of increasing infrastructure needs, followed by zip code-level results to illustrate the variation between zip codes. The charging energy requirements are summarized to show the underlying electricity demand that the city, charging providers, and utilities can

24 Dale Hall & Nic Lutsey. *Estimating the infrastructure needs and costs for the launch of zero-emission trucks,* (ICCT: Washington DC, 2019), https://theicct.org/publications/zero-emission-truck-infrastructure

25 Emissions Inventory (EMFAC), accessed May 4, 2020, https://arb.ca.gov/emfac/emissions-inventory

26 Assumptions used to calculate the delivery truck charging energy demand are 1) 300 kWh of electric truck battery capacity and 80% of that is usable 2) electric truck efficiency was 1.4 kWh per mile with an empty cargo and 1.46 kWh per mile when carrying a full cargo in 2016, 3) truck efficiency increase by 0.5% annually, 4) the truck fleet is divided equally into three groups with one-way route distances of 15, 30, and 50 miles performing 6, 4.4, and 3.7 trips a day (based on a continuous 12 hour workday), respectively, and 5) all electric trucks receive full charge overnight.

expect for a city electrification plan. In each case, the results are shown for the central case as well as the intervention case where additional goals are met that could greatly reduce charging needs.

## Charging infrastructure needs

Citywide, the public charging infrastructure needed in the central case is directly related to the amount of EVs in the LDV fleet. Meeting the goal of 100% EV sales shares by 2030 will require a significant deployment of home, workplace, and public charging infrastructure. Table 3 summarizes the overall public and workplace charging infrastructure needs in San Francisco for 2025 and 2030, including comparisons to chargers installed through 2019. By the end of 2019, San Francisco had installed about 41% of the public and workplace charging infrastructure it needs in 2025. To meet its electric vehicle goals, San Francisco public chargers would need to increase from about 800 in 2019, to 2,000 by 2025, and to over 5,100 by 2030. This means 6.1 times more charging is needed by 2030 from what was installed by the end of 2019; or an 18% annual growth rate. For context, the annual growth rate of public chargers in San Francisco was about 20% from 2015 through 2019. The charging needs are greatly reduced in the intervention case. If the city interventions are implemented, chargers needed by 2030 are reduced by 40% and annual public-access charger growth rate is reduced from 18% to 12%.

**Table 3.** San Francisco public and workplace charging infrastructure deployment needed to reach 100% of new electric vehicles by 2030.

| | Year | Central case | Intervention case |
|---|---|---|---|
| **Total public access chargers (public, workplace, fast)** | 2019[a] | 834 | 834 |
| | 2025 | 2,013 | 1,612 |
| | 2030 | 5,129 | 2,900 |
| **Electric vehicle stock** | 2019[b] | 17,000 | 17,000 |
| | 2025 | 68,605 | 68,605 |
| | 2030 | 178,421 | 178,421 |
| **Projected future charging compared to 2019** | 2025 | 2.4 | 1.9 |
| | 2030 | 6.1 | 3.5 |
| **2019 as percentage of future chargers needed** | 2025 | 41% | 52% |
| | 2030 | 16% | 29% |
| **Annual increase in chargers from 2019 to meet 2025 and 2030 needs** | 2025 | 16% | 12% |
| | 2030 | 18% | 12% |

[a] 2019 Charger data include public and fast chargers, but exclude workplace chargers due to lack of data
[b] 2019 Electric vehicles estimated from California Department of Motor Vehicles data

Charging infrastructure need projections for San Francisco from 2025 to 2050 are shown in Table 4. Home chargers represent the vast majority, approximately 90%, of all charging infrastructure by count in San Francisco. It also is the charger type accounting for the highest total energy demand in the city, as we will discuss in the next section. Home chargers grow from about 32,000 in 2025, to about 80,000 in 2030, and to over 150,000 by 2050. Workplace chargers are the second most abundant charger type. Depending on its development, it has the potential to account for an even larger portion of the total EV charger count and charging demand. In the analysis, we assume only 10% to 14% of the EV commuters have access to workplace chargers.

**Table 4.** Estimated charging infrastructure needed in San Francisco in 2025 through 2050.

| Year | Central case | | | | Intervention case | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Public Level 2 | DC fast[a] | Workplace | Home | Public Level 2 | DC fast[a] | Workplace | Home | Curbside |
| **2025** | 480 | 147 | 1,387 | 31,973 | 273 | 84 | 954 | 31,973 | 301 |
| **2030** | 1,412 | 348 | 3,369 | 79,961 | 435 | 110 | 1,557 | 79,961 | 798 |
| **2040** | 3,481 | 680 | 6,212 | 147,588 | 1,099 | 220 | 3,239 | 147,588 | 1,687 |
| **2050** | 4,104 | 805 | 7,107 | 151,280 | 1,299 | 261 | 3,939 | 151,280 | 1,945 |

[a] Does not include DC fast chargers dedicated for ride-hailing

For public charging, we find that by 2030, approximately 1,400 public Level 2 and 350 DC fast chargers are needed. By 2040, public charging infrastructure needs increase to 3,500 public Level 2 and 680 DC fast chargers and grow to 4,100 public Level 2 and 810 DC fast chargers by 2050. As of 2019, there were about 600 public Level 2 and 28 DC fast chargers in San Francisco. To achieve the projected public charging infrastructure size, the public Level 2 network would need to increase by more than two-fold in 10 years and almost six-fold in 20 years. The number of DC fast chargers, although smaller compared to public Level 2 chargers, requires a more than twelve-fold increase by 2030. As also shown in Table 4 and further assessed below, actions to reduce personal vehicle use in the intervention case greatly reduce the need for charging infrastructure.

Several factors can influence how many future chargers are needed. With all three interventions (i.e., sustainable trips, congestion pricing, and curbside charging), the number of public chargers (Level 2 and DC fast chargers) in the intervention case is reduced by about 70% starting 2030 compared to the central case. Table 5 shows the impact of each intervention on each charger type. We find that, out of the three policies, the sustainable trip goal has the most substantial impact on infrastructure projections. Sustainable trip increases lead to a direct decrease in vehicle trips in all zip codes—an approximately 60% decrease in public charging infrastructure projections and 50% decrease in workplace charger projections in 2030. Congestion pricing leads to a 9% reduction in public chargers and workplace chargers starting 2030. And lastly, installing curbside chargers and shifting public charging demand to the curbside chargers can lead to on average 7% reduction in public chargers.

**Table 5.** Intervention impacts on charger projections from 2025 to 2050.

| | Charger type | 2025 | 2030 | 2040 | 2050 |
|---|---|---|---|---|---|
| **Sustainable trips** | Public Level 2 | -174 | -833 | -2,050 | -2,415 |
| | DC fast | -52 | -200 | -391 | -436 |
| | Workplace | -433 | -1,673 | -2,707 | -5,092 |
| **Congestion pricinga** | Public Level 2 | 0 | -134 | -329 | -387 |
| | DC fast | 0 | -33 | -64 | -76 |
| | Workplace | 0 | -320 | -586 | -668 |
| **Curbside chargers** | Public Level 2 | -33 | -89 | -198 | -231 |
| | DC fast | -11 | -24 | -42 | -49 |

[a] Congestion pricing intervention impact shown here is independent of the sustainable trip goal. When both the sustainable trip goal and congestion pricing are enacted, the congestion pricing further impacts the sustainable trip reduced vehicle travel demand.

At the zip code level, those with more EVs are generally projected to have more public chargers needed. Figure 2 illustrates the projected EV stock and the numbers of public Level 2 and DC fast chargers in each zip code in 2030. The zip codes in the darker green have higher electric vehicle stocks, and vice versa. Public Level 2 and DC fast chargers are shown respectively by the orange and blue numbers within the circles with varying sizes. The size of the circles represents the relative size of the public charger projection in each zip code. Across the years, the differences in the projections between zip codes are similar in scale.

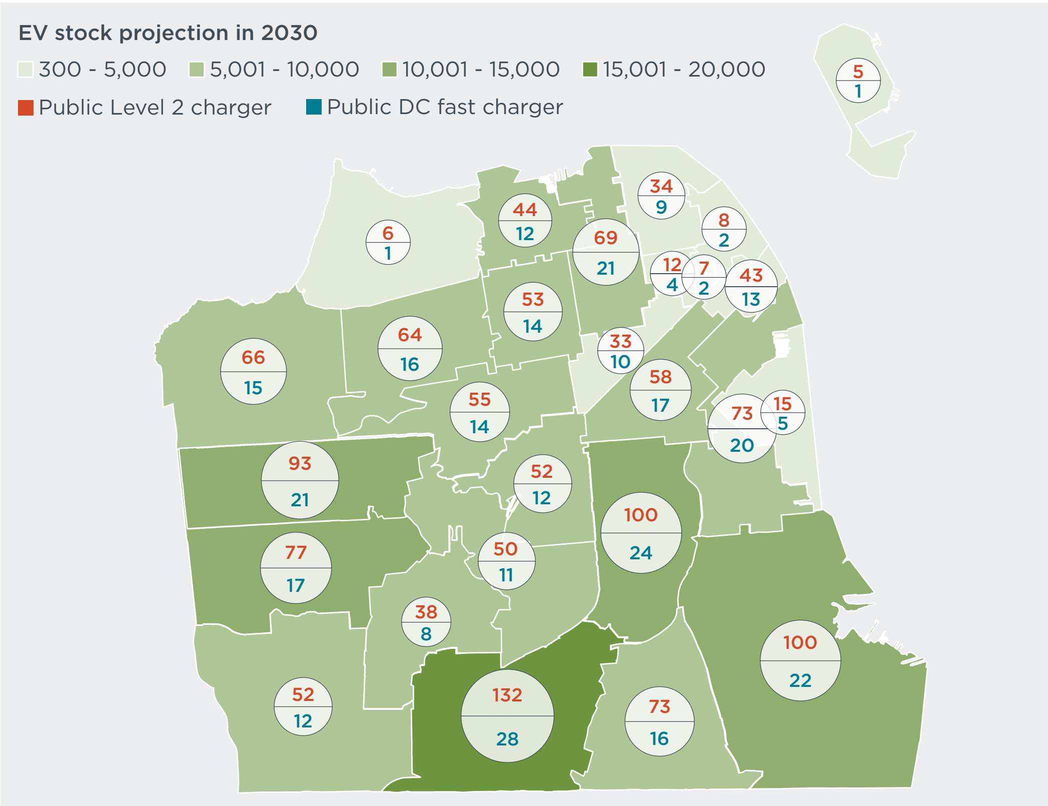


**Figure 2.** Public Level 2 (orange numbers) and DC fast (blue numbers) chargers needed in 2030.

Since EV stock by zip code is a primary input to the charger projection, the downtown core (northeast San Francisco), with fewer EVs, is projected to need fewer public chargers. Although the result indicates that these zip codes have lower public charging infrastructure needs compared to the zip codes with more EVs in the southern and eastern parts of the city, additional factors are noted. First, the downtown core has the highest workplace charger need, as we will discuss below, and the workplace chargers here are typically located in parking garages. This means these workplace chargers can serve other drivers, especially on weekends and during the nighttime, but this prospect is not investigated further in the analysis. Second, downtown San Francisco's space constraints may make typical public charging stations on lots less feasible. Therefore, commercial curbside chargers and chargers in garages may play an important role here.

Cities need a mix of public Level 2 and DC fast charging infrastructure to satisfy a diverse range of electric vehicle driver travel patterns, charging behavior, and price sensitivities. The ratios of the public Level 2 chargers to DC fast chargers across zip codes in a given year reflect the different charging needs of EV owners based on their unique characteristics, such a as housing type, availability of home charging, and commuting behavior. For example, EV drivers in a zip code with a higher portion of apartment units—leading to less home charging availability—would have a higher reliance on DC fast chargers versus Level 2 chargers compared to EV drivers in a zip code with more home charging available.

The projections of workplace chargers also follow a similar pattern between the zip codes across the different years as they are dependent on the distribution of the city's jobs in the zip codes based on our method. Figure 3 shows the workplace charger projections in 2030, 2040, and 2050 in each zip code. The blue and red points represent workplace charging needs in the central and intervention cases, respectively. The job growth in each zip code is factored in, but since the scale of growth is small, it did not alter the relative differences between the zip codes significantly. Overall, zip codes with higher percentages of the city's jobs are projected to have higher workplace charger needs. The three zip codes in the order of the highest workplace chargers needs in 2030 are 94105 (East Cut-Rincon Hill), 94103 (SoMa), and 94107 (South Park-Potrero Hill).

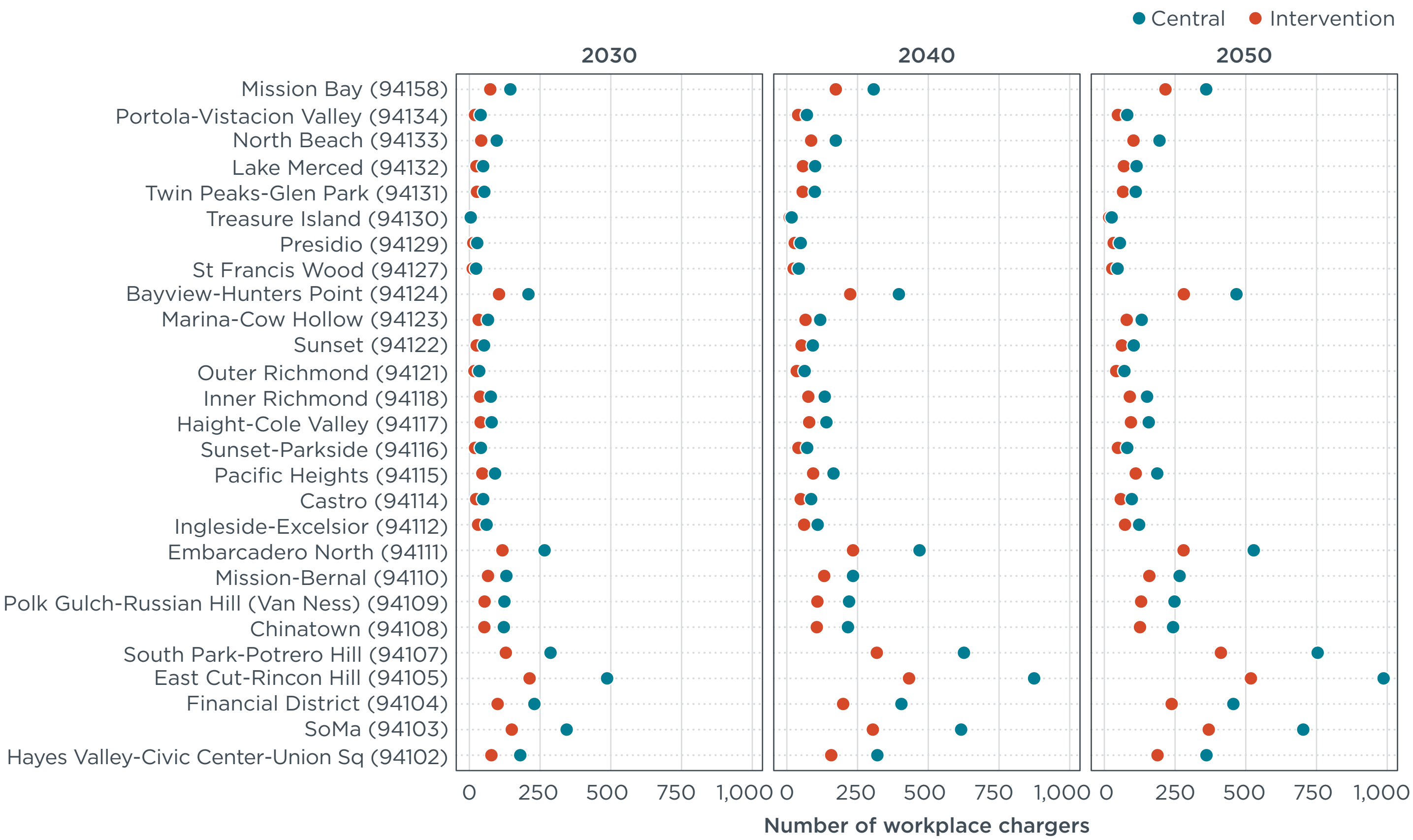


**Figure 3.** Workplace charger needs in 2030, 2040, and 2050.

## EV charging energy demand

The total citywide daily EV charging, as measured in gigawatt-hours (GWh) of energy demand, is significant. We estimate 0.4, 1.1, 2.2, and 2.5 GWh are needed daily by 2025, 2030, 2040, and 2050 for EV charging. For reference, the daily total electricity consumption of San Francisco was around 15.4 GWh in 2018.[27] Table 6 shows the energy consumption by charger types in the central and intervention cases from 2025 to 2050. Home chargers consistently have the highest total energy consumption, followed by DC fast chargers, workplace chargers, and public Level 2 chargers. Home chargers account for more than half of the total EV charging energy demand in both the central and intervention cases. Starting in 2030, we find that the total energy demand under the intervention case (i.e., by achieving sustainable trips and implementing congestion pricing) is less than half of the energy demand in the central case due to the reduced EV travel demand.

**Table 6.** Projected daily EV charging energy demand (MWh) from 2025 to 2050.

| | Year | Public Level 2 | DCFC[a] | Workplace | Home | Curbside[b] | Total |
|---|---|---|---|---|---|---|---|
| **Central case** | 2025 | 25 | 84 | 29 | 252 | 0 | 391 |
| | 2030 | 75 | 260 | 75 | 649 | 0 | 1,058 |
| | 2040 | 183 | 626 | 147 | 1,258 | 0 | 2,215 |
| | 2050 | 217 | 741 | 179 | 1,369 | 0 | 2,506 |
| **Intervention case** | 2025 | 14 | 48 | 21 | 156 | 8 | 247 |
| | 2030 | 23 | 82 | 35 | 223 | 22 | 385 |
| | 2040 | 58 | 202 | 77 | 431 | 49 | 818 |
| | 2050 | 69 | 240 | 100 | 469 | 57 | 936 |
| **Percentage Change from central to intervention** | 2025 | -44% | -43% | -28% | -38% | NA | -37% |
| | 2030 | -69% | -68% | -53% | -66% | NA | -64% |
| | 2040 | -68% | -68% | -48% | -66% | NA | -63% |
| | 2050 | -68% | -68% | -44% | -66% | NA | -63% |

[a] Does not include DC fast charging demand of the ride-hailing fleet.
[b] NA = not applicable, as curbside charging was not analyzed in the central case

Most zip codes are similar to the citywide result in terms of proportional patterns of the charging demand supplied by each type of chargers. For most zip codes, home charging (both Level 1 and Level 2) accounts for the largest portion, more than half in most cases, of the energy consumption. The colored segments in Figure 4 show the central case charging energy demand of each type of chargers by zip code in 2030, 2040, and 2050. The black dot represents the intervention case total charging energy demand. For zip codes with predominantly apartments, home charging accounts for less than half of the overall charging demand. Figure 4 shows the top three zip codes with the highest percentage of apartments all have very small home charging energy demand: 94104 (Financial District), 94158 (Mission Bay), and 94105 (East Cut and Rincon Hill) with 100%, 98%, and 97% apartments, respectively. Lastly, the top three zip codes with the most projected EVs, 94112 (Ingleside, Excelsior, and Balboa), 94124 (Bay View and Hunters Point), and 94110 (Mission and Bernal), have three largest EV charging demand across all years.

27 California Energy Commission, Electricity Consumption by County, accessed May 4, 2020, https://ecdms.energy.ca.gov/elecbycounty.aspx

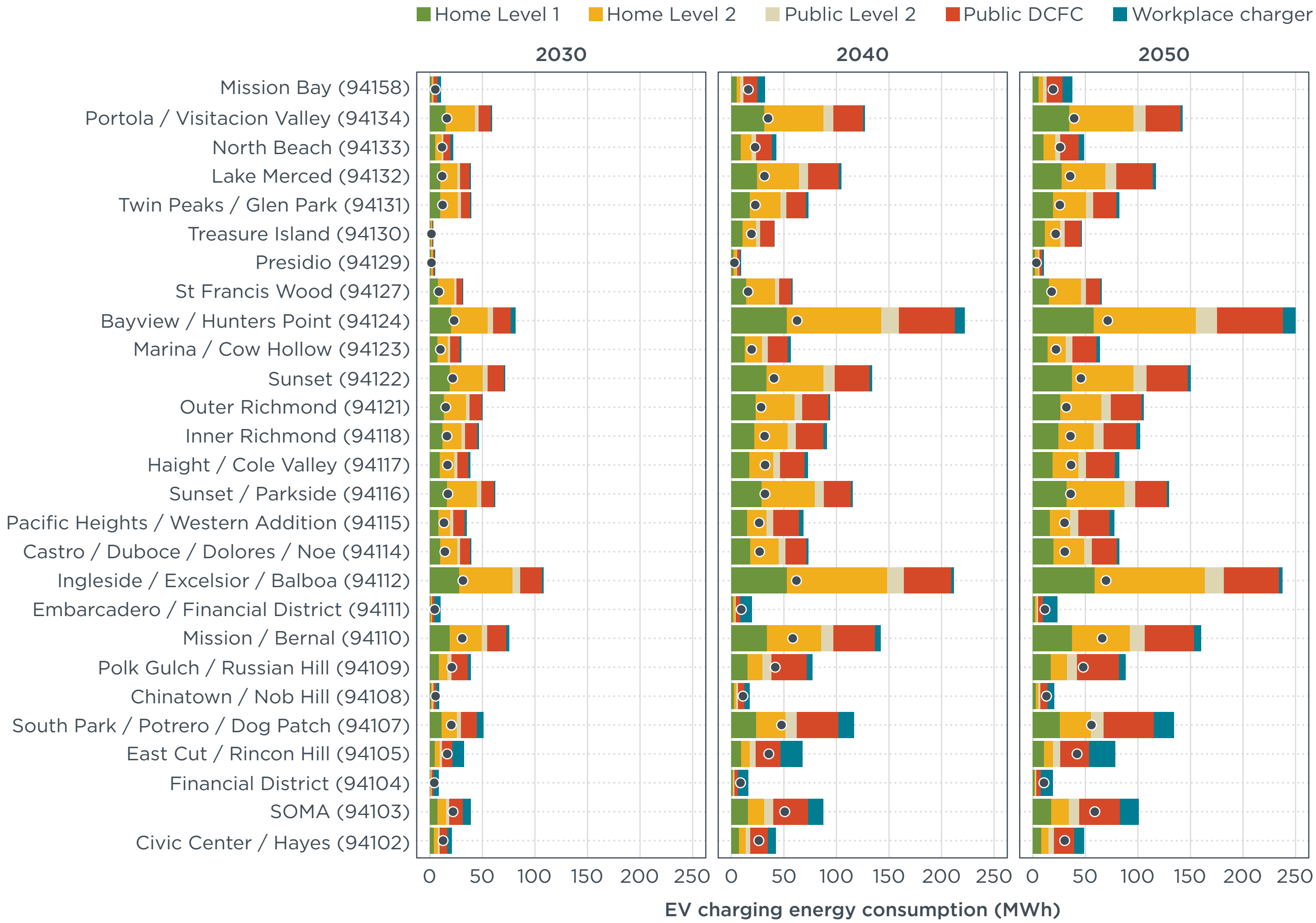


**Figure 4.** EV charging energy consumption in 2030, 2040, and 2050 for zip codes in San Francisco. The black dots show the reduced total energy consumption in the intervention case.

The proportion of the total charging demand by each charger type largely depends of the inputs regarding energy consumption per event and charging events per day. These inputs are derived from the observed behavior among the early EV adopters across California. In the early market, public charging infrastructure is not yet fully developed. In addition, early EV adopters statewide have on average different housing characteristics and travel behaviors comparing to urban EV drivers, like those in San Francisco. Since early adopters tend to live in single unit detached houses and are operating EVs with a less comprehensive public charging network, we suspect the early adopters' charging behavior can potentially be skewed toward more home charging. [28]

## Ride-hailing and medium-duty vehicles

We conduct more limited analyses on the supporting infrastructure needed for ride-hailing fleet and urban delivery electric truck fleet at the city level. Although fleet-level specific operating behavior and operators' decisions can dramatically influence the

28 Clean Vehicle Rebate Project, EV Consumer Survey Dashboard, https://cleanvehiclerebate.org/eng/survey-dashboard/ev

infrastructure layout, we make aggregate estimates for charging needs with assumptions based on two recent ICCT technical analyses.[29]

Ride-hailing charging infrastructure needs are projected based on an aggressive transition where BEVs reaches 80% of the ride-hailing fleet by 2030 and 100% by 2040, and the fleet size grows by 2% annually. Table 7 shows the daily energy demand and the charging infrastructure needed to support the electric ride-hailing fleet from 2030 to 2050. Based on these assumptions, the estimated daily electricity consumption of the ride-hailing BEV fleet in the city and SFO reaches 179 MWh, 265 MWh, and 308 MWh in 2030, 2040, and 2050, respectively. Depending on the year, this is equivalent to approximately 12% to 17% of the light-duty vehicle EV energy demand citywide. The amount of additional *dedicated* DC fast chargers needed in the city and SFO are about 192, 207, and 238 by 2030, 2040, and 2050; equal to around 55%, 30%, and 30% of the projected DC fast chargers for the LDVs in the city in the central case by 2030, 2040, and 2050, respectively.

**Table 7.** San Francisco metropolitan area ride-hailing BEV charger needs in 2030, 2040, and 2050.

| Year | Number of electric ride-hailing vehicles | BEV share of ride-hailing fleet | Daily energy demand (MWh) | Additional dedicated DC fast chargers needed[a] | Dedicated DC fast chargers at SFO |
|---|---|---|---|---|---|
| **2030** | 74,500 | 80% | 179 | 162 | 30 |
| **2040** | 115,500 | 100% | 265 | 171 | 36 |
| **2050** | 141,000 | 100% | 308 | 196 | 42 |

[a] As shown Table 4 above there are 348, 680, and 805 DC fast chargers in the central case by 2030, 2040, and 2050, respectively, before considering electric ride-hailing vehicles

We assumed that there is a minimal capacity for ride-hail drivers to charge on non-dedicated ride-hail chargers of 45 minutes per charger per day. This is because our primary infrastructure analysis above already assumed relatively high utilization of DC fast chargers by the general public of 8 hours per day starting in 2025. Achieving additional capacity would require the coordination between the general public and the ride-hailing fleet, e.g., by having accurate and real-time information on chargers in operation, in use, and queuing.

Many ride-hailing drivers make trips to and from SFO and often wait for trips at the nearby cellphone waiting lot, thus we identified this area as a potential key hub for ride-hailing DC fast charging. Having DC fast chargers at SFO offsets the additional charger needs in the city. This analysis did not evaluate specific areas within the city for dedicated ride-hailing DC fast charger deployment. One option is charging hubs at selected transit stations which could facilitate ride-hailing while complementing transit by providing first and last-mile trips that are electric and shared.

We also assess the charging infrastructure needed to support a fleet of electric delivery trucks in San Francisco. We analyze a total fleet of about 3,800 trucks in 2020 that grows by 1% a year. Table 8 shows the energy demand and the charging infrastructure needed from 2030 to 2050. The electric truck fleet consumes a significant amount of energy—amounting to approximately half of the energy demand of all light duty EVs on the city's road in the central case across all years. The significant energy consumption

29 Peter Slowik, Sandra Wappelhorst, and Nic Lutsey, *How can taxes and fees on ride-hailing fleets steer them to electrify?*, (ICCT: Washington DC, 2019), https://theicct.org/publications/taxes-and-fees-electrify-ridehailing and Dale Hall and Nic Lutsey, *Estimating the infrastructure needs and costs for the launch of zero-emission trucks*, (ICCT: Washington DC, 2019), https://theicct.org/publications/zero-emission-truck-infrastructure

is due to the high energy demand per electric truck. Electric delivery trucks have an energy efficiency about five times lower than passenger BEVs and have longer average daily travel distances. The two factors combined leads to an electric truck daily energy consumption more than 30 times higher compared to a passenger BEV.

Charging infrastructure for the electric truck fleets likely will not be shared by the general public, especially the depot chargers. However, the ultra-fast on-route chargers and the electrical equipment upstream from chargers may be shared with other heavy-duty EVs, including the city's electric buses. The city could investigate the feasibility of developing an ultra-fast charging network in partnership with private fleet owners to share the cost of charging infrastructure.

**Table 8.** Charging infrastructure needs for electrifying urban delivery trucks.

| Year | Total electric trucks | Electric truck share | Energy demand (MWh) | Depot chargers | Ultra-fast chargers |
|---|---|---|---|---|---|
| **2030** | 1,650 | 39% | 531 | 1,101 | 83 |
| **2040** | 3,853 | 83% | 1,070 | 1,926 | 121 |
| **2050** | 4,906 | 96% | 1,240 | 2,453 | 121 |

## Conclusions

This working paper demonstrates the steps cities can take to utilize local data to estimate charging infrastructure needs to plan for the transition to electric mobility. The research analyzes questions that are highly relevant across many leading local EV markets in the United States and beyond, namely, quantifying the number, type, and distribution of chargers needed to support rapid uptake in cities. The EV charging analysis presents the case of San Francisco based on data inputs for EV growth, vehicle ownership patterns, commuting and housing patterns, EV charging behavior, and home charging access, among others.

The pace and scale of EV and charging infrastructure growth assessed here for San Francisco would be an unprecedented. Several major cities have surpassed 20% electric share of their passenger vehicle sales.[30] Providing infrastructure for the EV transition presents uncertainties related to charging equipment and reasonable limits on the utilization of chargers to serve drivers and reduce the number of chargers needed. A key principle for infrastructure planning is to opportunistically take advantage where of EVs are parked most often, as done in this idealized analysis of maturing market with co-evolution of EV charging behavior and infrastructure. Improved EV charger coordination, pricing, and transparency are likely necessary to serve drivers and charging providers. The work leads us to the following conclusions and potential policy implications that could be explored further.

**City electric vehicle goals require substantial charging infrastructure deployment.** For San Francisco, achieving the 100% EV sales goal in 2030 means that more than 170 thousand EVs could be on the city's roads that year. Much more charging infrastructure is needed to support these EVs. Publicly accessible charging (i.e., public Level 2, DC fast, and workplace chargers) in San Francisco would need to increase from approximately 800 in 2019, to 2,000 by 2025, and over 5,000 by 2030. This means six times more charging is needed by 2030 from what was installed by the end of 2019. Cities with

30 Dale Hall, Hongyang Cui, Marie Rajon Bernard, Shuyang Li, Nic Lutsey, *Electric vehicle capitals: Cities aim for all-electric mobility*, (ICCT: Washington, D.C., 2020), https://theicct.org/publications/ev-capitals-of-the-world-2020

similar electric vehicle adoption goals likely require similar expansion in the availability of public charging infrastructure.

**Access to home charging remains a key pillar in the infrastructure ecosystem.** While public and workplace charging options are needed to support mass market adoption, the vast majority of EV charging will continue to be at home if 2020 charging patterns persist. Widespread access to overnight home charging, including at homes, multi-unit dwellings, residential curbsides, and other near-home locations, are key to minimizing public charging demand. This analysis finds that over 90% of the total chargers needed across San Francisco in 2030 are home chargers, and home chargers supply over half of the total EV charging demand. This is important as home chargers are typically the least expensive charger type to install and charge from, and lower-power overnight charging can reduce overall grid upgrade costs and provide demand management flexibility.

**Achieving city electric vehicle goals and the associated charging infrastructure will require supporting policy.** San Francisco will need to see the deployment of charging continue to increase at about 18% per year through 2030. This is approximately in line with charging infrastructure growth rates from the past several years. Increasingly stronger city policies like EV-ready building codes, streamlined permitting, prioritized zoning, and preferential EV parking can continue to encourage private infrastructure investment and lay the groundwork for widespread EV adoption and infrastructure deployment.[31] Continued public-private collaboration between city agencies, utilities, and charging providers will be essential. Such collaboration is important to identify and address areas that need charging more quickly, and conversely, areas that are less urgent, depending on EV demand and grid considerations associated with charging behavior, power demand dynamics, and timing for grid upgrades.

**Implementing cross-cutting city policies to reduce personal vehicle use can be especially important for cities to reduce charging infrastructure needs.** The analysis reveals how public EV charging infrastructure needs by 2030 are reduced by 45%, from approximately 5,100 to 2,900 chargers, and annual 2019-2030 public charger growth rate is reduced from 18% to 12%, if the city interventions are implemented. Shifting mobility from private vehicle trips to sustainable modes of transport like transit, reducing trips into the city core through congestion pricing, and equipping curbside parking with EV charging substantially reduce the need for public and workplace chargers. Doing so would require continued collaboration across city agencies to simultaneously support multiple city goals.

As EV adoption and charger deployment goals are implemented, cities can reexamine and adapt to underlying trends, local factors, and limitations. Deeper investigation into the local energy loads, grid capacity, and site viability could inform utility and charging provider plans. City infrastructure planning would ideally update their charging infrastructure modeling using the latest data, incorporating local community feedback, and identifying additional policy support where warranted. Trends related to EV deployment, transit, and special local policies like San Francisco's Slow Streets program through the pandemic recovery present further uncertainties for cities to track. Beyond incorporating universal EV uptake and increased transit and pedestrian trips as done here, more comprehensive assessment of how cities can simultaneously achieve equity and climate goals in their transportation policies is warranted. San Francisco's in-development plans to accomplish such wide-ranging mobility goals offer an important and exemplary first step.

31 Dale Hall and Nic Lutsey, *Charging infrastructure in cities: Metrics for evaluating future needs*, (ICCT: Washington, D.C., 2020), https://theicct.org/publications/EV_charging_metrics_aug2020

# Appendix

Table A1 shows zip code-level charging needs in 2030 based on the analysis above. Home charger projections are identical between central and intervention cases.

**Table A1.** San Francisco charger needs in 2030 for central and intervention cases

| Zip code | Neighborhood name | Home Level 1 | Home Level 2 | Central case | | | Intervention case | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Public Level 2 | DCFC | Workplace | Public Level 2 | DCFC | Workplace | Curbside |
| **94102** | **Civic Center / Hayes Valley** | 669 | 527 | 33 | 10 | 180 | 16 | 5 | 78 | 55 |
| **94103** | **SOMA** | 1,295 | 1,135 | 58 | 17 | 344 | 29 | 8 | 150 | 59 |
| **94104** | **Financial District** | 117 | 70 | 7 | 2 | 230 | 4 | 1 | 100 | 1 |
| **94105** | **East Cut / Rincon Hill** | 846 | 662 | 43 | 13 | 487 | 23 | 7 | 213 | 7 |
| **94107** | **South Park / Potrero / Dog Patch** | 1,785 | 1,995 | 73 | 20 | 287 | 25 | 7 | 129 | 33 |
| **94108** | **Chinatown / Nob Hill** | 244 | 190 | 12 | 4 | 122 | 5 | 2 | 53 | 32 |
| **94109** | **Polk Gulch / Russian Hill** | 1,487 | 1,242 | 69 | 21 | 124 | 24 | 7 | 54 | 130 |
| **94110** | **Mission / Bernal** | 2,715 | 3,706 | 100 | 24 | 131 | 34 | 8 | 66 | 52 |
| **94111** | **Embarcadero / Financial District** | 191 | 161 | 8 | 2 | 266 | 3 | 1 | 117 | 5 |
| **94112** | **Ingleside / Excelsior / Balboa** | 3,201 | 5,011 | 132 | 28 | 61 | 37 | 8 | 31 | 6 |
| **94114** | **Castro / Duboce / Dolores / Noe** | 1,510 | 2,070 | 52 | 12 | 49 | 15 | 4 | 24 | 32 |
| **94115** | **Pacific Heights / Western Addition** | 1,313 | 1,505 | 53 | 14 | 91 | 13 | 3 | 46 | 68 |
| **94116** | **Sunset / Parkside** | 1,912 | 2,911 | 77 | 17 | 41 | 20 | 4 | 20 | 8 |
| **94117** | **Haight / Cole Valley** | 1,445 | 1,745 | 55 | 14 | 79 | 15 | 4 | 40 | 74 |
| **94118** | **Inner Richmond** | 1,723 | 2,225 | 64 | 16 | 76 | 17 | 4 | 38 | 40 |
| **94121** | **Outer Richmond** | 1,800 | 2,487 | 66 | 15 | 35 | 17 | 4 | 18 | 24 |
| **94122** | **Sunset** | 2,392 | 3,418 | 93 | 21 | 52 | 25 | 6 | 26 | 19 |
| **94123** | **Marina / Cow Hollow** | 1,144 | 1,351 | 44 | 12 | 66 | 9 | 2 | 33 | 45 |
| **94124** | **Bayview / Hunters Point** | 2,394 | 3,588 | 100 | 22 | 209 | 25 | 6 | 105 | 13 |
| **94127** | **St Francis Wood** | 857 | 1,417 | 38 | 8 | 24 | 10 | 2 | 12 | 3 |
| **94129** | **Presidio** | 143 | 176 | 6 | 1 | 28 | 1 | 0 | 14 | 2 |
| **94130** | **Treasure Island** | 111 | 117 | 5 | 1 | 5 | 1 | 0 | 3 | 12 |
| **94131** | **Twin Peaks / Glen Park** | 1,349 | 1,974 | 50 | 11 | 53 | 13 | 3 | 27 | 18 |
| **94132** | **Lake Merced** | 1,252 | 1,795 | 52 | 12 | 49 | 14 | 3 | 25 | 8 |
| **94133** | **North Beach** | 862 | 866 | 34 | 9 | 97 | 13 | 4 | 42 | 42 |
| **94134** | **Portola / Visitacion Valley** | 1,716 | 2,663 | 73 | 16 | 40 | 19 | 4 | 20 | 7 |
| **94158** | **Mission Bay** | 296 | 184 | 15 | 5 | 145 | 7 | 2 | 74 | 5 |
| **Total** | | **34,772** | **45,190** | **1,412** | **348** | **3,369** | **435** | **110** | **1,557** | **798** |