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STAFF REPORT

Access to Public Near-Home Charging Among Electric Vehicles Without Home Charging

Senate Bill 1000 Third California Electric Vehicle Infrastructure Deployment Assessment

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Abstract

The third *Senate Bill (SB) 1000 California Electric Vehicle Infrastructure Deployment Assessment* evaluates access to public near-home charging among electric vehicle (EV) owners who are less likely to have home charging. The ability to charge an EV at home increases driver convenience and reduces the need for and reliance on public charging. The authors estimate the likelihood of having home charging using a variety of inputs including housing attributes, renter status, vehicle registration records, and charging surveys.

Analysis indicates that most owners of EVs as of 2024 have home charging capability. Further, estimates from this assessment indicate that most EV drivers that do not have home charging have public Level 2 or direct current fast charging within two miles of their home. Public near-home charging access among EVs without home charging is compared between disadvantaged or low-income communities and those that are not disadvantaged or low-income. The report also provides a comparison between urban and rural areas. On average, EVs at multi-family homes within disadvantaged or low-income communities have slightly lower access to home charging than those that are not but are more likely to have near-home public chargers to meet demand unmet by home charging. Relatedly, urban areas, on average, have slightly lower access to home charging than rural areas but better access to near-home public charging if home charging is not available.

In a hypothetical 100 percent EV future, home charging potential drops. For disadvantaged or low-income communities, home charging potential for EV owners is estimated to drop from 83 percent in 2024 to 46 percent in a future with full EV penetration, and from 90 to 57 percent respectively for communities not designated as disadvantaged or low-income.

Keywords: home charging, infrastructure, transportation electrification, electric vehicle, equitable transportation planning, multi-family housing, disadvantaged community, low-income community, rural community

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

Executive Summary

Senate Bill 1000 (Lara, Statutes of 2018, Chapter 368) requires the California Energy Commission (CEC) to assess whether electric vehicle (EV) charging station infrastructure is disproportionately deployed by geographical area, population density, or population income level to inform EV infrastructure investments.

The CEC published the first SB 1000 report in 2020 which focused on the geographic distribution of public Level 2 and direct current fast chargers by income level and population density. The second report was published in 2022 and focused on drive times from residential population centers to the nearest public direct current fast charging station. This report will update previous years' geographic public charger distribution and drive time results using recent designations of disadvantaged, low-, middle-, and high-income, and urban and rural communities. Updates can be found in Appendices A and B.

In 2022, the CEC published the *Home Charging Access in California Report*, which evaluated access to Level 1 home charging based on survey respondents' perception of access to a 120-volt outlet. This report builds off the previous report by evaluating access to Level 1 or Level 2 home charging based on barriers to having home charging, such as panel capacity,[1] parking availability and home ownership. Households with access to Level 1 charging at home are assumed to be able to upgrade to Level 2 charging if panel capacity is sufficient. Furthermore, this report estimates access to near-home public charging for EVs likely without home charging and provides results at fine scales to enable assessment of access across geographical areas, population density, and income levels.

The goals of this assessment are to:

- Identify barriers to at-home charging installations and areas in the state with collectively higher home charging barriers.
- Estimate the number of EVs in 2024 that have access to home charging.
- Of the EVs in 2024 that do not have access to home charging, estimate those with existing near-home public charging.
- Estimate the number of EVs in a hypothetical 100 percent EV future that have access to home charging given current trends.
- Examine how at-home and near-home charging access differs across housing types and geographic and sociodemographic factors to inform the design of charging programs, including equitable home charging programs and public fast charging programs.

Home Charging Access

Staff evaluated parcel-level housing attributes and demographics including year built, panel capacity, parking, and tenure,[2] with data on vehicles and EV adoption, and applied assumptions from home charging survey results to estimate home charging potential among

[1] Level 1 charging generally does not require a panel upgrade since it utilizes a standard 120V outlet. Level 2 charging requires a 240V outlet and dedicated circuit and may require a panel upgrade.

[2] Tenure identifies whether a housing unit is owner- or renter-occupied.

EVs today and EVs in a 100 percent EV future. Staff grouped homes into 4 barrier categories for evaluating likeliness of not having access to home charging:

- Low Barriers – Homes that have vehicles that park off street, are estimated to be panel ready,[3] and are owner-occupied.
- Moderate Barriers – Homes that have vehicles that park off street and are either estimated to be almost panel ready[4] or are renter-occupied.
- High Barriers – Homes that have vehicles that park off street and are either, a) estimated to be almost panel ready and are renter-occupied, or b) are estimated to require a panel upgrade to support Level 2 home charging.
- No Access – Homes that do not have off street parking for vehicles and therefore require public charging.

After grouping homes into barrier categories, staff applied survey results to assess percentage of households, by housing type, from each barrier group that likely have and do not have charging at home. Staff then estimated household EV adoption using survey and vehicle registration data. To estimate demand met by home charging, staff applied additional survey results of home charging usage.

Results from the model show:

- Across all housing types, about 88 percent of EVs in 2024 likely have access to home charging. In a hypothetical 100 percent EV future, where all vehicles are assumed to be electric, estimated home charging access drops to 52 percent.
- At multi-family homes,[5] about 55 percent of EVs in 2024 (representing 7 percent of all EVs) and about 26 percent of EVs in a hypothetical 100 percent EV future likely have home charging (representing 6 percent of all EVs in a hypothetical 100 percent EV future).
- At single-family homes,[6] about 92 percent of EVs in 2024 (representing 81 percent of all EVs) and about 60 percent of EVs in a hypothetical 100 percent EV future likely have access to home charging (representing 46 percent of all EVs in a hypothetical 100 percent EV future).

There are subtle differences in estimated home charging access between disadvantaged[7] or low-income communities[8] and those not falling under these definitions. The results in Figure ES-1 show that on average, disadvantaged or low-income communities have less access to

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[3] Single-family homes with panels of 150 Amps or greater are considered panel ready. Multi-family homes built in 1980 or after are estimated to be panel ready.

[4] Single-family homes with estimated panels of 100 Amps or 125 Amps are considered almost panel ready.

[5] Multi-family homes (MFHs) are a classification of housing where separate housing units for residential inhabitants are contained within one building or several buildings within one complex. Units can be next to each (side-by-side units) or stacked on top of each other (top and bottom units). A common form is an apartment building.

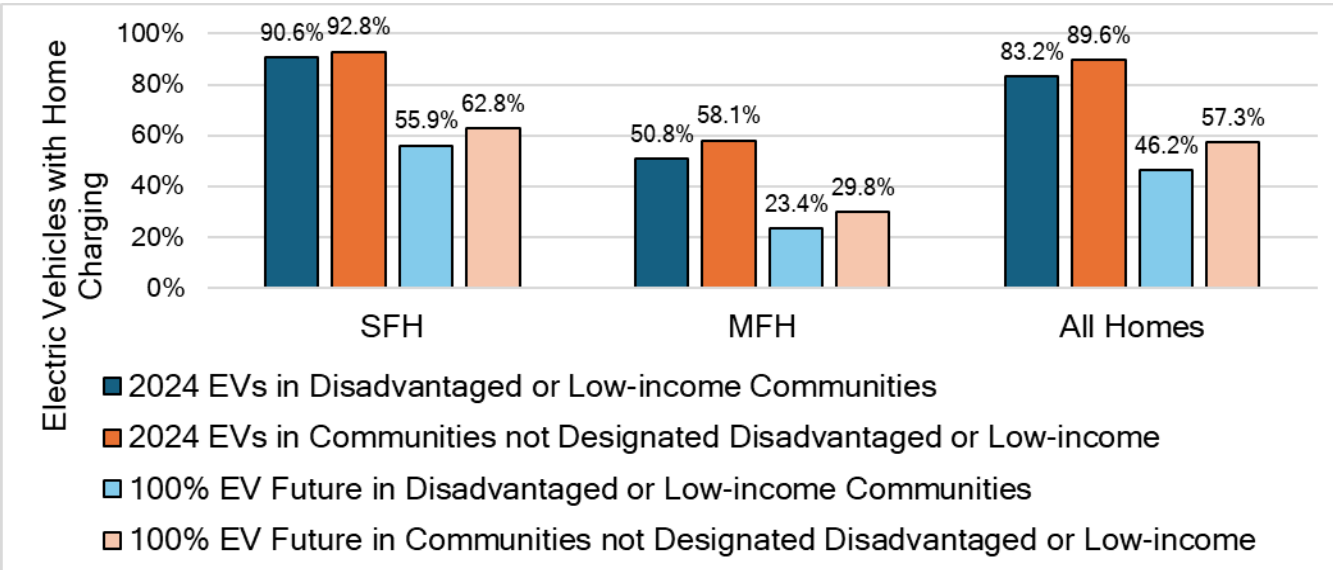
[6] Single-family homes (SFHs) are units that are separated by a ground-to-roof wall, have separate heating system, individual meters for public utilities, and no units located above or below. May include detached, semi-detached, row houses, duplexes, and townhomes.

[7] As defined by Senate Bill 535 (De León, Chapter 830, Statutes of 2012).

[8] As defined by Assembly Bill 1550 (Gomez, Chapter 369, Statutes of 2016).

home charging in 2024 and in a hypothetical 100 percent EV future than communities not designated as disadvantaged or low-income. Notably, in a hypothetical 100 percent EV future, the percent of EVs at multi-family homes in disadvantaged or low-income communities with home charging potential drops to 23 percent (representing 3 percent of all future EVs in a hypothetical 100 percent EV future).

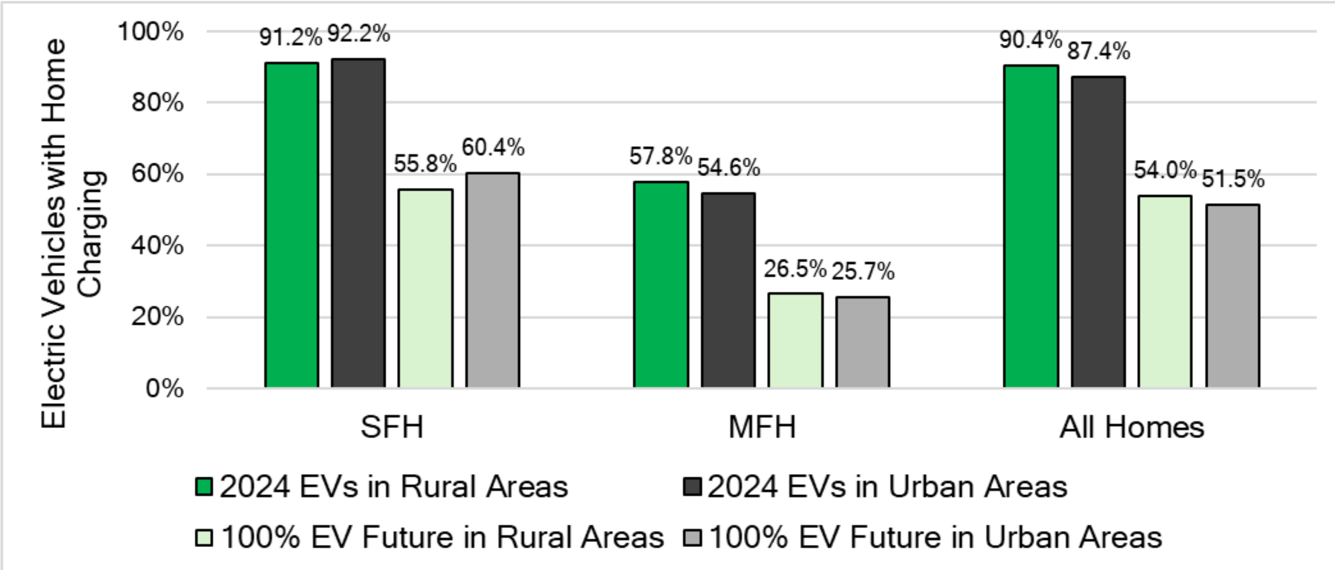
Figure ES-1: Electric Vehicles Estimated to Have Home Charging by Disadvantaged or Low-income Designation



Source: CEC

About 89 percent of all Californians live in urban areas; the remaining 11 percent live in rural areas. There is little difference in home charging access between urban and rural areas on average. The results in Figure ES-2 show that on average, across all homes, EVs in urban areas have slightly less access to home charging in 2024 and in a hypothetical 100 percent EV future than rural areas.

Figure ES-2: Electric Vehicles Estimated to Have Home Charging by Population Density



Source: CEC

Access to Public Near-Home Charging

EVs without sufficient home charging require charging away from home. Public charging located near home can provide charging access when at-home or workplace charging is not available. Staff evaluated proximity of existing public chargers to EVs in 2024 estimated to lack home charging. While EVs without home charging may access charging in a variety of ways, staff analyzed two scenarios for near-home charging[9]:

- Neighborhood public Level 2 or Direct-Current fast charging – Public Level 2 or Direct-Current charging within two miles of home.
- Walking-distance public Level 2 charging – Public Level 2 only charging within an eighth of a mile from home. An eighth of a mile is estimated to be within walking distance for most drivers to leave their EV parked and charging for several hours, including overnight. Certain restrictions, such as land use, zoning, and local permitting could prevent public charging installation within an eighth of a mile of homes.

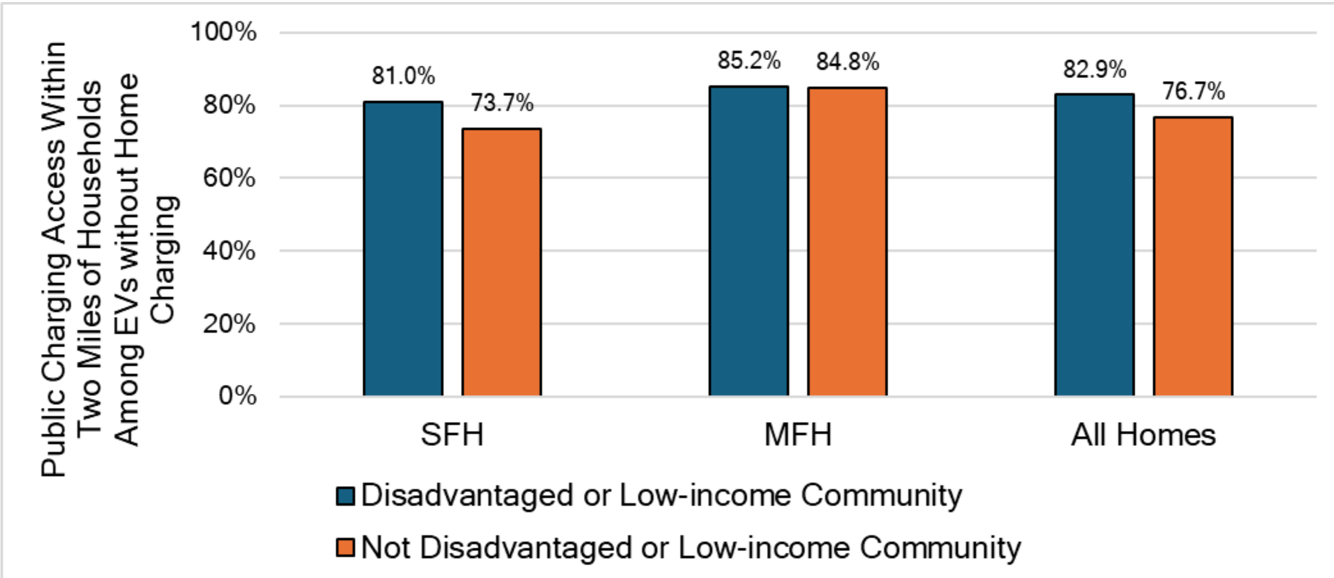
Results from the model show that across all housing types in 2024, about 79 percent of EVs estimated to lack sufficient home charging have near-home public charging options. Across multi-family homes in 2024, about 85 percent of EVs estimated to lack sufficient home charging have near-home public charging options (this represents 5 percent of all EVs). Across single-family homes in 2024, about 76 percent of EVs estimated to lack sufficient home charging have near-home public charging options (this represents 9 percent of all EVs).

EVs in disadvantaged or low-income communities likely have less access to home charging, on average, than communities that are not. But EVs in disadvantaged or low-income communities estimated to lack sufficient home charging likely have better access on average to near-home

[9] Workplace charging is another option for drivers without access to home charging, however, was not evaluated due limited data on shared-private workplace chargers.

public charging than communities that are not disadvantaged or low-income. These results are shown in Figure ES-3.

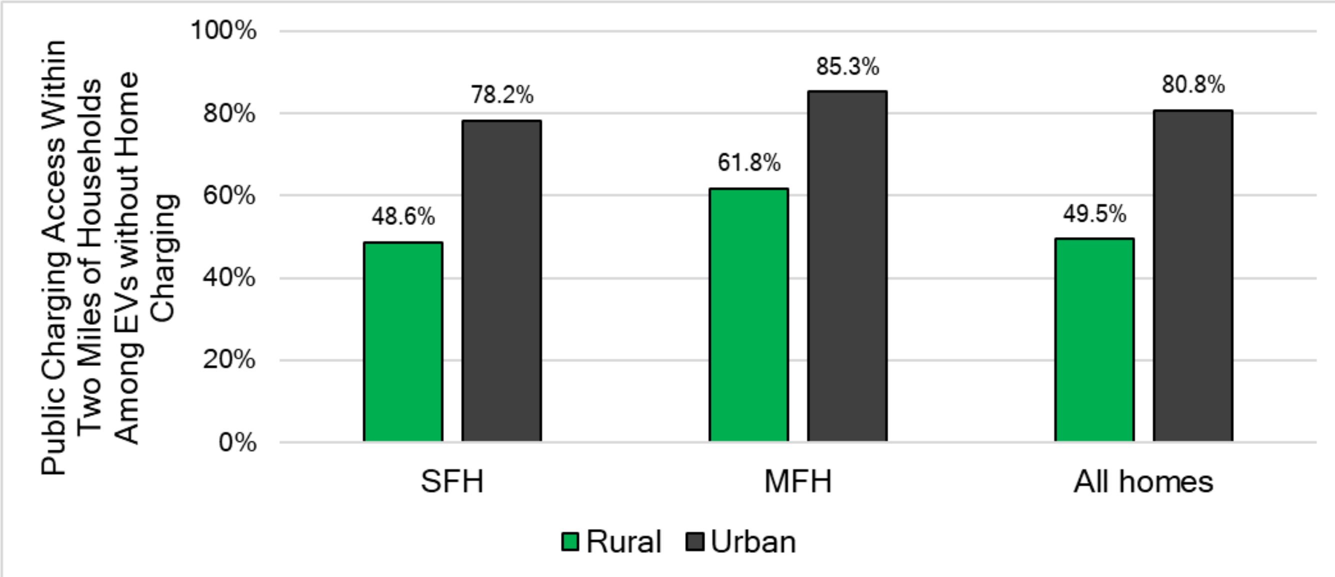
Figure ES-3: Public Level 2 or DC Fast Charging Within Two Miles of Electric Vehicles in 2024 Without Sufficient Home Charging by Disadvantaged or Low-income Designation



Source: CEC

In urban areas, EVs, on average, have less access to home charging than in rural areas. But EVs in urban areas estimated to lack sufficient home charging have better access to near-home public charging, on average, than rural communities. These results are shown in Figure ES-4.

Figure ES-4: Public Level 2 or DC Fast Charging Within Two Miles of Electric Vehicles in 2024 Without Sufficient Home Charging by Population Density



Source: CEC

Interactive Map Showing Geographic Distribution of Electric Vehicles Estimated to Lack Home Charging, Public Walking-Distance, or Public Neighborhood Charging

The Near-Home Public Charging Demand From Electric Vehicles Without Home Charging: Senate Bill 1000 Assessment Map, available at https://www.energy.ca.gov/programs-and-topics/programs/clean-transportation-program/electric-vehicle-infrastructure/near-home, is an interactive map that displays results aggregated into quarter-mile areas throughout California. Results include concentrations of:

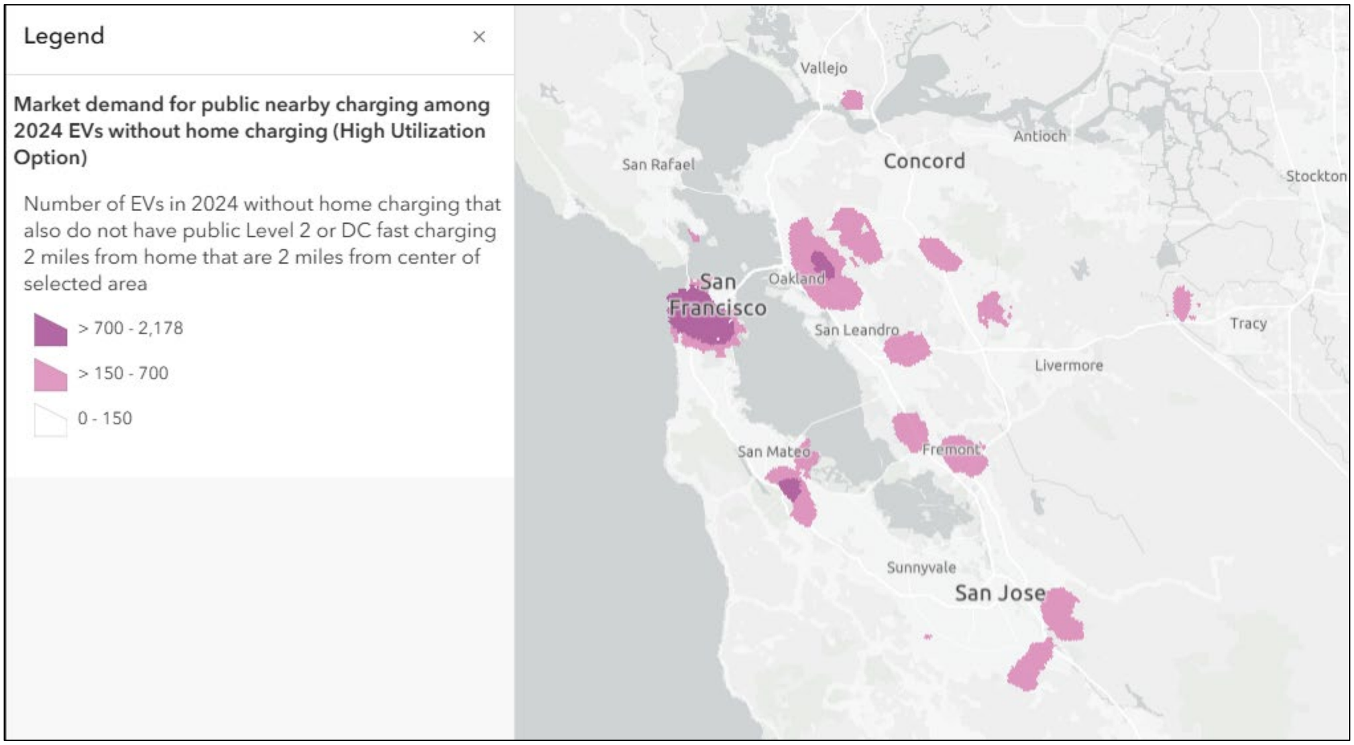
- EVs in 2024 estimated to lack sufficient home charging due to barriers to installing a home charger.
- EVs in 2024 estimated to lack home charging and public charging within two miles of households.
- EVs in 2024 estimated to lack home charging that also lack public Level 2 chargers within an eighth of a mile of households.
- EVs in a 100 percent EV future estimated to not have home charging capability.

The map displays areas where installing public charging could expand access to charging for EVs within two miles that likely do not have sufficient home and near-home public charging. Deploying public chargers in areas with high concentrations of EVs without home and existing near-home public charging could improve charging access for EV drivers. It is important to note that deploying chargers within two miles of households is not the only way to improve charging access for EV drivers. Other approaches, including workplace charging, may also improve access for drivers depending on individual travel patterns and preferences.

Figure ES-5 shows a snapshot of areas of the Bay Area with high market demand for public Level 2 and DC fast charging within two miles of households. Generally, high concentrations of

EVs without home charging that also do not have public Level 2 or DC fast charging within 2 miles of households occur in the Bay Area and parts of Los Angeles and San Diego. Deploying additional public chargers in these areas could provide drivers with more options for near-home charging.

Figure ES-5: Market Demand in the Bay Area for Public Near-Home Charging Among Electric Vehicles in 2024 Without Home Charging



Source: CEC

Conclusions

This assessment takes household level data and presents a rigorous methodology for estimating at-home and near-home public charging access throughout California. It builds on available research and provides granular level results that enables assessment of potential disparities in charging access. CEC staff can more accurately assess potential disparities in charging access by analyzing which populations have barriers to home charging, which is often preferred for its convenience and cost over other forms of charging, and which drivers have to travel further from home to access charging when home charging is not available. Expanding access to public charging near home is one way of providing households with a charging option if home, workplace, and charging enroute to frequent destinations are not available.

The granular at-home charging access results from this assessment will be incorporated into the light-duty vehicle charging infrastructure modeling component of the CEC's third Assembly Bill 2127 charging infrastructure assessment. The addition of this data source will make it possible to estimate the number of chargers needed to support vehicles without home charging more accurately and at a much finer spatial scale. Results can also be used by CEC staff to help inform design of grant funding opportunities targeting EVs that lack potential home charging access. The lack of home charging estimated in 2024 and in a hypothetical 100 percent EV future will require both public and private sectors to come together to overcome barriers to ensure convenient, affordable, and reliable charging for all Californians. A visible and reliable charging network can provide a backbone for a 100 percent EV future and broaden access for all Californians.

CHAPTER 1: Introduction

Transportation-related emissions, including emissions from fuel production and vehicle fuel use, contribute to roughly half of California's greenhouse gas emissions (GHGs). Nearly 80 percent of smog-forming nitrogen oxides (NOx) and 90 percent of toxic diesel particulate matter in the state come from transportation, making it a major source of air pollution.[10] Widespread adoption and use of zero-emission mobility options, including zero-emission vehicles (ZEVs) powered by clean energy, will bring California closer to achieving its long-term air quality and GHG emissions reduction goals. To support this transition, in September 2020, Governor Gavin Newsom issued Executive Order (EO) N-79-20, which set a target that by 2035 all new passenger car and truck sales shall be zero-emission, along with other targets for medium-, heavy-, and off-road vehicles.[11]

EO N-27-25,[12] issued June 2025, reaffirms the state's commitment to accelerate deployment of zero-emission technologies in light of federal actions on state regulations. EO 27-25 calls for the California Air Resources Board (CARB) to develop an Advanced Clean Cars III regulation that advances deployment of clean air vehicles and technologies.

The CEC prepares statewide assessments of charging infrastructure needed to meet the state's zero-emission vehicle goals, pursuant to AB 2127 (Ting, Chapter 365, Statutes of 2018).[13] The CEC, using the Energy Assessment Division Additional Achievable Transportation Electrification 3 (AATE3) scenario, developed for the 2022 Integrated Energy Policy Report (IEPR), projects a plug-in electric vehicle (PEV) population of 7.1 million in 2030 and 15.2 million in 2035.[14]The Second AB 2127 Assessment projected the number and types of PEV chargers that are needed for the state to meet its ZEV adoption targets.[15] Results from this analysis indicate that by 2030, California will need 1.01 million chargers (including 39,000 direct current fast chargers) to support 7.1 million light-duty PEVs. CEC staff plan to periodically update projections in response to trends in vehicle adoption, charger usage, and consumer behavior.

As of September 2025, the CEC estimates that California has approximately over 201,000 operational public and shared private charging ports and an estimated 238,000 chargers for

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[10] California Energy Commission staff. 2023. 2023 Integrated Energy Policy Report. California Energy Commission. Publication Number: CEC-100-2023-001-CMF. Available at https://www.energy.ca.gov/data-reports/reports/integrated-energy-policy-report-iepr.

[11] Governor Gavin Newsom. Executive Order N-79-20. Issued September 23, 2020. Available at https://www.gov.ca.gov/wp-content/uploads/2020/09/9.23.20-EO-N-79-20-text.pdf.

[12] Governor Gavin Newsom, Executive Order N-27-25. Issued June 12, 2025. Available at https://www.gov.ca.gov/wp-content/uploads/2025/06/CRA-Response-EO-N-27-25_-bl-formatted-GGN-Signed-6-11-954pmFinal.pdf.

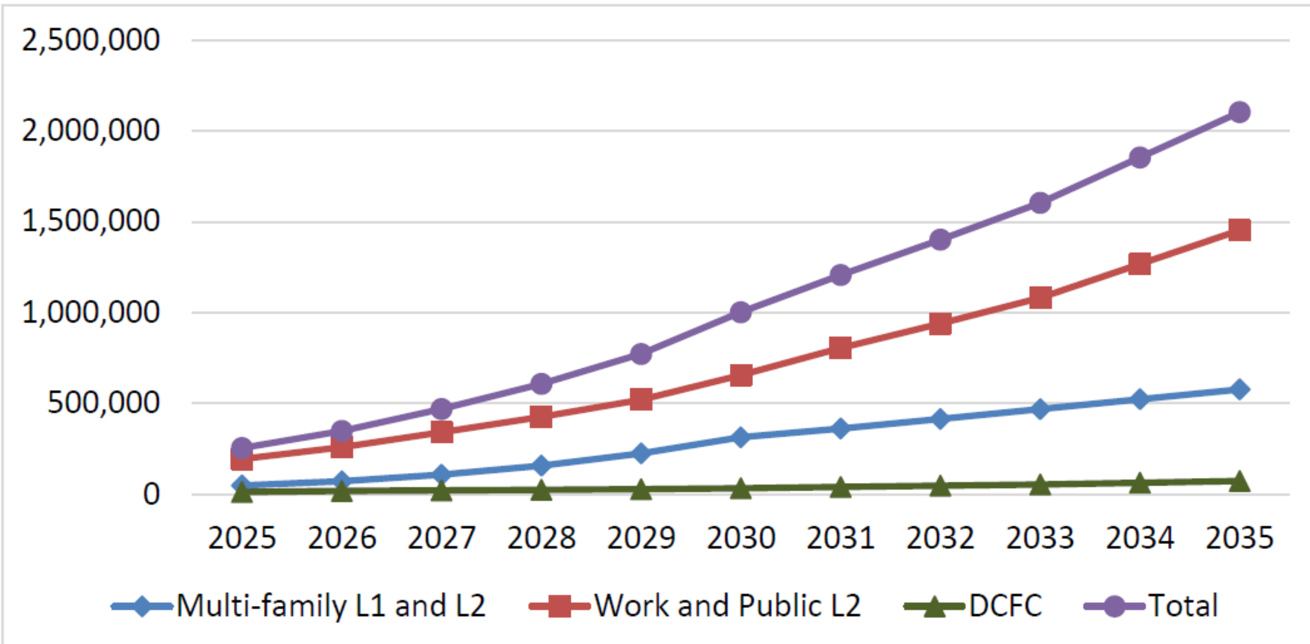
[13] Assembly Bill 2127 (Ting), Chapter 365, Statutes of 2018. Available at https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201720180AB2127.

[14] California Energy Commission staff. 2022. 2022 Integrated Energy Policy Report. California Energy Commission. Publication Number: CEC-100-2022-001-CMF. Available at https://www.energy.ca.gov/data-reports/reports/integrated-energy-policy-report/2022-integrated-energy-policy-report-update.

[15] California Energy Commission staff. 2024. Assembly Bill 2127 Electric Vehicle Charging Infrastructure Assessment: Assessing Charging Needs to Support Zero-Emission Vehicles in 2030 and 2035. California Energy Commission. Publication Number: CEC-600-2024-003. Available at https://www.energy.ca.gov/data-reports/reports/electric-vehicle-charging-infrastructure-assessment-ab-2127.

which funding has been allocated or deployed as a result of green building code compliance.[16] Figure 1 shows the Second AB 2127 Assessment's projected annual charger needs from 2025 to 2035 under the AATE3 scenario. California will need to significantly ramp up charging station deployment as the number of chargers needed to serve light-duty PEVs in California will increase steadily through 2035, when PEVs will need 2.11 million public and shared private chargers, including more than 80,000 DC fast chargers.[17]

Figure 1: Total Annual Charger Needs for Light-Duty PEVs Under the AB 2127 Second Assessment



Source: CEC, NREL, UC Davis

A key determinant of the need for public and shared private chargers is access to home charging. Due to its convenience, affordability, and reliability, most electric vehicle (EV) charging today occurs at home. Studies have shown that EV chargers have the largest electric load range of any standard home appliance and highest potential nameplate load, thereby requiring high-capacity electric service panels and/or load management strategies to achieve

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[16] California Energy Commission (2025). Electric Vehicle Chargers in California. Data last updated (September 8, 2025). Retrieved January 28, 2026 from https://www.energy.ca.gov/zevstats.

Lopez, Thanh, Adam Davis, Brendan Burns, Magdulin Dwedari. 2025. *2024 Zero-Emission Vehicle Infrastructure Plan: Deployment Strategy 2025 – 2030.* California Energy Commission. Publication Number: CEC-600-2025-002.

CEC staff are working on updating the number of estimated chargers for which funding has been allocated or deployed as a result of green building code compliance for the next Zero-Emission Vehicle Infrastructure Plan.

Existing charging ports estimated based on available data from U.S. Department of Energy's Alternative Fuels Data Center and surveys to electric vehicle network service providers, utilities, and public agencies in California.

Estimate of ports from other state programs derived from public presentations and statements by utilities, California Public Utilities Commission (CPUC), CARB, other entities, and CEC. Includes funding from the National Electric Vehicle Infrastructure (NEVI) Program, the State Budget Act of 2021 and State Budget Act of 2022 intended to close the gaps for Level 2 and DC fast chargers; the estimated number of charger could change as solicitations are released.

[17] California Energy Commission staff. 2024. Assembly Bill 2127 Electric Vehicle Charging Infrastructure Assessment: Assessing Charging Needs to Support Zero-Emission Vehicles in 2030 and 2035. California Energy Commission. Publication Number: CEC-600-2024-003. Available at https://www.energy.ca.gov/data-reports/reports/electric-vehicle-charging-infrastructure-assessment-ab-2127.

full home electrification. Home charging will be a critical consideration in residential building electrification and the state's building decarbonization efforts. Today, residential and commercial buildings account for about a quarter of California's GHG emissions.[18] By electrifying buildings that use natural gas and other combustion fuels, California can achieve meaningful emission reductions. California has passed several pieces of legislation aimed at electricity generation decarbonization, including:

- Senate Bill 100 (De León, Chapter 312, Statutes of 2018), which requires renewable energy and zero-carbon resources supply 100 percent of electric retail sales to end-use customers by 2045.
- Senate Bill 350 (De León, Chapter 547, Statutes of 2015), which codified the state's goals to reach 50 percent renewable energy sources, double energy efficiency savings by 2030, and study barriers to energy efficiency and clean energy for disadvantaged and low-income communities.[19]
- Assembly Bill 3232 (Friedman, Chapter 373, Statutes of 2018), which requires the CEC to assess the potential for California to reduce GHG emissions from buildings by 40 percent below 1990 levels by 2030 and prepare a building decarbonization assessment.[20]
- Senate Bill 68 (Becker, Chapter 720, Statutes of 2021), which directs the CEC to gather information and develop guidance and best practices for building owners, the construction industry, and local governments to help overcome barriers to building electrification and the installation of EV chargers.[21]

Furthermore, CARB is assessing the equity implications and cost of residential and commercial building electrification for disadvantaged and low-income populations to identify building decarbonization barriers and knowledge gaps.[22] The study is based on estimations of electric service panel capacity and opinion research around community values and knowledge of building electrification decisions. Results will inform policy recommendations to achieve rapid and equitable building decarbonization.

As the state seeks to rapidly roll out charging infrastructure, it will be increasingly important to ensure that deployment of and access to chargers is equitable and serves all Californians. Senate Bill (SB) 1000 (Lara, Statutes of 2018, Chapter 368) requires the CEC to assess whether EV charging station infrastructure is disproportionately deployed by geographical area, population density, or population income level to inform Clean Transportation Program

[18] Kenney, Michael, Nicholas Janusch, Ingrid Neumann, and Mike Jaske. 2021. California Building Decarbonization Assessment. California Energy Commission. Publication Number: CEC-400-2021-006-CMF. Available at https://www.energy.ca.gov/data-reports/reports/building-decarbonization-assessment.

[19] California Energy Commission (2023). "Clean Energy and Pollution Reduction Act – SB 350." November 21, 2023, from https://www.energy.ca.gov/rules-and-regulations/energy-suppliers-reporting/clean-energy-and-pollution-reduction-act-sb-350.

[20] California Energy Commission (2023). "Building Decarbonization Assessment." November 22, 2023, from https://www.energy.ca.gov/data-reports/reports/building-decarbonization-assessment.

[21] California Energy Commission (2023). "Building Decarbonization and Electric Vehicle Charging Equipment Web Guide Development". November 21, 2023, from https://www.energy.ca.gov/proceeding/inactive-proceeding/building-decarbonization-and-electric-vehicle-charging-equipment-web-guide#:~:text=Senate%20Bill%2068%20(Becker%2C%20Chapter,of%20electric%20vehicle%20charging%20equipment.

[22] University of California, Los Angeles. Equitable Electrification of Existing Buildings: A Pathway to Decarbonization. Available at https://www.ioes.ucla.edu/project/equitable-electrification-of-existing-buildings-a-pathway-to-decarbonization/.

light-duty charging infrastructure investments.[23] This includes assessment of whether direct current (DC) fast charging stations are disproportionately distributed and whether access to these stations is disproportionately available. The results of ongoing analysis are intended to direct statewide planning to ensure charging access for all.

First SB 1000 Assessment: Geographic, Population, and Income Distribution of Public Chargers

The first SB 1000 assessment, published in December 2020, examined the geographic distribution of public Level 2 (L2) and direct current fast chargers (DCFCs) by income and population.[24] For the assessment, CEC staff used mapping software to count the number of public L2 and DCFCs located within counties and census tracts to evaluate per capita chargers and chargers per square mile.

Key findings from the first SB 1000 assessment include the following:

- Low-income communities (LICs), on average, have fewer public L2 chargers per capita than middle- or high-income communities but more public DCFCs per capita than high-income communities. Differences appear modest but indicate that on average, LICs have the fewest total chargers per capita.[25]
- Public L2 and DCFCs are unevenly distributed across counties but are co-located with county populations and PEVs with high concentrations in metropolitan areas.
- High-population-density census tracts have fewer public L2s and DCFCs than other tracts with lower population density, likely due to more public chargers being installed in non-residential areas.

Results from the assessment support the following:

- A commitment to invest at least 50 percent of CEC's Clean Transportation Program funding to provide benefits to disadvantaged[26] and low-income communities.
- An effort to saturate dense residential cores with chargers. The CEC released the Reliable, Equitable, and Accessible Charging for multifamily Housing (REACH) GFO in November 2021 to provide $8,500,000 in funds for projects that will increase charging access for multifamily housing residents. Given the success of this GFO, the CEC released subsequent versions, REACH 2.0 in April 2023, which provided $20,000,000 in

[23] Senate Bill 1000 (Lara), Chapter 368, Statutes of 2018. Available at https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201720180SB1000.

[24] California Energy Commission staff. 2020. California Electric Vehicle Infrastructure Deployment Assessment: Senate Bill 1000 Report – Increasing Access to Electric Vehicle Infrastructure for All. California Energy Commission. Publication Number: CEC-600-2020-153. Available at https://www.energy.ca.gov/programs-and-topics/programs/clean-transportation-program/electric-vehicle-infrastructure.

[25] Assembly Bill 1550 (Gomez, Chapter 369, Statutes of 2016) defines low-income communities as census tracts with median household incomes at or below 80 percent of the statewide median income or with median household incomes at or below the threshold designated as low income by the Department of Housing and Community Development's list of state income limits adopted pursuant to California Health and Safety Code section 50093. See Appendix A for definitions for middle- and high-income communities and the methodology for census tract designation.

[26] Disadvantaged Communities (DACs) are communities that are disproportionately burdened by multiple sources of pollution and especially vulnerable to pollution's effects. DACs are designated by the California Environmental Protection Agency for the purposes of Senate Bill 535 ((De León, Statutes of 2012, Chapter 830), which establishes minimum funding level requirements for DACs.

grant funding, and $19,000,000 for REACH 3.0 in October 2024.[27] Given the success of REACH, the CEC increased funding for eligible projects to $41,000,000 under REACH 2.0 and $38,000,000 under REACH 3.0.

Second SB 1000 Assessment: Drive Times to Public DC Fast Charging Stations

The second SB 1000 assessment, published in July 2022, sought to improve analysis of charging access by examining drive times to public DC fast charging stations. DCFCs allow for quicker charging and are especially important for road trips and for those that do not have access to charging at home or at their workplace. Drive time analysis reveals gaps in the fast charging network that can discourage EV travel. For the second assessment, staff used mapping software to find the quickest drive time routes from residential population centers to the nearest public DC fast charging station. Communities were then characterized by income, population, and exposure and sensitivity to pollution. Communities with drive times of 5 minutes or less were considered to have adequate fast charging coverage while those with drive times of 10 minutes or more were considered to have sparse coverage.

Key findings from the second SB 1000 assessment include the following:

- Most rural communities in California have sparse public DC fast charging coverage, indicated by drive times of 10 minutes or more. About a fifth of these rural communities have drive times between 30 minutes to an hour and about 5 percent have drive times of over an hour, up to 4 hours, to a public DC fast charging station.
- Low-income rural communities have the least coverage. About 70 percent of low-income rural communities have drive times of 10 minutes or more. About a fifth of these low-income rural communities have drive times between 30 minutes to an hour and about 8 percent have drive times of over an hour.
- Disadvantaged communities (DACs) tend to be in urban areas where more public DC fast charging stations are likely to be deployed. However, gaps still exist. About 15 percent of DACs have drive times of 10 minutes or more.

Results from that assessment support the following:

- A commitment to invest at least 50 percent of CEC's Clean Transportation Program funding to provide benefits to priority populations, including DACs and LICs.
- An effort to close charging gaps in rural areas of the state. The CEC released the Rural Electric Vehicle (REV) Charging GFO in December 2021 and provided $4,800,000 in funds for projects that provide charging access in rural areas and support travel by rural EV drivers, especially those from LICs or DACs. The CEC released the Rural Electric Vehicle Charging 2.0 (REV 2.0) GFO in February 2025 to provide an additional $9,800,000 in funds to continue to expand charging access in rural areas. [28]

[27] GFO-22-614 Reliable, Equitable, and Accessible Charging for multi-family Housing 2.0 (REACH 2.0). Available at https://www.energy.ca.gov/solicitations/2023-04/gfo-22-614-reliable-equitable-and-accessible-charging-multi-family-housing-20. GFO-24-604 Reliable, Equitable, and Accessible Charging for multi-family Housing 3.0 (REACH 3.0). Available at https://www.energy.ca.gov/solicitations/2024-10/gfo-24-604-reliable-equitable-and-accessible-charging-multi-family-housing-30.

[28] GFO-21-604 Clean Transportation Program Rural Electric Vehicle (REV) Charging. Available at https://www.energy.ca.gov/event/workshop/2024-03/pre-solicitation-workshop-rural-electric-vehicle-charging-20-rev-20.

Third SB 1000 Assessment: Barriers to Home Charging and Access to Public Near-Home Charging

This current SB 1000 assessment focuses on examining access to home charging and near-home public charging among EVs likely without home charging. The U.S. Department of Energy estimates that 80 percent of EV charging today is done at home.[29] Home charging is often more convenient, affordable, reliable, and grid friendly than public charging or refueling a conventional internal combustion engine vehicle (ICEV).[30] Access to home charging can encourage PEV adoption and move the state closer towards achieving its ZEV goals, therefore maximizing access to home charging is a CEC priority.[31]

In January 2022, the CEC published the *Home Charging Access in California Report*, which evaluated access to Level 1 (L1) home charging based on an individual's perception of access to a 120-volt outlet.[32] CEC staff partnered with the National Renewable Energy Laboratory (NREL) for the statewide analysis and collected nearly 1,300 survey responses to examine parking options, behavior, and access to electricity by housing type, tenure,[33] and income. A "PEV likely adopter" model was developed to estimate future access as the PEV fleet share increases.

Key findings from the *Home Charging Access in California Report* include the following:

- Single-family and high-income residents have greater access to L1 home charging than multifamily and lower income residents. The disparity between housing types and income groups are most pronounced when shifts in parking behavior are considered.[34] Overall, single-family and higher income drivers have more parking options that are suitable for home charging.
- L1 home charging access does not surpass 33 percent if infrastructure and parking conditions remain business as usual. In the most optimistic scenario, where parking behavior changes and new chargers are installed, no more than 66 percent of survey respondents have access.
- In a hypothetical 100 percent PEV future, L1 home charging access does not surpass 11 percent under business-as-usual conditions. In the most optimistic scenario, which considers parking behavior modification, no more than 71 percent of survey respondents have access.

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[29] Blonsky, Michael, Prateek Munankarmi, Sivasathya Balamurugan .2021. Incorporating Residential Smart Electric Vehicle Charging in Home Energy Management Systems. National Renewable Energy Laboratory. Conference Paper: NREL/CP-5D00-78540. Available at https://www.nrel.gov/docs/fy21osti/78540.pdf.

[30] California Energy Commission staff. 2021. Final 2020 Integrated Energy Policy Report Update. California Energy Commission. Publications Number: CEC-100-2020-001-V1-CMF. Available at: https://www.energy.ca.gov/data-reports/reports/integrated-energy-policy-report/2020-integrated-energy-policy-report-update.

[31] Lopez, Thanh and Madison Jarvis. 2022. Zero-Emission Vehicle Infrastructure Plan (ZIP). California Energy Commission. Publication Number: CEC-600-2022-054-REV. Available at: https://www.energy.ca.gov/publications/2022/zero-emission-vehicle-infrastructure-plan-zip.

[32] Alexander, Matt. January 2022. *Home Charging Access in California*. California Energy Commission. Publication Number: CEC-600-2022-021. Available at https://www.energy.ca.gov/publications/2022/home-charging-access-california.

[33] Tenure identifies whether a housing unit is owner- or renter-occupied.

[34] An example of a shift in parking behavior is when a driver modifies where they usually park so they can have access to parking near an electric outlet that supports charging.

- There are three key gaps that impact PEV adoption and home charging ability: 1) education about PEVs and charging, 2) installing 120V electricity in homes, and 2) shifting parking behavior.

The home charging survey and results were used as modeling inputs for the CEC's second AB 2127 assessment to evaluate charging needs. Staff evaluated needs under baseline, higher, and lower home access scenarios.[35] Higher home charging access reduces the need for public charging infrastructure. Under the higher home charging access scenario, the need for public and workplace L2 and DCFC infrastructure away from home decreased by 6 percent when home charging access for PEVs increased from 66 to 76 percent.

Under the lower home charging access scenario, the need for public and workplace L2 and DCFC infrastructure increased by 10 percent when home charging access decreased from 66 to 56 percent.

Whereas the *Home Charging Access in California Report* exclusively evaluated L1 home charging access through a survey respondent's perception of access, this assessment examines potential access to home charging, including L2 home charging based on estimations of residential panel capacity, tenure, and parking availability. This assessment is aligned with survey results from NREL on perceived access to home charging and survey results from the University of California, Davis, Institute of Transportation Studies on whether EV drivers use home L1, home L2, or public charging.

L2 home charging offers more flexibility in charging schedules and more opportunities for shifting load and minimizing electricity costs than L1 charging. Furthermore, studies indicate L2 charging is more electrically efficient than L1 charging[36] and that drivers limited to L1 charging at home are more likely to switch back to a gasoline vehicle than those that had access to a L2 charger from home.[37] While L1 charging is sufficient for some drivers, these reasons emphasize the importance of exploring access to L2 home charging.

The ability to charge from home is a key driver for PEV ownership but not everyone has access to at-home charging. A University of California, Davis study, based on survey results from California EV drivers, found that over 50 percent of BEV drivers living in multifamily housing charge exclusively at public charging stations.[38] According to the *Home Charging Access in California Report*, only 16 percent of multifamily residents perceive having existing access to an on-site L1 charger. Data also indicates that access is limited for renters and low-income

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[35] California Energy Commission staff. 2024. Assembly Bill 2127 Electric Vehicle Charging Infrastructure Assessment: Assessing Charging Needs to Support Zero-Emission Vehicles in 2030 and 2035. California Energy Commission. Publication Number: CEC-600-2024-003. Available at https://www.energy.ca.gov/data-reports/reports/electric-vehicle-charging-infrastructure-assessment-ab-2127. (See page 55 for alternative scenarios.)

[36] Sear, Justine, David Roberts, Karen Glitman. 2014. "A comparison of electric vehicle Level 1 and Level 2 charging efficiency." IEEE. Available at https://ieeexplore.ieee.org/document/7046253.

[37] Hardman, Scott, Gil Tal. 2021. "Why are Some California Consumers Abandoning Electric Vehicle Ownership?" National Center for Sustainable Transportation. Available at https://escholarship.org/uc/item/5s738624.

[38] Tal, Gil, Jae Hyun Lee, and Michael Nicholas. 2018. "Observed Charging Rates in California." University of California, Davis Institute of Transportation Studies. Research Report: UCD-ITS-WP-18-02. Available at https://escholarship.org/uc/item/2038613r.

residents.[39] Inequities are created when some drivers can conveniently charge from home and gain the cost savings from it while others are not.

The goal of this assessment is to evaluate private at-home and near-home public charging access through an equity lens to guide state planning and target public funding in a way that prevents disparities in charging access, including providing access to conveniently located public chargers near home that likely do not have home charging. This assessment will:

- Identify barriers to at-home charging installations and areas with collectively higher home charging barriers.
- Estimate the location of EVs in 2024 that have access to home charging.
- Of the EVs in 2024 that do not have access to home charging, estimate those with existing near-home public charging.
- Estimate the number of EVs in a hypothetical 100 percent EV future that have access to home charging given current trends.
- Examine how at-home and near-home charging access differs across housing types and geographic and sociodemographic factors to inform the design of charging programs, including equitable home charging programs and public fast charging programs.

Chapter 2 describes the methodology, including model inputs, assumptions, and outputs.

Chapter 3 provides results statewide, by disadvantaged or low-income community designation, and by urban or rural designation.

Chapter 4 concludes with a summary of results and their implications.

[39] Alexander, Matt. January 2022. *Home Charging Access in California*. California Energy Commission. Publication Number: CEC-600-2022-021. Available at https://www.energy.ca.gov/publications/2022/home-charging-access-california.

CHAPTER 2: Methods

Modeling Overview

This assessment uses residential property and parcel boundary data, single-family home (SFH) panel capacity estimations, data on vehicle registrations, and home charging survey results to estimate at-home charging potential amongst EVs in 2024 and EVs in a hypothetical 100 percent EV future. CEC staff assigned households to home charging barrier categories based on household type, panel capacity, year built, parking, and tenure:

- Low Barriers – Homes that have vehicles that park off street, are estimated to be panel ready[40], and are owner-occupied.
- Moderate Barriers – Homes that have vehicles that park off street and are either estimated to be almost panel ready[41] <u>or</u> are renter-occupied.
- High Barriers – Homes that have vehicles that park off street and are either, a) estimated to be almost panel ready <u>and</u> are renter-occupied, or b) are estimated to require a panel upgrade to support L2 home charging.
- No Access – Homes that do not have off street parking for vehicles and therefore require public charging.

CEC staff then applied statewide survey results to determine the percent of households that might have charging access within each barrier category, and staff further split this access into L1 and L2 based on observed charging patterns from early adopters of EVs. To estimate the number of vehicles owned by each household, staff used microdata from the US Census Bureau to extract a distribution of number of vehicles for a set of housing characteristics in a region, including type of home, home age, tenure, and number of bedrooms. Staff estimated current EV ownership based on the number of EVs registered in each ZIP code at the end of 2023 and the number of EVs sold in 2024 using DMV data aggregated on the CEC Zero Emission Vehicle and Infrastructure Statistics dashboard. Finally, to assess the ability of the existing public charging network to serve EVs in 2024 estimated to lack home charging, staff matched households without home charging to nearby existing public L2 and DCFCs. Figure 2 provides an overview of methods.

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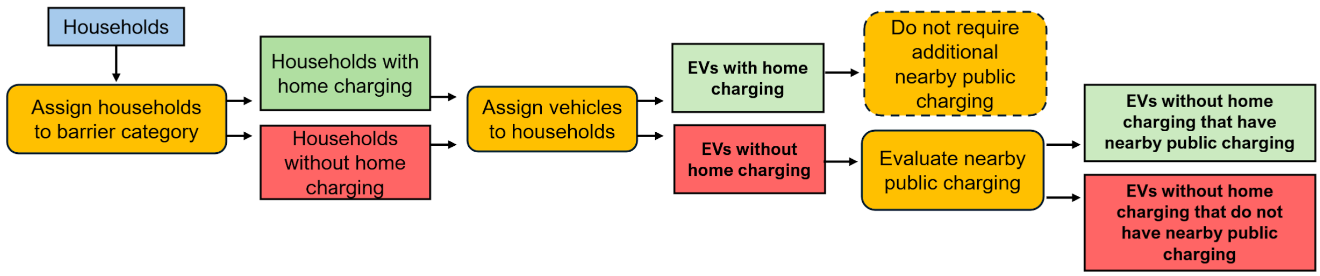
[40] Single-family homes with estimated panels of 150 Amps or greater are considered panel ready. Multifamily homes built in or after 1980 are estimated to be panel ready.

[41] Single-family homes with estimated panels of 100 Amps or 125 Amps are considered almost panel ready.

Figure 2: Modeling Overview



Source: CEC

Model Inputs

Table 1 shows data inputs to the model to estimate potential home charging and public charging distribution for homes estimated to lack home charging. CEC purchased property and parcel boundary data from CoreLogic, Incorporated that includes information on parcel location, ownership, tax assessment, and property characteristics.[42] CEC staff implemented quality control and standardization procedures to the CoreLogic data before imputing housing attributes into the model to estimate barriers to home charging.

CEC staff collaborated with CARB staff and researchers from the University of California, Los Angeles California Center for Sustainable Communities (UCLA) to estimate panel capacity at SFHs.[43] Appendix C describes how staff inferred panel size for SFHs to estimate barriers to home charging.

CEC staff applied results from a 2020 survey of perceived access to home charging in California to estimate the proportion of households with home charging access.[44] The survey collected information on available home parking options, existing 120-volt (V) electricity near a parking location, perceived ability to install 120V electricity where parking is available, and other sociodemographic and housing characteristics. The full survey can be found in Appendix D. Appendix E shows results from the *Home Charging Access in California Report* used to estimate households likely to have home charging access. To estimate whether households can sufficiently meet charging demand from home, staff applied additional survey results from

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[42] CoreLogic, Inc. and/or its subsidiaries retain all ownership rights in the data, which end user agree is proprietary to CoreLogic. All Rights Reserved. The data is provided AS IS; end user assumes all risk on any use or reliance on the data.

[43] Fournier, Eric, Robert Cudd, Samantha Smithies, and Stephanie Pincetl. June 2024. "Quantifying the electric service panel capacities of California's residential buildings." Energy Policy, Vol. 192, https://www.sciencedirect.com/science/article/pii/S0301421524002581.

[44] In 2020, CEC partnered with NREL to conduct a survey on home charging access and parking in California, which garnered 1,286 respondents. Full details can be found in: Alexander, Matt. January 2022. *Home Charging Access in California*. California Energy Commission. Publication Number: CEC-600-2022-021. Available at https://www.energy.ca.gov/publications/2022/home-charging-access-california.

the University of California, Davis and the International Council on Clean Transportation (ICCT) of EV drivers and whether they charge from a home L1, home L2, or public charger.[45, 46]

CEC staff collected and analyzed data on number of vehicles by home type, home age, number of bedrooms, and tenure from the American Community Survey Public Use Microdata Sample (PUMS) to estimate the number of vehicles at households. Staff collected data from the Zero Emission Vehicle and Infrastructure Statistics Dashboard (ZEV Dashboard) to estimate the number of EVs in each zip code in 2024.[47] Staff collected data on existing public L2 and DCFCs from the U.S. Department of Energy's Alternative Fuels Data Center and PlugShare and evaluated proximity to EVs estimated to not have home charging.

Table 1: Description of Model Inputs

Data Input	Source	Geographic Resolution	Assumptions Formed
Housing Type Housing Vintage Tenure Parking (on- or off-street)	CoreLogic, Incorporated	Parcels	Barriers to home charging
SFH Panel Size	University of California, Los Angeles, California Center for Sustainable Communities	Parcels	Barriers to home charging
Home Charging Access	National Renewable Energy Laboratory Home Charging Access Survey	Statewide	Potential access to at-home Level 1 charging
Home Charging Access	University of California, Davis	Statewide	Access to Level 1 or Level 2 home charging
Household Vehicles	Public Use Microdata Sample	Public Use Microdata Areas	Household vehicle assignment
Vehicle Registration by Fuel Type	Zero Emission Vehicle and Infrastructure Statistics Dashboard	Zip Codes	EV adoption
Locations of Public Charging Stations	U.S. Department of Energy's Alternative Fuels Data Center and PlugShare	Latitude and Longitude Points	Public charging station distribution around households without home charging

Source: CEC

[45] The survey garnered 2,831 respondents from EV drivers statewide. Tal, Gil, Jae Hyun Lee, and Michael Nicholas. 2018. "Observed Charging Rates in California." University of California, Davis Institute of Transportation Studies. Research Report: UCD-ITS-WP-18-02. Available at https://escholarship.org/uc/item/2038613r.

[46] Nicholas, Michael, Dale Hall, and Nic Lutsey. 2019. Quantifying the Electric Vehicle Charging Infrastructure Gap Across U.S. Markets. International Council of Clean Transportation. Available at https://theicct.org/publication/quantifying-the-electric-vehicle-charging-infrastructure-gap-across-u-s-markets/.

[47] California Energy Commission (2024). Zero Emission Vehicle and Infrastructure Statistics – Collection. Data last updated December 31, 2023. Retrieved April 30, 2024 at https://www.energy.ca.gov/data-reports/energy-almanac/zero-emission-vehicle-and-infrastructure-statistics-collection.

Home Charging Barriers

Factors evaluated that contribute to being able to install an L2 home charger, include:

- Panel capacity
- Tenure
- Parking

SFHs with estimated panels of 150A or greater are considered panel ready for L2 home charging. Whereas those with 100A or 125A panels are almost panel ready, and those with less than 100A panels likely require a panel upgrade to enable L2 home charging. Although analysis by Pecan Street[48] suggests relatively high-power requirements of 18kW, staff acknowledge that lower power L2 or even L1 meets many people's needs. However, all else being equal, larger panels make incorporation of an EV charger easier. In the future, staff expect larger vehicle batteries and more than one EV in the home, which would require higher power L2 home charging. Appendix C provides more information on inferring panel size at SFHs.

At multi-family homes (MFHs), a house panel controls the electrical supply for shared appliances and common-area amenities. Since data on house panels at MFHs is limited, staff used home age as a proxy to assess panel capacity at MFHs. A study by Ecology Action found that MFHs built after 1980 likely have 60A of power available for EV charging.[49] Legacy electric panels in older buildings typically have lower current ratings and fewer breaker slots and may not easily accommodate an EV charger. Based on this, staff consider MFHs built in or after 1980 to be more panel ready and those built before to require a panel upgrade to support L2 charging.

In addition to panel capacity, tenure plays a significant role in the ability to install charging at home. Renters generally have less control over physical changes to homes than owners. Renters also have less of an incentive to invest money in upgrading a home since they are more likely to move after a few years.

Critical to the ability to charge at home is parking availability. CEC staff used CoreLogic data to identify parking availability and whether households have on- or off-street parking, or a mix of both. Staff assigned each household with off-street parking to one of three home charging access categories based on its panel readiness and tenure and assigned all households with on-street parking to the no access category. Households without access to charging at home are assumed to require public charging.

Table 2 defines home charging barrier categories, Table 3 displays SFH barrier category assignment, and Table 4 displays MFH barrier category assignment.

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[48] Pecan Street. 2021. Addressing an Electrification Roadblock: Residential Electric Panel Capacity. Available at https://www.pecanstreet.org/2021/08/panel-size/.

[49] Bryan, Sherry and Mahlon Aldridge. November 2020. Innovation in Electric Vehicle Charging for Multi-Unit Dwellings. Available at https://www.peninsulacleanenergy.com/wp-content/uploads/2021/05/Ecology-Action-Level-1-Plan-for-MUDs.pdf.

Table 2: Home Charging Barrier Category Definitions

Barrier	Definition
Low	Panel ready and Owner-occupied and Off-street parking
Moderate	Panel ready and Renter-occupied or Almost panel ready and Owner-occupied and Off-street parking
High	Almost panel ready and Renter-occupied or Panel needs upgrade and Off-street parking
No Access	On-street parking

Source: CEC

Table 3: Home Charging Barrier Assignment for Single-Family Homes

Barrier Assignment	Panel Capacity	Tenure	Parking Availability
Low	≥ 150A	Owner	Off-street
Moderate	≥ 150A	Renter	Off-street
Moderate	100A or 125A	Owner	Off-street
High	100A or 125A	Renter	Off-street
High	< 100 A	--	Off-street
No Access	--	--	On-street

Source: CEC

Table 4: Home Charging Barrier Assignment for Multi-Family Homes

Barrier Assignment	Year Built	Tenure	Parking Availability
Low	≥ 1980	Owner	Off-street
Moderate	≥ 1980	Renter	Off-street
High	< 1980	--	Off-street
No Access	--	--	On-street

Source: CEC

Home Charging Access

To estimate the proportion of households with home charging access in each barrier category, CEC staff applied results from a 2020 survey conducted by NREL for the *Home Charging Access in California Report,*[50] which evaluated potential access to L1 home charging.

- About 36 percent of SFHs in California lack potential access to home charging and require public charging.
- About 72 percent of MFHs in California lack potential access to home charging and require public charging.

This report evaluates access to L1 and L2 home charging and assumes that most households with access to L1 charging at home can upgrade to a L2 home charger given sufficient panel capacity. CEC staff assigned individual households to two groups – those with and those without home charging – so that overall statewide results align with survey results from the *Home Charging Access in California Report.*

CEC staff assigned single-family and multi-family households from barrier categories to those likely with and without home charging to align with statewide results. For SFHs, as illustrated by Figure 3,

- Households likely with home charging include 80 percent of households from the low barrier category, 65 percent from the moderate, and 25 percent from the high barrier category. This results in 64 percent of SFHs with potential access to home charging. This leaves 36 percent of SFHs without potential access to home charging.

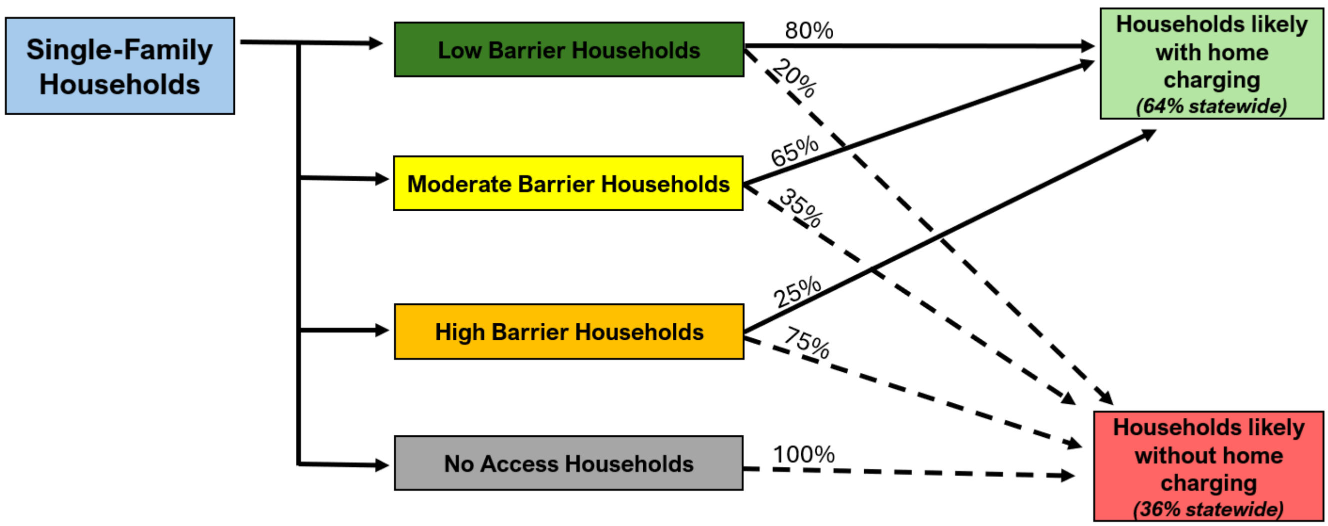
For MFHs, as illustrated by Figure 4,

- Households likely with home charging include 60 percent of households from the low barrier category, 40 percent from the moderate, and 20 percent from the high barrier category. This results in 28 percent of MFHs with potential access to home charging. This leaves 72 percent of MFHs without potential access to home charging.

[50] In 2020, CEC partnered with NREL to conduct a survey on home charging access and parking in California, which garnered 1,286 respondents. Full details can be found in: Alexander, Matt. January 2022. *Home Charging Access in California*. California Energy Commission. Publication Number: CEC-600-2022-021. Available at https://www.energy.ca.gov/publications/2022/home-charging-access-california.

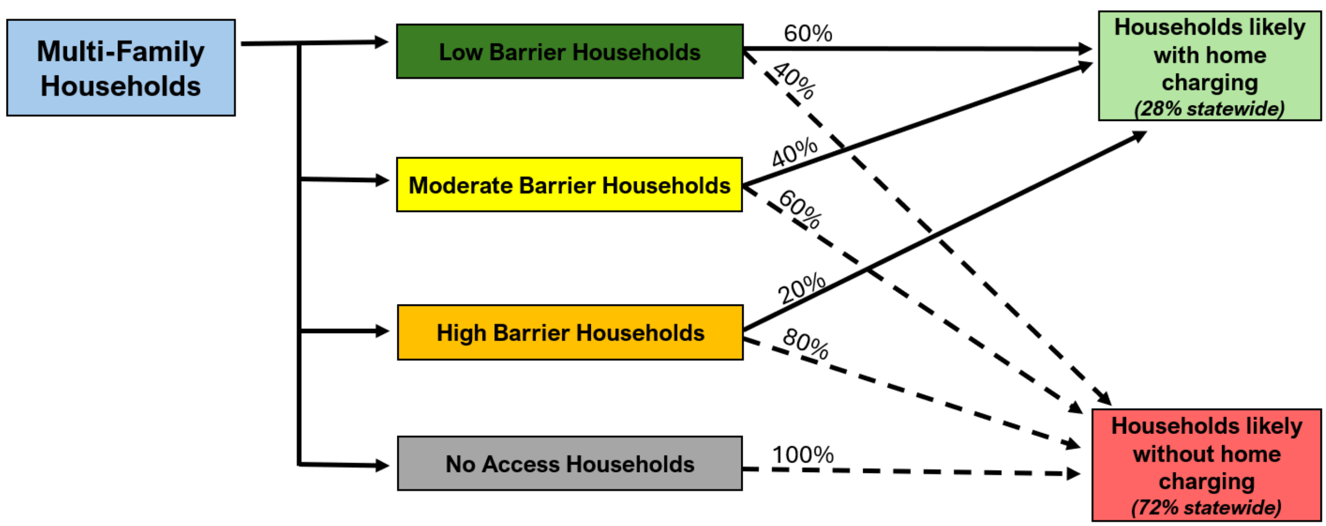
[51] Ibid.

Figure 3: Estimating Single-Family Households Likely With and Without Home Charging



Source: CEC

Figure 4: Estimating Multi-Family Households Likely With and Without Home Charging



Source: CEC

To estimate the number of vehicles at households, CEC staff collected and analyzed data from the American Community Survey Public Use Microdata Sample (PUMS)[52]. For households with vehicles that park on- and off-street, staff estimated that drivers would move their vehicles in such a way that would enable and optimize charging from home 70 percent of the time, resulting in public charging the remaining 30 percent.

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[52] To track regional variation in vehicle ownership, staff performed this analysis separately for each of the 281 Public Use Microdata Areas (PUMA) in California. A PUMA is a geographic unit for which the US Census Bureau provides complete household-level results from the American Community Survey. Staff assigned vehicles to households such that the distribution of vehicle ownership for a given set of housing characteristics within a PUMA matches the weighted distribution of vehicles owned by matching households in the PUMS data for that PUMA. For example if 10% of the owner-occupied 3-bedroom homes in the PUMS data for PUMA *0600101* have 3 cars, then staff assign 3 cars to 10% of the matching households in our dataset.

To estimate the number of EVs in 2024 by zip code likely with and without home charging, CEC staff combined zip code level 2023 vehicle population and 2024 new vehicle sales data from the ZEV Dashboard.[53] Then, staff calculated EV adoption rates for homes likely with and without home charging at the zip code level. This was done in a way to ensure that total EV adoption in each zip code aligned with the ZEV Dashboard while maintaining set ratios of adoption between SFHs and MFHs with and without charging in each zip code:

- Vehicles at SFHs with home charging are 3 times more likely to have adopted an EV than vehicles at MFHs with home charging in the same zip code.
- Vehicles at SFHs with home charging are 7.5 times more likely to have adopted an EV than vehicles at SFHs without home charging in the same zip code.
- Vehicles at MFHs with home charging are 3 times more likely to have adopted an EV than vehicles at MFHs without home charging in the same zip code.

To estimate the number of EVs in a 100 percent hypothetical EV future, staff used 2024 vehicle counts and assumed that all of these vehicles would be EVs.

To estimate whether households can sufficiently meet charging demand from home, staff applied additional survey results of EV drivers and whether they reported charging from a home L1, home L2, or public charger within the past 30 days. [54,55] As a result:

- Among those having home charging, about 72 percent of high-range BEVs[56] from SFHs likely have access to home L2 and 28 percent have access to home L1.
- Among those having home charging, about 35 percent of high-range BEVs from MFHs likely have access to home L2 and 65 percent have access to home L1.

EVs estimated to likely have L2 home charging are assumed to be able to sufficiently meet charging demand from home. Whereas EVs estimated to likely have L1 home charging are assumed to be able to sufficiently meet charging demand from home 80 percent of the time and require charging away from home the other 20 percent.

Access to Public Near-Home Charging

EVs without sufficient home charging require charging away from home. Public charging near home may be an alternative to home charging for some drivers. While EVs without home charging may access charging in a variety of ways, this assessment evaluates two scenarios for near-home charging that may serve EVs without home charging[57]:

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[53] California Energy Commission (2024). Zero Emission Vehicle and Infrastructure Statistics – Collection. Data last updated December 31, 2023. Retrieved April 30, 2024 at https://www.energy.ca.gov/data-reports/energy-almanac/zero-emission-vehicle-and-infrastructure-statistics-collection.

[54] Tal, Gil, Jae Hyun Lee, and Michael Nicholas. 2018. "Observed Charging Rates in California." University of California, Davis Institute of Transportation Studies. Research Report: UCD-ITS-WP-18-02. Available at https://escholarship.org/uc/item/2038613r.

[55] Nicholas, Michael, Dale Hall, and Nic Lutsey. 2019. Quantifying the Electric Vehicle Charging Infrastructure Gap Across U.S. Markets. International Council of Clean Transportation. Available at https://theicct.org/publication/quantifying-the-electric-vehicle-charging-infrastructure-gap-across-u-s-markets/.

[56] In this survey, "high range BEV" included all BEVs with at least 150 miles of range.

[57] Workplace charging is another option for drivers without access to home charging, however, was not evaluated due limited data on shared-private workplace chargers.

- Neighborhood public L2 or DC fast charging – Public charging within two miles of home. Two miles is estimated to be conveniently located within most neighborhoods for drivers to charge for short durations at a public L2 or DCFC, potentially while running errands or doing other activities.
- Walking-distance public L2 charging – Public charging within an eighth of a mile from home. An eighth of a mile is estimated to be within walking distance for most drivers to leave their EV parked and charging at a public L2 for several hours, including overnight.

While the above scenarios are used for this analysis, staff note that the availability of near-home charging is subject to many variables, including existing land use, zoning, and local permitting. For instance, zoning could prevent installation of public chargers in some residential areas, which would include households within an eighth of a mile. The two-mile near-home scenario accounts for areas where there may be fewer restrictions for collocating public chargers with amenities near households. Furthermore, staff recognize that chargers located further than two miles could also provide charging for EVs without home charging, especially if they are enroute to work or other frequently visited destinations further from home.

Staff collected data on existing public L2 and DCFCs to evaluate proximity to EVs estimated to not have home charging. Additionally, staff estimated public charging capacity at night and during the day to evaluate how many EVs without home charging a public charger could potentially serve. Staff made the following assumptions:

- A public L2 charger may sufficiently charge
  - Three EVs without home charging overnight (on different nights) for long duration charging. Staff estimate that these EVs will not have to compete with other EVs that can sufficiently charge from home.[58]
  - Two EVs without home charging during the day for short duration charging. Staff estimate that these EVs will have to compete with other EVs that can sufficiently charge from home.[59]
- A public DCFC may sufficiently charge
  - 30 EVs without home charging during the day for short duration charging. Staff estimate that these EVs will have to compete with other EVs on long-distance trips.[60]
  - Public DCFC would not be used for overnight charging.

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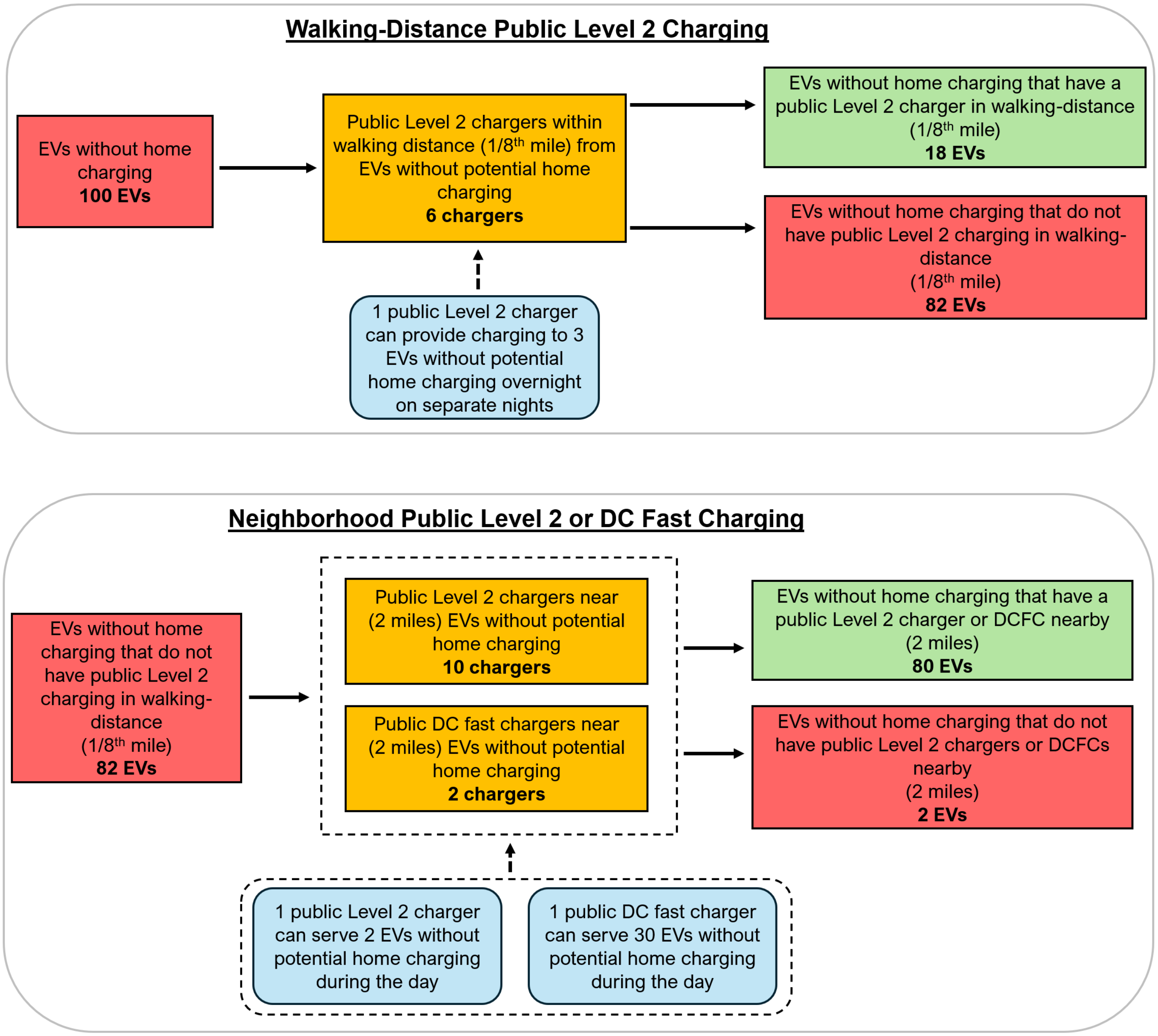
[58] The basis for this assumption is that a 6.6 kW L2 charger can provide 66 kWh of charging in a 10 hour overnight charging session. Assuming a vehicle can travel about 3 miles on a kWh of charge, an overnight charging session can provide up to 198 miles of range. Light-duty vehicles in the US travel about 11,000 miles each year or 30 miles per day on average, meaning one overnight charging event would provide at least six days of charge for an average vehicle or three days of charge for a vehicle driven twice as far each day. Assuming each vehicle needs to charge overnight every three days, then a single charger can provide overnight charging for up to three vehicles. Source: Federal Highway Administration, 2021. Annual Vehicle Distance Traveled in Miles and Related Data by Highway Category and Vehicle Type. Available at https://www.fhwa.dot.gov/policyinformation/statistics/2021/pdf/vm1.pdf.

[59] Using the same annual mileage and efficiency assumptions as the overnight L2 case above, a 6.6 kW L2 charger with a capacity factor of 15% could meet the average daily needs of 2.7 EVs each day through a series of shorter charging events, with each vehicle requiring about 90 minutes of L2 charging per day to provide for routine travel. Staff discount this to 2 EVs to account for competing uses.

[60] Using the same annual mileage and efficiency assumptions as the overnight L2 case above, a 150 kW fast charger with a capacity factor of 10% could meet the average daily energy needs of about 35 EVs each day. Staff discount this to 30 to account for competing uses.

Figure 5 provides an example of how staff estimated EVs likely without home charging that could receive a charge from near-home public chargers within walking distance of home (eighth of a mile) or within the neighborhood (two miles). The scenario starts with 100 EVs without home charging and posits six L2 chargers within walking distance, ten neighborhood L2s and two DCFCs. EVs are assigned to the public near-home chargers and in this example there are 2 EVs without home charging and without near-home public charging.

Figure 5: Estimating Access to Public Near-Home Charging for EVs Likely Without Home Charging



Source: CEC

Geographical Distribution of Electric Vehicles Estimated to Lack Home Charging, Public Walking-Distance, or Public Neighborhood Charging

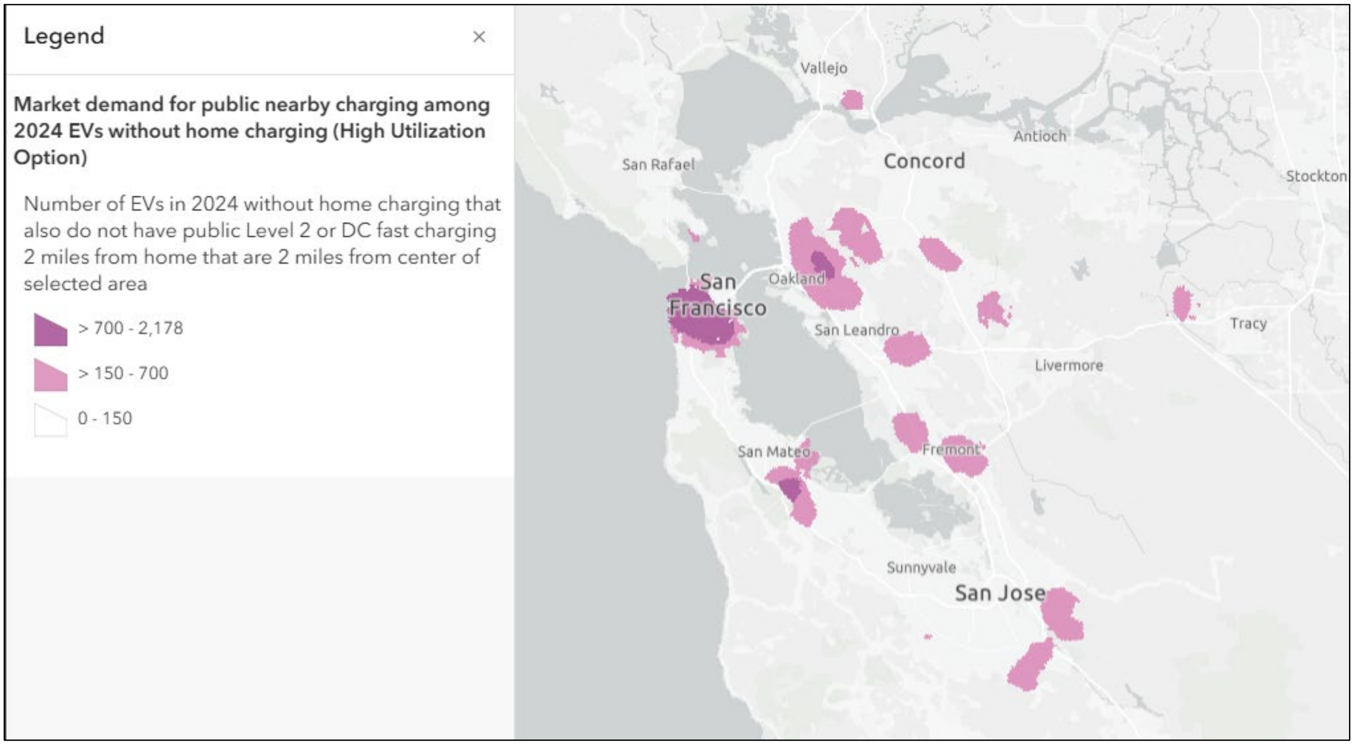
Household level results were aggregated into quarter-mile areas and displayed on the Near-Home Public Charging Demand From Electric Vehicles Without Home Charging: Senate Bill 1000 Assessment Map, available at https://www.energy.ca.gov/programs-and-topics/programs/clean-transportation-program/electric-vehicle-infrastructure/near-home. The interactive map displays areas where installing public charging can meet demand for EVs likely without home charging that also do not have existing near-home public charging. The map includes results on concentrations of:

- EVs in 2024 estimated to lack sufficient home charging due to barriers to installing a home charger.
- EVs in 2024 estimated to lack home charging and public charging within two miles of households.
- EVs in 2024 estimated to lack home charging that also lack public L2 chargers within an eighth of a mile of households.
- EVs in a 100 percent EV future estimated to not have home charging capability.

The map displays areas where installing public charging could provide charging access for EVs within two miles that likely do not have charging at home and do not have near-home public charging. Deploying public chargers in areas with high concentrations of EVs without home and existing near-home public charging could improve access for EV drivers. Viewers can additionally turn on and off layers to see where installing public Level 2 charging could provide charging access within an eighth of a mile of households that have barriers to installing a home charger. It is important to note that deploying chargers within two miles or an eighth of a mile of households is not the only way to improve charging access for EV drivers as there are several ways to improve access for drivers with varying travel patterns and preferences.

Figure 6 shows a snapshot of the map and estimated market demand for public L2 or DCFC within two miles of households. Generally, high concentrations of EVs without home charging that also do not have public L2 or DCFC within 2 miles of households occur in pockets of the Bay Area and parts of the Los Angeles and San Diego areas. Deploying additional public chargers in these areas could provide more options for charging near-home for drivers that rely on charging away from home.

Figure 6: Market Demand in the Bay Area for Public Near-Home Charging Among Electric Vehicles in 2024 Without Home Charging



Source: CEC

Users can also turn on and off layers including:

- Location of DACs or LICs
- Location of urban or rural areas
- Location of federally recognized tribes

CHAPTER 3: Model Results

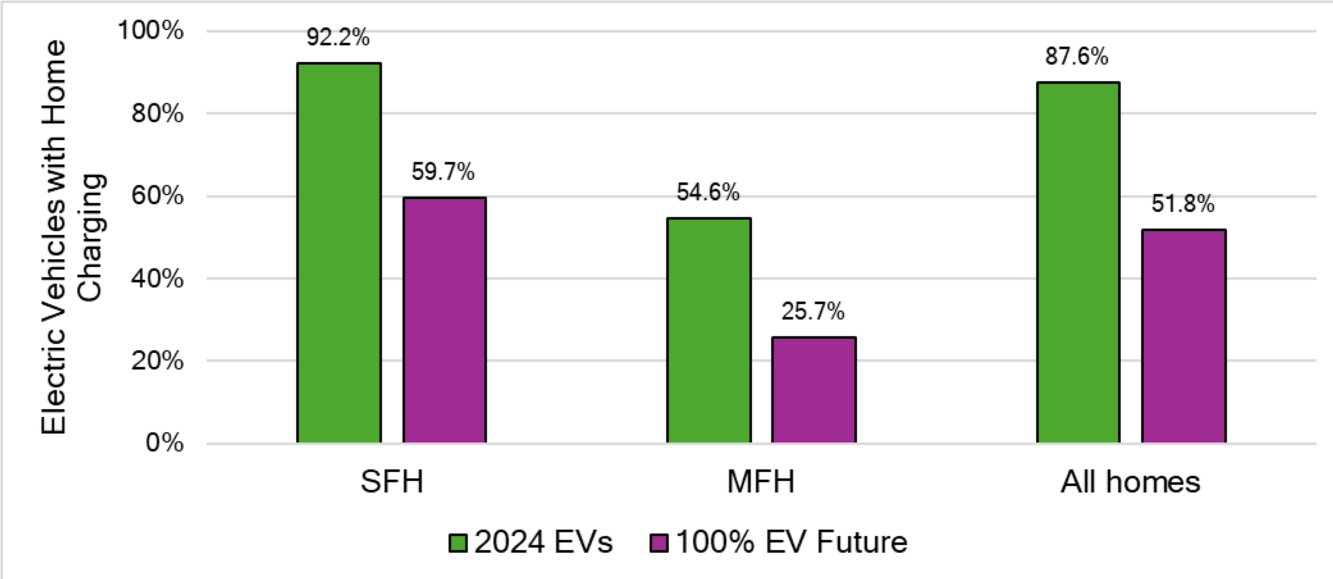
Home Charging Access

Figure 7 shows the percent of EVs statewide in 2024 and in a hypothetical 100 percent EV future that are estimated to have home charging by housing type. Across all housing types, about 88 percent of EVs in California today are estimated to have home L1 or home L2 charging. In a hypothetical 100 percent EV future, where all vehicles in 2024 are estimated to be electric, home charging access among EVs drops from 88 percent to 52 percent.

Estimated home charging among EVs in 2024 from SFHs is above 90 percent (representing 81 percent of all EVs). Panel capacity is a primary driver of home charging access. In the model, SFHs with estimated panels of 150A or greater were assigned to the low barrier category where staff estimated that 80 percent of households likely have home charging. About 56 percent of all SFHs in California are estimated to have panels with 150A or greater. SFHs with estimated panels of 100A or 125A were assigned to the moderate barrier category where 65 percent of households were estimated to likely have home charging. About 41 percent of all SFHs in the state are estimated to have 100A or 125A panels. The remaining 3 percent of SFHs have panels with less than 100A and 25 percent of these homes were estimated to likely have home charging. Furthermore, about 80 percent of SFHs are owner-occupied, which puts more SFHs into the low barriers than moderate barriers category. Appendix G provides detailed results including breakouts by barrier category and panel capacity.

In MFHs, about half of EVs in 2024 are estimated to have home charging (representing 7 percent of all EVs). The model assumes that MFHs generally have greater barriers to home charging than SFHs. About 80 percent of SFHs in the low barriers category are assumed to have home charging whereas 60 percent of MFHs in the low barriers category are assumed to have access. Similarly, fewer MFHs in the moderate barriers category are estimated to have home charging compared to SFHs in the same category. More than half of all MFHs are estimated to be built before 1980 (62 percent), which puts more MFHs in the high barriers category where 80 percent are estimated to not have home charging. More renters in MFHs (71 percent) than owners (29 percent) means that more MFHs were assigned to the moderate barrier category relative to low barriers.

Figure 7: Percent of Electric Vehicles Estimated to Have Home Charging by Housing Type



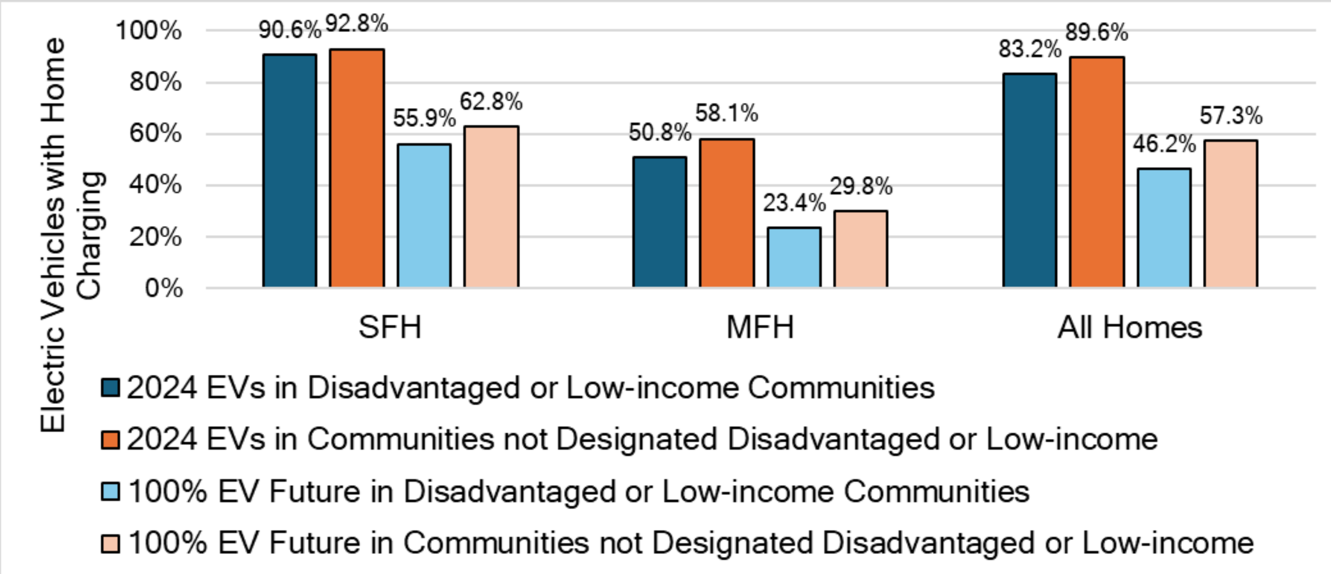
Source: CEC

Electric Vehicles in Disadvantaged or Low-Income Communities on Average Have Less Access to Home Charging

Results were aggregated by census tract to compare EVs in DACs, designated by the California Environmental Protection Agency (CalEPA) through Senate Bill (SB) 535, or designated as low-income by CARB through Assembly Bill (AB) 1550, to communities not designated as DAC or LIC. Appendix A defines DACs and LICs. Results were also aggregated by communities designated as low-, middle-, or high-income, which are also defined in Appendix A. Results by income level can be found in Appendix F.

More than half of all Californians live in a DAC or LIC. Approximately 31 percent of EVs in 2024 are estimated to be from DACs or LICs, and about 50 percent of EVs in a 100 percent EV future are from DACs or LICs. Figure 8 shows the percent of EVs in 2024 estimated to have home charging and the percent of EVs in a hypothetical 100 percent EV future estimated to have home access by DAC or LIC designation. Results indicate that on average, compared to communities not designated as DAC or LIC, DACs or LICs have less access to home charging today and in a hypothetical future where all vehicles are EVs. Notable is the difference among EVs in MFHs in the future scenario – less than 25 percent of EVs on average within DACs or LICs likely have home charging (representing 3 percent of all future EVs).

Figure 8: Electric Vehicles Estimated to Have Home Charging by Disadvantaged or Low-income Designation



Source: CEC

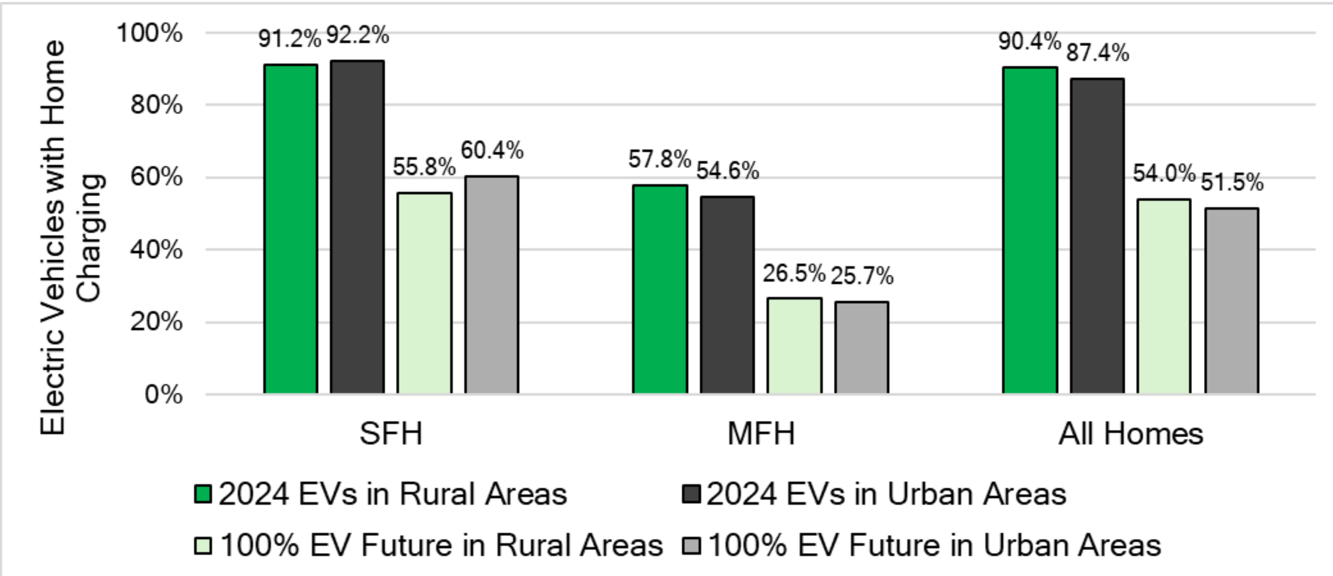
Driving these results are SFH panel capacity, MFH year built, and tenure. As previously reported, most SFHs are estimated to have panels that are equal to or greater than 100A (96.3 percent) which puts them into the low or moderate home charging barrier category resulting in more SFHs likely with home charging. In DACs or LICs, about 93.5 percent of SFHs are estimated to have panels that are equal to or greater than 100A. More SFHs in communities not designated as DAC or LIC have panels equal to or greater than 100A (98.6 percent). Furthermore, a higher percentage of SFHs in communities not designated as DAC or LIC have panels that are equal to or greater than 150A which means more are estimated to have home charging than in DACs or LICs (60.3 percent in communities not designated as DAC or LIC versus 49.8 percent in DACs or LICs).

Generally, home charging among MFHs is lower since the model assumes greater barriers to home charging in MFHs than in SFHs, and more MFHs were built prior to 1980 and renter occupied. DACs or LICs, on average, have a greater share of MFHs built prior to 1980 than communities not designated as DAC or LIC (68.2 percent compared to 51.9 percent). DACs or LICs also have more renters on average than communities not designated as DAC or LIC (75.2 percent compared to 62.1 percent). This results in fewer MFHs and EVs within MFHs with home charging, on average, and as a result fewer home chargers in DACs or LICs than communities not designated as DAC or LIC. Appendix G provides detailed results including breakouts by LIC or DAC designation.

Electric Vehicles in Urban Areas on Average Have Less Access to Home Charging

Results were additionally broken out by urban or rural area. Appendix A defines urban and rural areas for this assessment. About 89 percent of Californians live in an urban area, about 94 percent of EVs in 2024 are estimated to be from urban areas, and about 87 percent of EVs in a 100 percent EV future are estimated to be from urban areas. The remaining are from rural areas. About 83.8 percent of all SFHs and about 96.7 percent of all MFHs are in urban areas. The remaining are in rural areas. Figure 9 shows the percent of EVs in 2024 estimated to have home charging and the percent of EVs in a hypothetical 100 percent EV future estimated to have access by urban or rural designation. There is little difference in average access to home charging between urban and rural areas. That said, EVs in urban areas on average appear to have slightly less access to home charging than EVs in rural areas both in 2024 and in a hypothetical future where all vehicles are EVs.

Figure 9: Electric Vehicles Estimated to Have Home Charging by Population Density



Source: CEC

There are more SFHs in rural areas with less than 100A panels than in urban areas (4.6 percent versus 3.6 percent). This combined with a higher percentage of SFH renters in rural areas than urban areas (30.6 percent versus 17.5 percent) results in a slightly lower percentage of SFHs from rural areas estimated to have home charging compared to in urban areas. At the opposite end, more MFHs in urban areas were built before 1980 and therefore are estimated to need panel upgrades than in rural areas (62.6 percent versus 54 percent). The percent of renters in urban MFHs is also higher than in rural MFHs (70.4 percent versus 51.1 percent). This combination results in EVs in urban MFHs having slightly lower home charging access compared to EVs in rural MFHs.

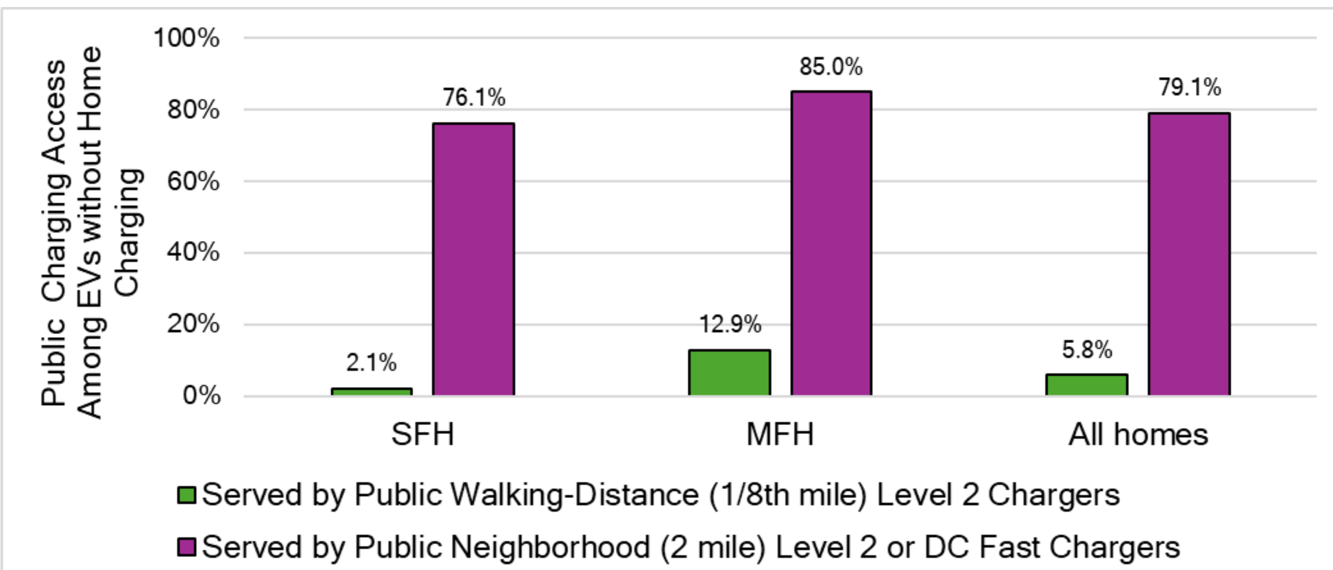
Access to Public Near-Home Charging

EVs without sufficient home charging require charging away from home. Staff evaluated proximity of existing public chargers to EVs in 2024 likely without home charging.

- About 60 percent of public L2 chargers are within walking distance, or an eighth of a mile, from an EV estimated to not have sufficient home charging in 2024.
- About 99.6 percent of public L2 and about 98.7 percent of public DCFCs are within the neighborhood, or two miles, of EVs estimated to not have sufficient home charging in 2024.

Figure 10 shows the percent of EVs by housing type estimated to not have sufficient home charging that have near-home public L2 charging within walking distance or public L2 or DCFC within two miles. In 2024, about 6 percent of EVs likely without sufficient home charging have public L2 within walking distance. As mentioned before, the availability of public charging close to homes is subject to many variables including, but not limited to, existing land use, zoning, and local permitting. Generally, EVs without sufficient home charging at MFHs have better access to public L2s within walking distance than EVs at SFHs. Access to nearby neighborhood public L2 or DC fast charging is generally high for EVs estimated to not have sufficient home charging. About 79 percent of EVs without sufficient home charging have a public charger with sufficient capacity within two miles.

Figure 10: Percent of Electric Vehicles in 2024 Without Home Charging That Have Public Chargers Within Two Miles of Households



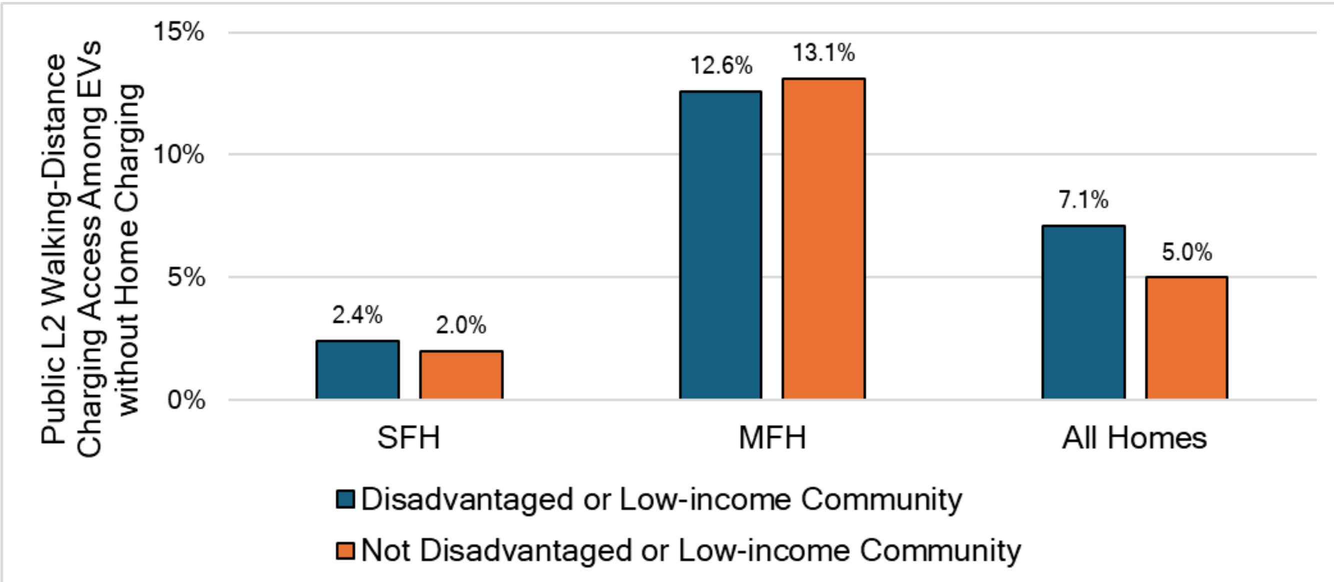
Source: CEC

Electric Vehicles Without Sufficient Home Charging in Disadvantaged or Low-Income Communities Have More Access to Near-Home Public Charging on Average

As previously reported, EVs in DACs or LICs, on average are estimated to have less access to sufficient home charging than communities not designated as DAC or LIC. But among EVs without sufficient home charging, those in DACs or LICs have more access to near-home public charging than communities not designated as DAC or LIC, as shown by Figures 11 and

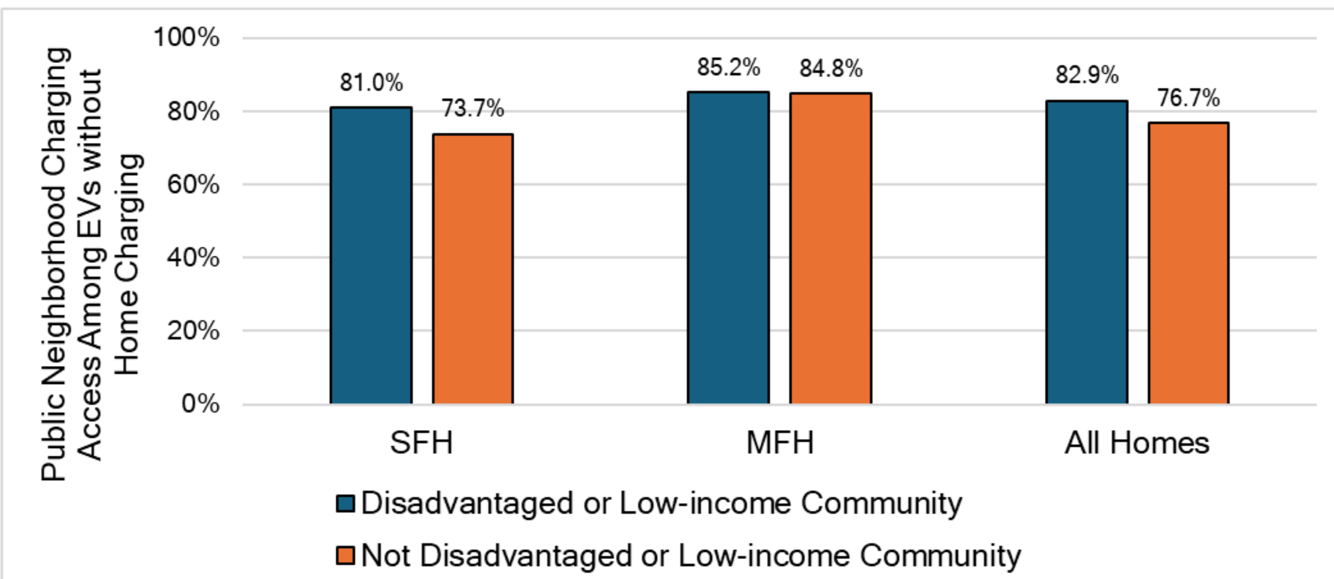
12. The exception to this are EVs in MFHs without sufficient home charging. Access to walking-distance public L2s are worse among EVs without home charging in DACs or LICs on average.

Figure 11: Public Level 2 Charging Within an Eighth of a Mile of Electric Vehicles in 2024 Without Sufficient Home Charging by Disadvantaged or Low-income Designation



Source: CEC

Figure 12: Public Level 2 or DC Fast Charging Within Two Miles of Electric Vehicles in 2024 Without Sufficient Home Charging by Disadvantaged or Low-income Designation

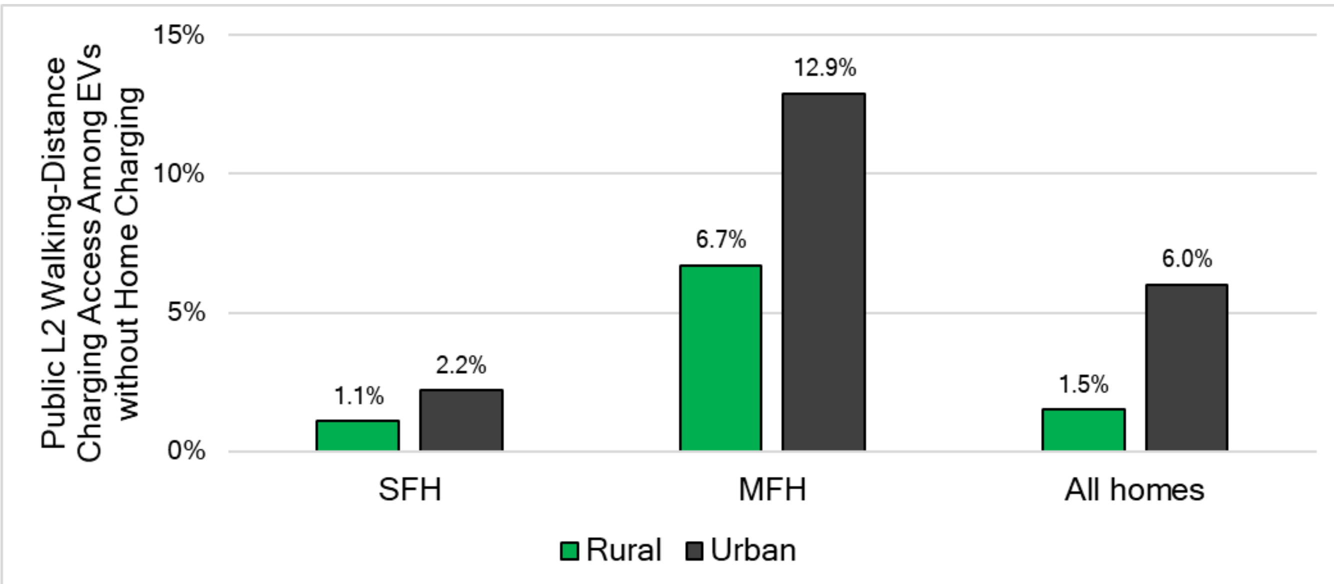


Source: CEC

Electric Vehicles Without Sufficient Home Charging in Urban Areas are Twice as Likely to Have Access to Near-Home Public Charging as Rural Areas

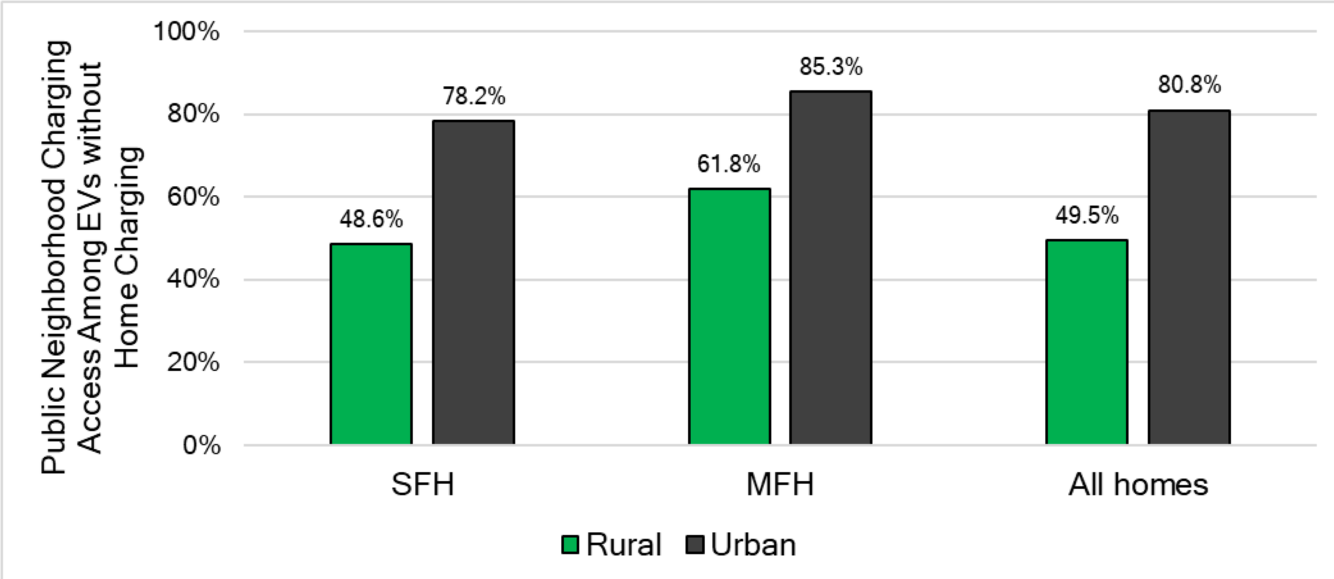
EVs in urban areas on average have slightly less access to home charging than rural areas but among EVs estimated to not have home charging, those in urban areas, on average, have higher access to near-home public charging than in rural areas. Figure 13 shows that among EVs without sufficient home charging, those in urban areas are four times as likely to have access to a public L2 in walking distance as rural areas. EVs without sufficient home charging in urban areas are twice as likely to have access to a public L2 or DCFC within 2 miles of home as rural areas, as shown by Figure 14.

Figure 13: Public Level 2 Charging Within an Eighth of a Mile of Electric Vehicles in 2024 Without Sufficient Home Charging by Population Density



Source: CEC

Figure 14: Public Level 2 or DC Fast Charging Within Two Miles of Electric Vehicles in 2024 Without Sufficient Home Charging by Population Density



Source: CEC

CEC staff evaluated approximate locations of public L2 chargers within walking distance (eighth mile, representing 60% of chargers), and public L2 and DCFCs within the neighborhood (two miles, representing 99% of chargers) of an EV without home charging. For each charger, the nearest land use type from parcel data was extracted. This analysis characterizes site type for public chargers within an eighth of a mile and two miles from households. Table 5 shows the distribution of land use types for public chargers within walking distance from households and within the neighborhood.

More than 50 percent of public L2 chargers that are within walking distance of households are in residential areas. Drivers can walk to and from these charging sites while their vehicle charges for several hours, including overnight. Likewise, about 40 percent of public L2 or DCFCs within two miles of EVs are in residential areas. About 25 percent of public chargers within two miles of households are in commercial areas where drivers could shop or do other activities while charging.

Table 5: Percent of Public Chargers Nearby EVs Estimated to Not Have Sufficient Home Charging by Location Type

Location Type	Percent of Walking Distance Public Chargers	Percent of Neighborhood Public Chargers
RESIDENTIAL - SINGLE FAMILY	28.7%	19.2%
RESIDENTIAL - MULTI-FAMILY	27.3%	18.3%
COMMERCIAL	11.9%	14.8%
COMMERCIAL - SHOPPING	6.7%	7.9%
OFFICE	5.6%	6.9%
INDUSTRIAL	3.9%	8.3%
PARKING	2.7%	2.6%
RESIDENTIAL - OTHER	2.2%	1.7%
COMMERCIAL - FOOD SERVICE	2.0%	2.4%
HOTEL, MOTEL	1.9%	2.3%
GOVERNMENT	1.6%	2.2%
MEDICAL	1.0%	1.3%
GAS STATION	0.9%	1.1%
RECREATION	0.7%	0.9%
OTHER	0.6%	1.0%
RELIGIOUS	0.5%	0.5%
EDUCATION	0.5%	0.8%
AGRICULTURAL	0.5%	1.1%
COMMERCIAL - GROCERY	0.5%	0.4%
UNKNOWN	0.2%	6.0%
PARK	0.2%	0.2%
COMMERCIAL - ENTERTAINMENT	0.0%	0.0%
AIRPORT	0.0%	0.1%
COMMUNITY CENTER	0.0%	0.0%
TRIBAL	0.0%	0.0%

Source: CEC

CHAPTER 4: Conclusions

The results from this assessment show where at-home charging may be lacking for EV drivers and where near-home public charging is not currently available. Results provide several insights:

- **Fine scale estimates of home charging allow for more precise targeting of public charging need.** Parcel-level data along with supporting data from other studies give greater clarity on high areas of demand and underserved EVs.
- **Residents of harder to electrify MFHs in California, predominantly renter occupied and built before 1980, will more likely require alternatives to home charging.** Offering alternatives for home charging, especially for MFH residents, such as neighborhood charging and curbside charging, will be critical as EV adoption grows. For example, the CEC's Reliable, Equitable, and Accessible Charging for Multifamily Housing solicitation series promotes replicable and scalable business and technology models for large-scale deployment of EV charging infrastructure that will maximize access and EV travel for MFH residents.
- **Retrofits of existing buildings and new MFH construction should continue to maximize EV ready, EV capable, or electric vehicle supply equipment (EVSE) installed parking spaces.**[61] Increasing access to home charging will decrease the need for public charging. Costs can be reduced significantly if parking is made EV capable or chargers are installed during construction or associated with other major renovations.
- **Although most EVs at SFHs today are estimated to have home charging, some do not, and home charging access is expected to decrease as EV adoption grows.** Many current EV owners self-select based on the ease of home charging installation. Some currently rely on L1, but L2 charging may be increasingly important to support larger battery sizes and flexibility in charging schedules. Further, home electrification efforts will also require sufficient panel capacity to support new electrical loads. Efforts to prepare homes with cost-effective electrical upgrades will ease this transition along with technologies designed to maximize small panels by shifting load among high power electric loads such as water heaters, dryers, heating and cooling and stoves.

Model results indicate that most EVs in California today have home charging access, particularly among EVs at SFHs. However, disparities in home charging access exist based on housing type, whether a residence is owner or renter occupied, disadvantaged community designation, income level, and population density. On average, fewer EVs from MFHs have access to home charging compared to SFHs. Similarly, fewer EVs within communities

[61] 2022 CALGreen code definitions:
EV Capable Space – A vehicle space with electrical panel space and load capacity to support a branch circuit and necessary raceways, both underground and/or surface mounted, to support EV charging.
EV Ready Space – A vehicle space which is provided with a branch circuit; any necessary raceways, both underground and/or surface mounted; to accommodate EV charging, terminating in a receptacle or a charger.

designated as disadvantaged or low-income have access compared to communities not designated as low-income or disadvantaged and the same applies for EVs in urban areas versus rural areas, respectively. In a hypothetical 100 percent EV future, only about half of EVs statewide are expected to have home charging. For some communities, like those designated as disadvantaged or low-income and living in MFHs, on average, only about a quarter of future EVs are expected to have home charging (representing 3 percent of all future EVs).

These home charging results reinforce the importance of supporting charging installations at multi-family properties and offering non-home charging options as EV adoption grows beyond early adopters. Public charging near home may be an alternative to home charging for some drivers. This assessment estimates that about 20 percent of EVs in 2024 without sufficient home charging also lack public L2 or DC fast charging within two miles of home (representing 4 percent of all EVs in 2024). Expanding access to public charging near home will provide more households with a charging option that is convenient, especially if workplace charging and charging enroute to frequent destinations is unavailable. It is important to note that deploying public chargers within two miles of households with EVs that lack home charging is subject to many variables, including local permitting, zoning, and existing land use. Therefore, it is one way but not the only way to provide charging access to EVs without home charging.

This assessment has limitations that future research could improve. For instance, the model assumes that 36 percent of SFHs and 72 percent of MFHs in California lack potential access to home charging. These assumptions come from a survey based on perceived access to L1 home charging. The model for this assessment assumes that most households with access to L1 charging at home could upgrade to an L2 but future surveys on access to 240V for L2 charging at home would be a better input into the model. Further, household-level income data were not available and higher income households may have greater ability to overcome panel capacity and other barriers. Survey instruments that better target frontline equity communities and their preferences for home and near-home charging would also better inform what kinds of charging best serve these communities.

The assessment only distinguishes between on- and off-street parking as household level parking data on assigned versus unassigned parking at MFHs is limited and cannot offer conclusive results. Proximity of electrical service access points to available parking or desired charging sites is a known barrier for charging installation at MFHs but this was not measured due to limited data. Additionally, assessment of peak house panel loads would improve estimates of sufficient electrical capacity to accommodate a home charger, however limited data made this not possible.

Furthermore, this assessment forms results based on current and historic data. Changes to future housing stock, new construction trends, movement of people, and other factors, were not considered in this assessment but could impact charging access and vehicle ownership and would be informative and aid planning efforts. Updating this assessment over time will improve measurement of charging access as EV adoption grows.

The results from this assessment provide a significant step forward in understanding charging access. CEC staff can more accurately assess disparities in charging access by analyzing which population groups have barriers to home charging, and which drivers have to travel farther from home to access charging. The CEC created the Near-Home Public Charging Demand From Electric Vehicles Without Home Charging: SB 1000 Assessment Map, available at https://www.energy.ca.gov/programs-and-topics/programs/clean-transportation-program/electric-vehicle-infrastructure/near-home, which displays fine level estimates of EVs in a hypothetical 100 percent EV future estimated to lack home charging, and EVs in 2024 estimated to lack sufficient home charging or near-home public charging, including public charging within walking distance or in the neighborhood. This tool incorporates multiple layers, including layers on equity, on top of the results from this home charging assessment, and can be used by decisionmakers to help design a public charging network that improves charging access for all EV drivers.

GLOSSARY

CALENVIROSCREEN – A mapping tool that helps identify California communities that are most affected by many sources of pollution, and where people are often especially vulnerable to pollution's effects.

CALENVIROSCREEN SCORE – A percentile rank given to each California Census Tract in relation to the rest of California based on potential exposures to pollutants, adverse environmental conditions, socioeconomic factors, and prevalence of certain health conditions. This data is provided by the Office of Environmental Health Hazard Assessment (OEHHA). For more information on the CalEnviroScreen Score and how it is calculated, please go to www.oehha.ca.gov.

CENSUS TRACT – Small, relatively permanent statistical subdivisions of a county or equivalent entity that are updated by local participants prior to each decennial census as part of the U.S. Census Bureau's Participant Statistical Areas Program. Census tracts generally have a population size between 1,200 and 8,000 people, with an optimum size of 4,000 people. A census tract usually covers a contiguous area; however, the spatial size of census tracts varies widely depending on the density of settlement. Census tract boundaries generally follow visible and identifiable features.

CHARGER – The system within an EVSE that charges one EV. A charger may have multiple connectors, but it can provide power to charge only one EV through one connector at a time. Also referred to as a charging port.

CHARGING STATION – A physical address where one or more chargers are available for use. This is the same usage as for "gas station." A charging station can be public, shared private, or private.

DIRECT CURRENT FAST CHARGER (DCFC) – Electric vehicle charging anywhere from 200 to 1,000 volts using direct current.

DISADVANTAGED COMMUNITIES – Census tracts that score within the top 25th percentile of the Office of Environmental Health Hazards Assessment's California Communities Environmental Health Screening Tool (CalEnviroScreen) 4.0 scores, as well as areas of high pollution and low population, such as ports.

ELECTRIC VEHICLE (EV) – A broad category that includes all vehicles that can be fully powered by electricity or an electric motor.

ELECTRIC VEHICLE CHARGING STATION – An electric vehicle charging station, also called EV charging station, electric recharging point, charging point, charge point, electronic charging station (ECS), and electric vehicle supply equipment (EVSE), is an element in an infrastructure that supplies electric energy for the recharging of plug-in electric vehicles — including electric cars, neighborhood electric vehicles, and plug-in hybrids.

ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE) – A device with one or more charging ports and connectors for charging EVs.

HIGH-INCOME COMMUNITIES – Census tracts with median household income at or above 120 percent of the statewide median income or with median household incomes at or above the threshold designated as moderate-income by the Department of Housing and Community Development's list of state income limits adopted pursuant to section 50093 of the California Health and Safety Code.

LEVEL 1 (L1) CHARGING – Electric vehicle charging at 120 volts using alternating current.

LEVEL 2 (L2) CHARGING – Electric vehicle charging at 240 volts using alternating current.

LOW-INCOME COMMUNITIES – Census tracts with median household incomes at or below 80 percent of the statewide median income or with median household incomes at or below the threshold designated as low income by the Department of Housing and Community Development's list of state income limits adopted pursuant to Section 50093 of the California Health and Safety Code.

MIDDLE-INCOME COMMUNITIES – Census tracts with median household incomes between 80 to 120 percent of the statewide median income, or with median household incomes between the threshold designated as low- and moderate-income by the Department of Housing and Community Development's list of state income limits adopted pursuant to section 50093 of the California Health and Safety Code.

MULTIFAMILY HOME (MFH) – (also known as multi-unit dwelling or MUD) is a classification of housing where separate housing units for residential inhabitants are contained within one building or several buildings within one complex. Units can be next to each other (side-by-side units) or stacked on top of each other (top and bottom units). A common form is an apartment building. Many intentional communities incorporate multifamily residences, such as in cohousing projects.

RURAL CENTERS – Contiguous urban census tracts with a population of less than 50,0000. Urban census tracts are tracts where at least 10 percent of the tract's land area is designated as urban by the Census Bureau using the 2020 urbanized area criteria.

RURAL COMMUNITIES – Census tracts where less than 10 percent of the tract's land area is designated as urban by the Census Bureau using the 2020 urbanized area criteria.

SINGLE-FAMILY HOME (SFH) – Units that are separated by a ground-to-roof wall, have separate heating system, individual meters for public utilities, and no units located above or below. May include fully detached, semi-detached, row houses, duplexes, and townhomes.

TENURE – Identifies whether a housing unit is owner- or renter-occupied.

URBAN COMMUNITIES – Contiguous urban census tracts with a population of 50,000 or greater. Urban census tracts are tracts where at least 10 percent of the tract's land area is designated as urban by the Census Bureau using the 2020 urbanized area criteria.

APPENDIX A:
New Income, Disadvantaged Community, and Urban/Rural Designations

Previous reports referred to the 2017 designations of Senate Bill (SB) 535 disadvantaged communities (DACs), 2020 designations of low-, middle-, and high-income communities, and 2010 designations of urban and rural areas. These were the most recent final designations available at the time of analysis. Since the publication of these reports, California Environmental Protection Agency (CalEPA), U.S. Census Bureau (Census), and California Energy Commission (CEC) in consultation with the California Air Resources Board (CARB) have updated these designations. Appendix A compares designations used in previous reports and this report.

Disadvantaged Community Designations

In May 2022, the California Environmental Protection Agency (CalEPA) released an updated designation of DACs[62] for the purposes of Senate Bill (SB) 535 (De León, Statutes of 2012, Chapter 830) which establishes minimum funding level requirements for DACs.[63] Like previous designations, they relied on the Office of Environmental Health Hazzard Assessment's (OEHHA) mapping tool, the California Communities Environmental Health Screening Tool (CalEnviroScreen), to make these designations.[64] CalEnviroScreen screens environmental, public health and socioeconomic conditions data to identify California communities that are disproportionately burdened by multiple sources of pollution and especially vulnerable to pollution's effects. CalEPA's 2022 designation of DACs includes:

1. Census tracts that received the highest 25 percent of overall scores in CalEnviroScreen 4.0.
2. Census tracks that lacked overall scores in CalEnviroScreen 4.0 due to data gaps but received the highest 5 percent of CalEnviroScreen 4.0 cumulative pollution burden scores.
3. Census tracts identified in the 2017 designation as disadvantaged, regardless of their scores in CalEnviroScreen 4.0.
4. Lands under the control of federally recognized Tribes.

Figure A-1 displays the updated disadvantaged community designation.

[62] California Environmental Protection Agency (CalEPA), California Climate Investments to Benefit Disadvantaged Communities: Updated Disadvantaged Communities Designation (May 3, 2022). Available at https://calepa.ca.gov/envjustice/ghginvest/.

[63] Senate Bill 535 (De León), Chapter 830, Statutes of 2012. Available at https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201120120SB535.

[64] California Office of Environmental Health Hazard Assessment (OEHHA), SB 535 Disadvantaged Communities. Available at https://oehha.ca.gov/calenviroscreen/sb535.

Figure A-1: Map of Disadvantaged Communities

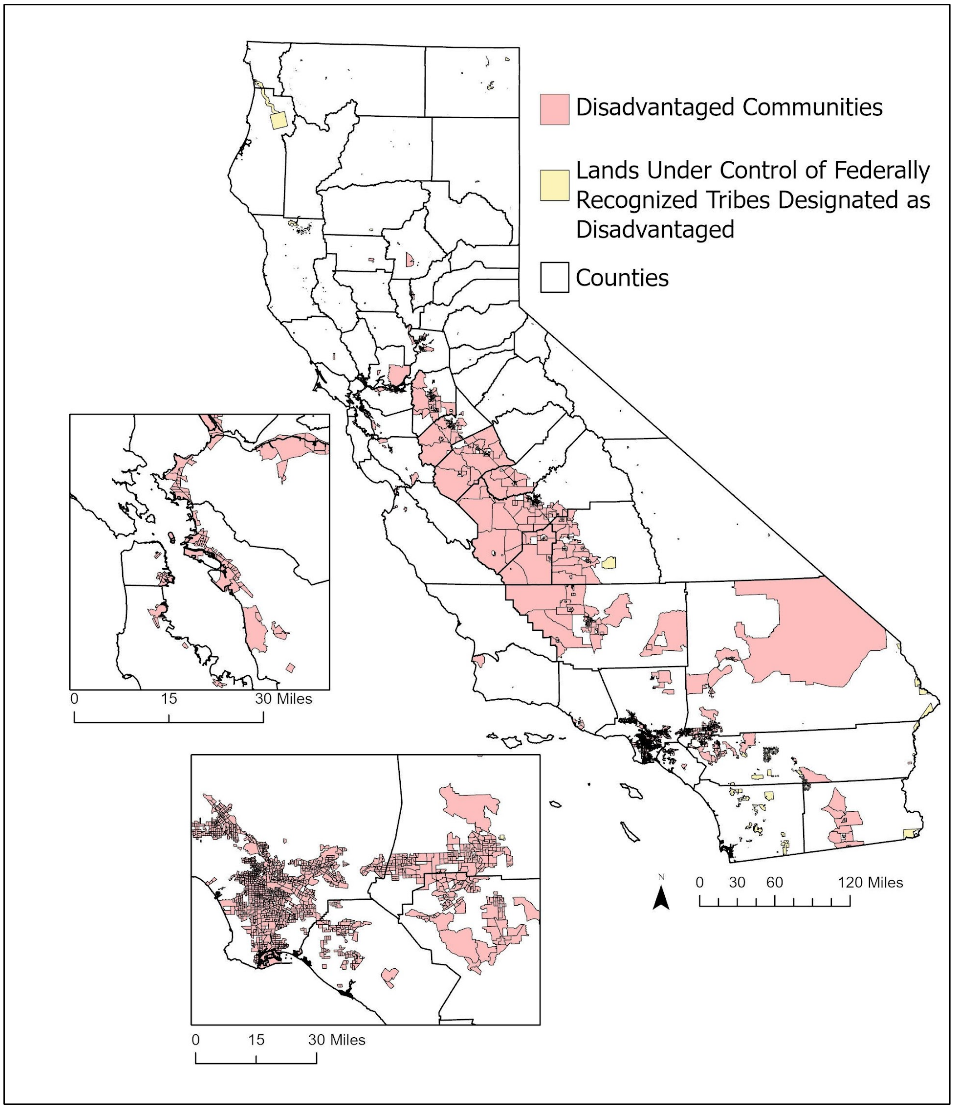


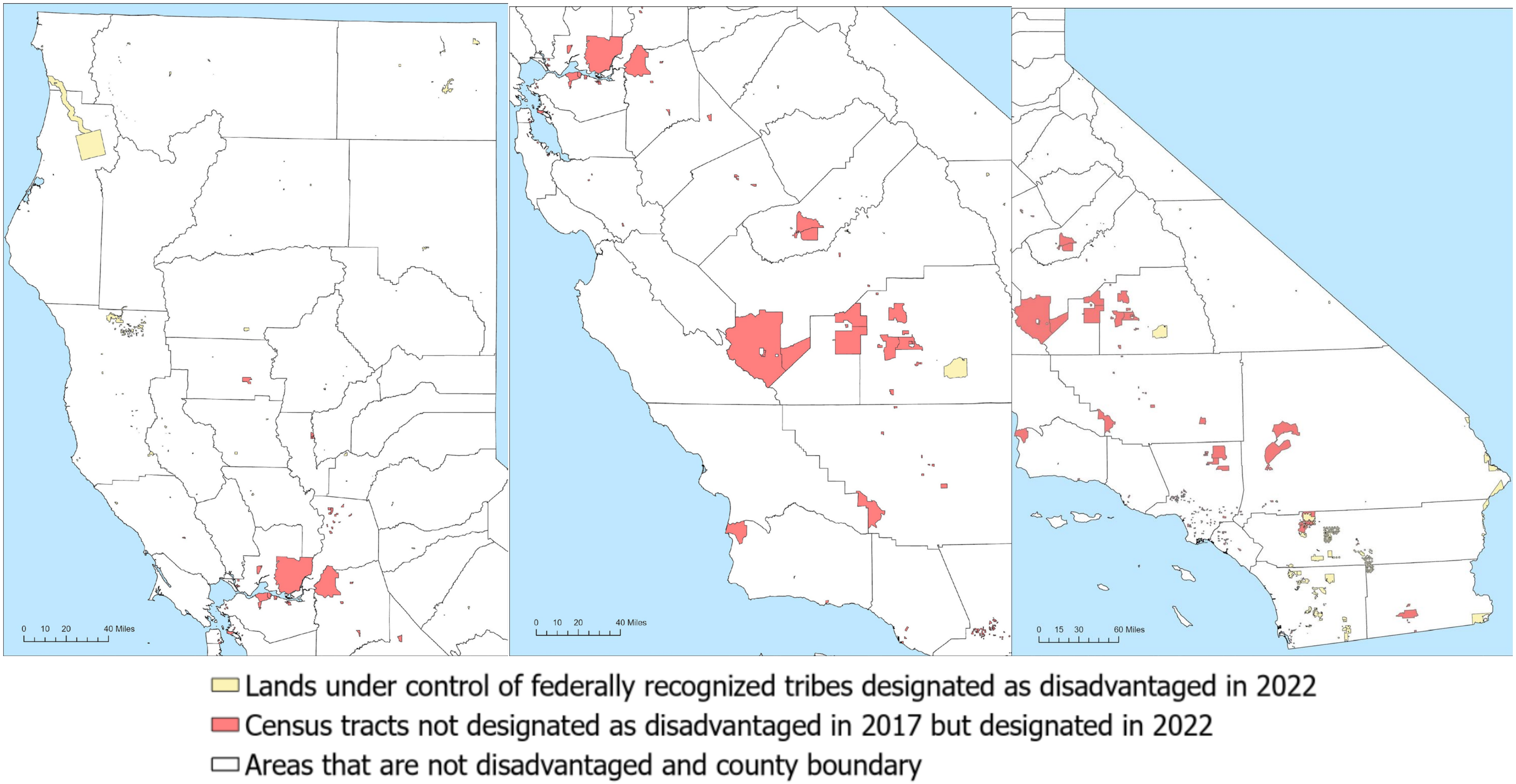
Table A-1 displays the total number of DAC census tracts in 2017 and 2022 and provides a breakdown of census tracts within the four categories of disadvantaged geographic areas. The new designation adds 305 census tracts plus lands under the control of federally recognized Tribes to the 2017 designation of DACs; these are shown in Figure A-2.

Table A-1: Breakdown of 2017 and 2022 Disadvantaged Community Designations

	Previous DAC Designation (2017)	**New DAC Designation (2022)***
# of census tracts that received the highest 25% scores	1,983	1,984
# of census tracts that lacked overall scores but received the highest 5% cumulative pollution burden scores	22	19
# of census tracts identified in a previous DAC designation as disadvantaged	0	307
# of federally recognized Tribes	0	106
Total # census tracts (Not including lands under control of federally recognized tribes)	**2,005**	**2,310**

*New DAC designations as of May 2022 were used for the 2024 SB 1000 report. The 2022 SB 1000 report used the previous 2017 designation.

Figure A-2: Additional Census Tracts Designated as Disadvantaged in 2022



Source: CEC

Low-, Middle-, and High-income Community Designations

The California Air Resources Board (CARB) also released updated designations of low-income communities (LICs) in May 2022 for the purposes of Assembly Bill (AB) 1550, which establishes minimum funding level requirements for LICs.[65] AB 1550 defines LICs as census tracts with median household incomes at or below 80 percent of the statewide median income or with median household incomes at or below the threshold designated as low income by the Department of Housing and Community Development's (HCD's) list of state income limits adopted pursuant to Health and Safety Code section 50093. The process that CARB staff used to designate LICs was:

1. Identify the median household income of census tracts from the 2015-2019 American Community Survey (ACS) 5-year median household income table (B19013).
2. Identify the average household size of census tracts from the 2015-2019 ACS 5-year average household size of occupied housing units by tenure table (B25010).
3. Identify the county of census tracts.
4. Use the county and household size of the census tract to match the income limit identified as "low-income" in HCD's State Income Limits for the county using HCD's Revised State Income Limits for 2021, released December 31, 2021.
5. Identify the statewide median household income. The statewide median household income from the I.S. Census Bureau and ACS QuickFacts California 2019 Tables based on 2015-2019 5-year estimates is $75,235.
6. A census tract is identified as low-income if the census tract's median household income is at or below the matched HCD low-income limit, or if it is at or below 80 percent of the statewide median household income.
   a. For census tracts where there was insufficient sample size to apply a median household income, staff substituted a baseline statewide median household income ($75,235). In these cases, a census tract is identified as low-income if the baseline income is at or below the matched HCD low-income limit.

CARB released New 2022 Update to the Identification of Low-Income Communities: A Methodology and Documentation for Maps under AB 1550, available at https://ww2.arb.ca.gov/sites/default/files/auction-proceeds/map/ab1550pp4licmethodology2022.pdf. This documentation provides more information on the methodology applied to designate 2022 LICs.

CEC staff applied this same methodology to identify middle- and high-income communities with the following exceptions:

- A census tract is identified as middle-income if the census tract's median household income is between the matched HCD's low- and moderate-income limit, or if it is between 80 to 120 percent of the statewide median household income ($60,188 - $90,282).

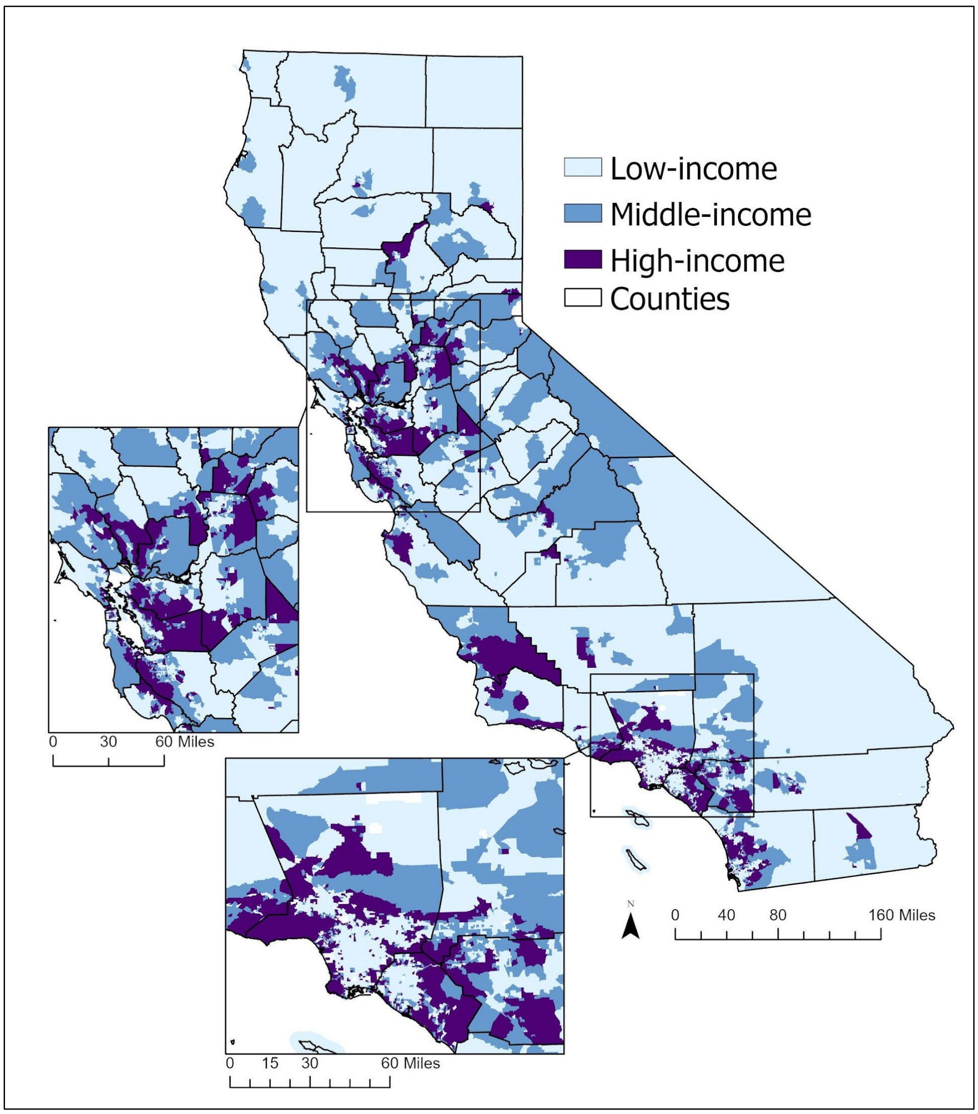
65 Assembly Bil 1550 (Gomez), Chapter 369, Statutes of 2016. Available at https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160AB1550.

- A census tract is identified as high-income if the census tract's median household income is at or above the matched HCD moderate-income limit, or if it is at or above 120 percent of the statewide median household income.
- For census tracts where there was insufficient sample size to apply a median household income, staff substituted a baseline statewide median household income ($75,235). In these cases, a census tract is identified as middle-income if the baseline income is between the matched HCD's low- and moderate-income limit. A census tract is identified as high-income if the baseline income is at or above the matched HCD's moderate-income limit.

If a census tract meets multiple income level definitions the census tract is designated as the lower income level. For example, if a census tract meets both the middle- and high-income definitions, staff designates it as a middle-income community (MIC).

Figure A-3 displays updated low-, middle-, and high-income community designations.

Figure A-3: Map of Low-, Middle-, and High-income Communities



Source: CEC

In 2020, to identify low-, middle-, and high-income communities (LICs, MICs, and HICs), staff applied the same methodology with data from the American Community Survey 2018 5-year estimates. The exception was that census tracts with insufficient sample sizes were not designated as low-, middle-, or high-income. These census tracts did not have a designated income group. Table A-2 shows the total number of low-, middle-, and high-income census tracts in 2020 and 2022. The new designations result in:

- 222 fewer low-income census tracts that were previously designated as low-income.
- 200 additional low-income census tracts that were not previously designated as low-income.
- 343 fewer middle-income census tracts that were previously designated as middle-income.
- 348 additional middle-income census tracts that were not previously designated as middle-income.
- 155 fewer high-income census tracts that were previously designated as high-income.
- 185 additional high-income census tracts that were not previously designated as high-income.
- 79 census tracts without an income designation as opposed to 92 census tracts in 2020.

These changes are shown in Figures A-4, A-5, and A-6.

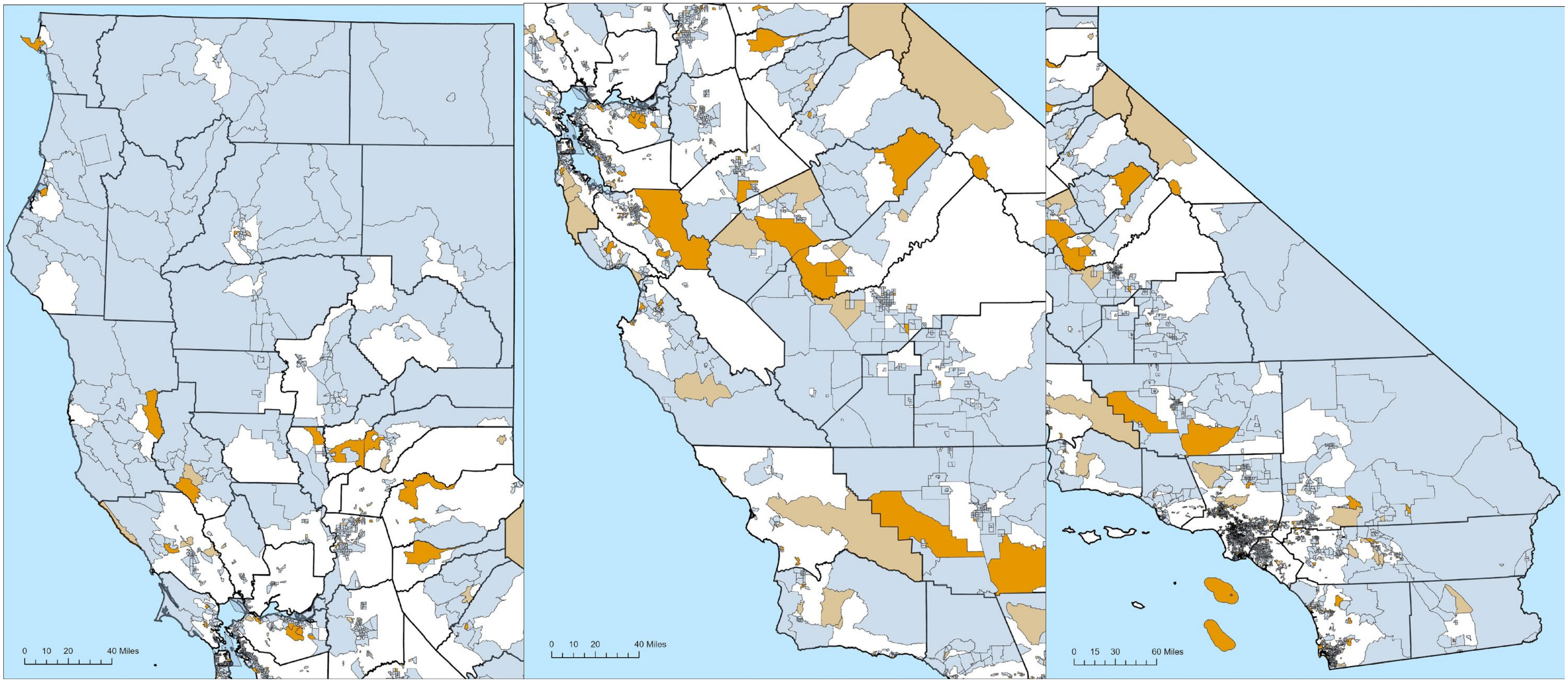
Table A-2: Breakdown of 2020 and 2022 Low-, Middle-, and High-Income Community Designations

	Total # of Census Tracts
Previous LIC Designation (2020)	4,536
New LIC Designation (2022)*	4,514
Previous MIC Designation (2020)	1,744
New MIC Designation (2022)*	1,749
Previous HIC Designation (2020)	1,685
New HIC Designation (2022)*	1,715

*New LIC, MIC, and HIC designations as of May 2022 were used for the 2024 SB 1000 report. The 2022 SB 1000 report used the previous 2020 designations.

Source: CEC

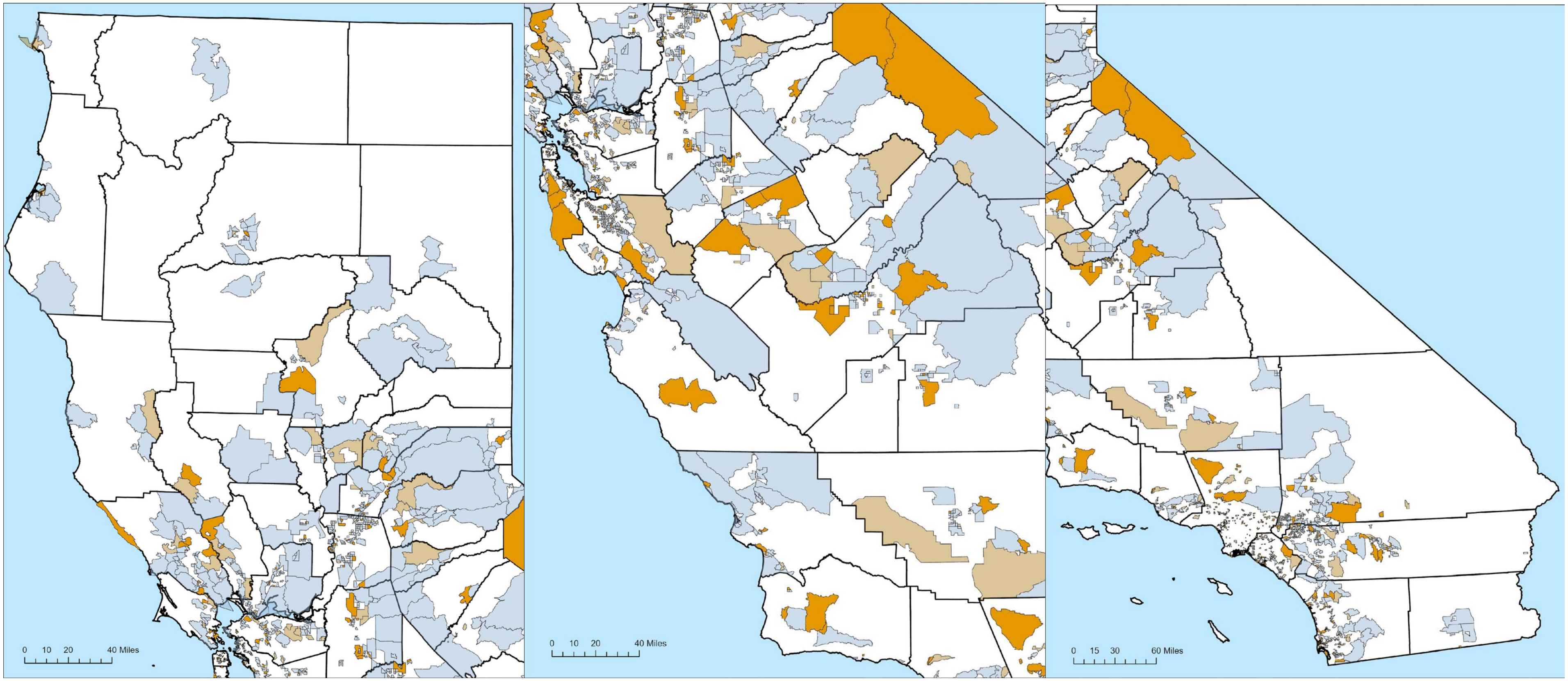
Figure A-4: Changes in Census Tracts Designated as Low-income



Census tracts designated as low-income in 2020 and 2022
Census tracts not designated as low-income in 2020 but designated in 2022
Census tracts not designated as low-income in 2022 but designated in 2020
Areas that are not low-income and county boundary

Source: CEC

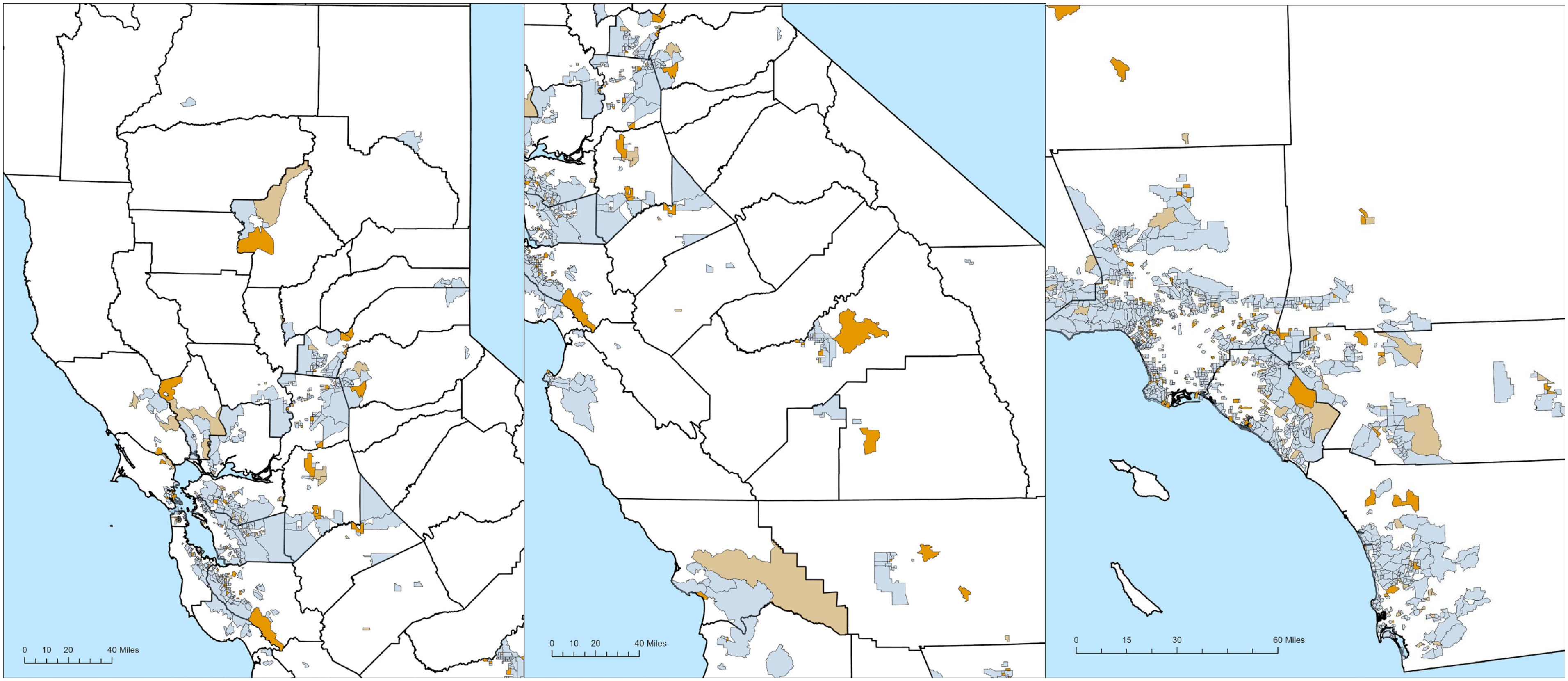
Figure A-5: Changes in Census Tracts Designated as Middle-income



Census tracts designated as middle-income in 2020 and 2022
Census tracts not designated as middle-income in 2020 but designated in 2022
Census tracts not designated as middle-income in 2022 but designated in 2020
Areas that are not middle-income and county boundary

Source: CEC

Figure A-6: Changes in Census Tracts Designated as High-income



Census tracts designated as high-income in 2020 and 2022
Census tracts not designated as high-income in 2022 but designated in 2020
Census tracts not designated as high-income in 2020 but designated in 2022
Areas that are not high-income and county boundary

Source: CEC

Urban and Rural Community Designations

The Census delineates urban and rural at the census block-level, which are the smallest level of geography (e.g., city block in a dense area) with basic demographic data. These are redefined every ten years following the decennial census. At the time of analysis for the 2022 SB 1000 report, 2010 urban and rural blocks were the most recent available data. For the 2022 report, CEC staff defined rural communities as census tracts where at least 50 percent of the tract's land area is designed as rural by the Census (i.e., does not meet the urbanized area criteria). Census tracts with no reported residential population count were not designated as either urban or rural.

This report updates urban and rural community designations and uses the 2020 urban and rural block delineations from the Census, which were finalized in March 2022. The Census uses criteria, including population density, housing density, and land use type, to identify urban blocks. Blocks not designated as urban are considered rural. Table A-3 provides a summary of the differences between the 2010 and 2020 urban area criteria, the most significant being the shift from a population-density-based metric to a housing-density-based metric.

Table A-3: Summary of 2010 and 2020 Urbanized Area Criteria Differences

Criteria	2010	2020
Identification of Initial Urban Area Cores	Blocks meeting population density, count, and size thresholds.	Blocks or aggregation of blocks with a housing unit density of 425.
Minimum Qualifying Threshold	Based on a minimum threshold of 2,500 people.	Based on a minimum threshold of 2,000 housing units or 5,000 people.
Inclusion of Group Quarters	NA	Blocks adjacent to already qualified urban blocks that do not meet the minimum housing unit density threshold but contain group quarters and a population density of at least 500 (population/square mile) are urban.
Additional Nonresidential Urban Territory	Groups of blocks with high degrees of impervious land cover and within ¼ miles of an urban area and at least 0.15 total square miles in area are urban.	Groups of blocks with high degrees of impervious land cover or have a 3-year average of at least 1,000 commuter designations within ½ mile of an urban area and at least 0.15 total square miles in area are urban.
Inclusion of Airports	Blocks within ½ mile of an urban area with an operating airport that has an annual enplanement of at least 2,5000 passengers.	Blocks within ½ mile of an urban area with an operating airport that has an annual enplanement of at least 2,5000 passengers. Blocks within ½ mile of an urban area with a qualified cargo airport. Blocks adjacent to urban area that have high association with airports.

Source: CEC

The updated designations do not apply the 50 percent land area threshold that was previously applied for the 2022 designations. CEC staff collaborated with UC Davis Plug-In Hybrid and Electric Vehicle Research Center to update urban and rural community designations and add a rural center category. The steps taken to arrive at these designations were:

1. Determine whether a census tract is urban or rural.
    a. Urban census tracts are tracts where at least 10 percent of the tract's land area is designated as urban by the Census using the 2020 urbanized area criteria.
    b. Rural census tracts are all other tracts[66] where less than 10 percent of the tract's land area is designated as urban by the Census using the 2020 urbanized area criteria.[67]
2. Identify contiguous tract areas.
3. Sum residential population[68] for contiguous census tract areas and use a population threshold of 50,000 to delineate urban, rural center, and rural communities.[69]
    a. Designate contiguous urban tract areas with populations of 50,000 or more as urban.
    b. Designate contiguous urban tract areas with populations of less than 50,000 as rural center.
    c. Designate all rural census tracts as rural.

Figure A-7 displays updated urban and rural community designations and the new rural center designation.

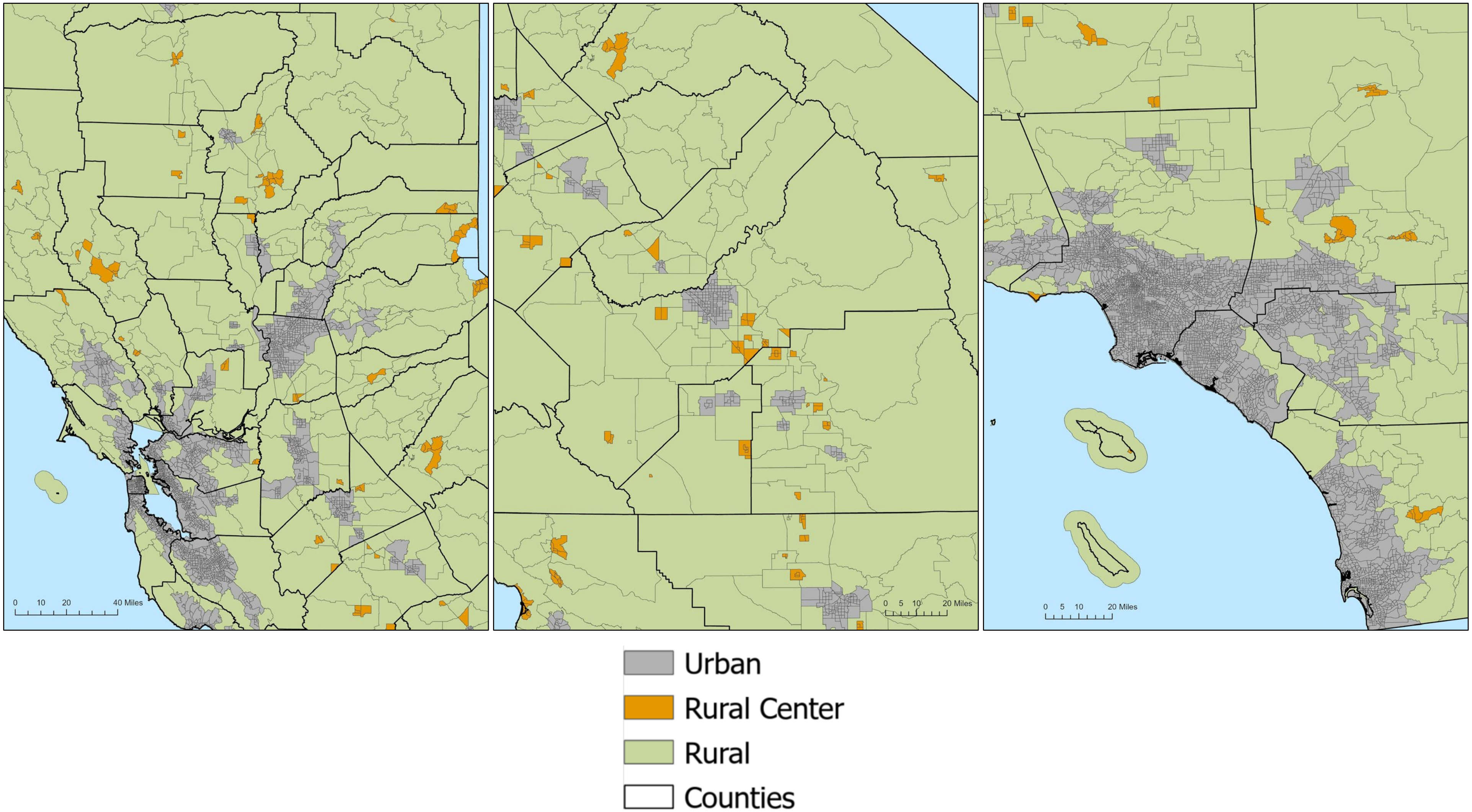
[66] Except census tracts that have no land area (i.e., all water).

[67] UC Davis researchers found that under this definition, rural census tracts on average have population densities of less than 200 persons per square mile and land cover that is more than 80 percent forest, shrubland, or cultivated crops.

[68] CEC staff used 2019 5-year U.S. Census Bureau American Community Survey estimates to align with 2016 census tract boundaries. CARB and the California EPA used 2016 census tract boundaries to delineate low-income and disadvantaged communities. The Census redrew census tracts for the 2020 census.

[69] The 2010 Census urban area criteria distinguished between urbanized areas and urban clusters using a 50,000-population threshold.

Figure A-7: Urban, Rural Center, and Rural Community Designations



Source: CEC

Table A-4 shows the total number of urban, rural center, and rural census tracts in 2022 and 2024. The new designations result in:

- 202 fewer urban census tracts that were previously designated as urban.
- 385 additional urban census tracts that were not previously designated as urban.
- 484 fewer rural census tracts that were previously designated as rural.
- 18 additional rural census tracts that were not previously designated as rural.
- 283 new rural center census tracts.
- 21 census tracts without an urban or rural designation as opposed to 36 census tracts in 2022.

These changes are shown in Figures A-8 and A-9.

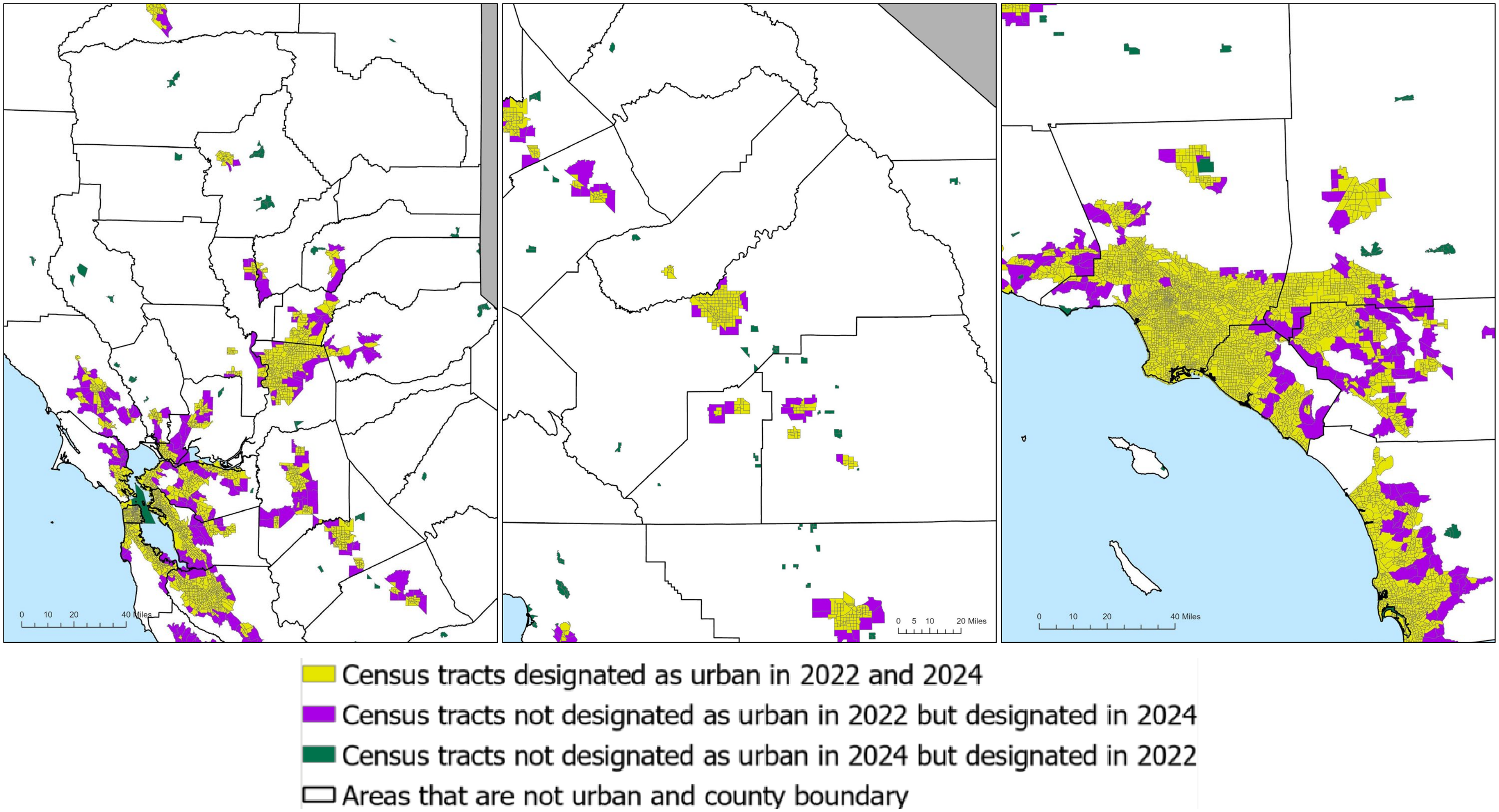
Table A-4: Breakdown of 2022 and 2024 Urban and Rural Community Designations

	Total # of Census Tracts
Previous Urban Designation (2022)	6,891
New Urban Designation (2024)*	7,074
Previous Rural Center Designation (2022)	0
New Rural Center Designation (2024)*	283
Previous Rural Designation (2022)	1,145
New Rural Designation (2024)*	679

*New Urban, Rural Center, and Rural designations as of 2024 were used for the 2024 SB 1000 report. The 2022 SB 1000 report used the previous 2022 designations.

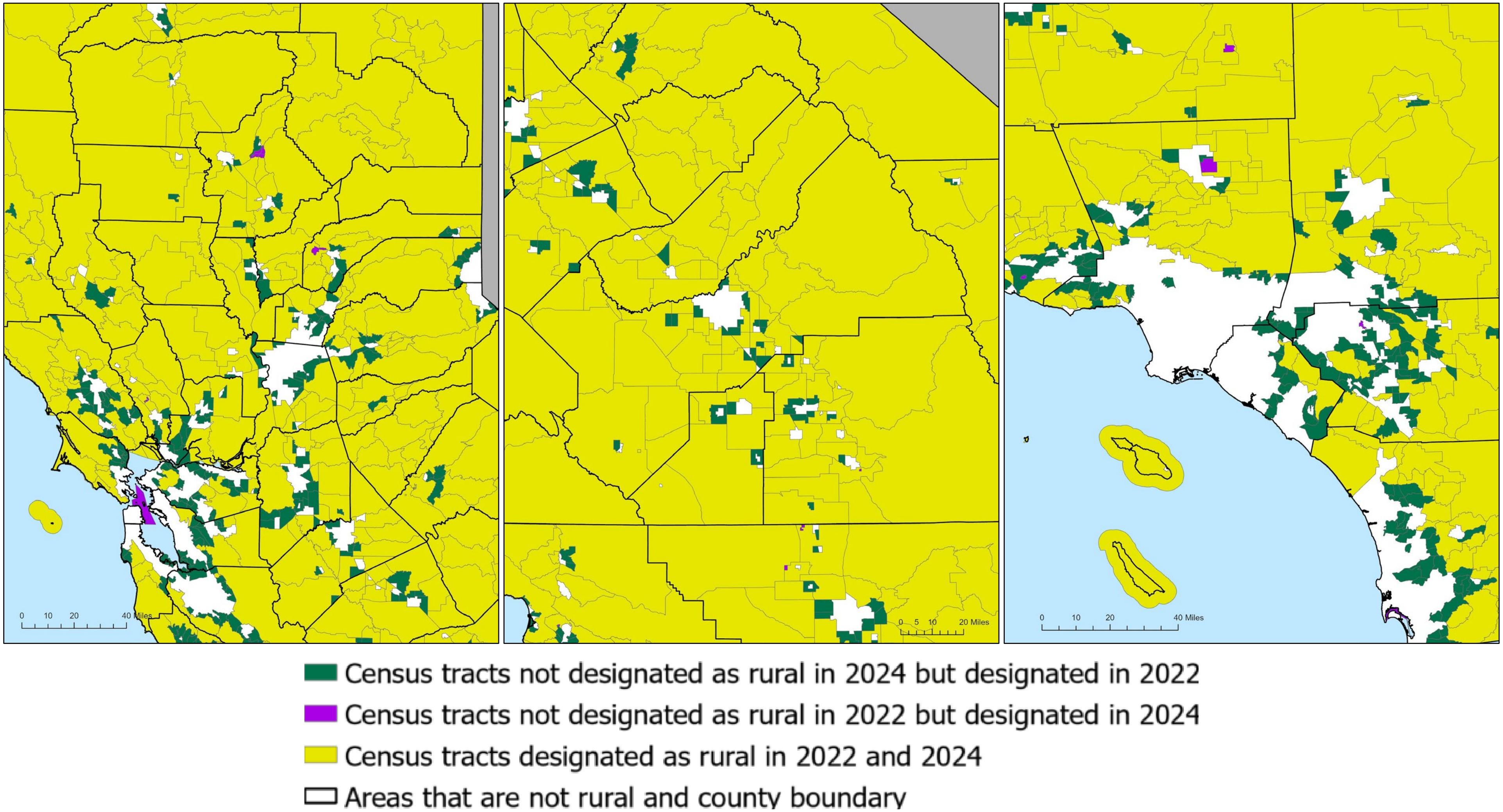
Source: CEC

Figure A-8: Changes in Census Tracts Designated as Urban



Source: CEC

Figure A-9: Changes in Census Tracts Designated as Rural



Source: CEC

APPENDIX B:
Update of Charger Count and Drive Time Results

In 2020, staff published the first SB 1000 report, which identified public charger counts by geographical area, population density, and population income level. In 2022, to improve analysis of charging access and coverage of public direct current fast chargers (DCFCs), staff published a second report that evaluated drive times from residential population centers to public DC fast charging stations. Since the publication of these reports, the number and distribution of public chargers have changed. Appendix B provides an update on the results published in previous reports. They are presented as appendices in this report for two reasons. First, they allow comparison to the previous reports to help assess whether disparities in access are increasing or decreasing. Second, by putting all three methods in the same report at the same time one can compare access using three different methods and help interpret the role of each method.

These alternate methods have some pros and cons compared to the method and results presented in the first part of this report using the lens of home charging access and vehicle ownership. The first SB 1000 report used chargers per capita as a metric. This is most similar to the 100 percent EV future metric used in the body of the assessment above. The drawback of this method is that it does not control for areas with fewer vehicles per capita. If people use transit, they will not need as many public chargers. Second it does not describe disparities in access among those who need charging today – namely EV owners. Third, it does not differentiate between those that have home charging and those that do not signaling demand in areas with high rates of Level 2 charging.

The drive time analysis to the nearest fast charger is also not scaled to EV adoption, but is superior to the analysis above in showing the gaps in the network. Unlike Level 2, DCFC is more likely to be used by both residents and travelers alike. Improvement in access metrics using drive times indicates an improvement in network connectivity.

Public Level 2 and DC Fast Charger Count Update

The 2020 report, which focused on the geographic, population, and income distribution of public Level 2 (L2) and DCFCs, was based on charger counts from July 2020. This report provides a 4-year update using charger counts as of August 2024. Staff used mapping software to count the number of public L2 and DCFCs located within counties and census tracts, which were characterized by population density and income level.

Geographic Distribution

As of August 2024, there were 29,372 more public L2 and 9,450 more public DCFCs deployed statewide since July 2020. Table B-1 shows the number of public chargers deployed in California from years used for SB 1000 analyses.

Table B-1: Statewide Public Level 2 and DC Fast Chargers in 2024 and 2020

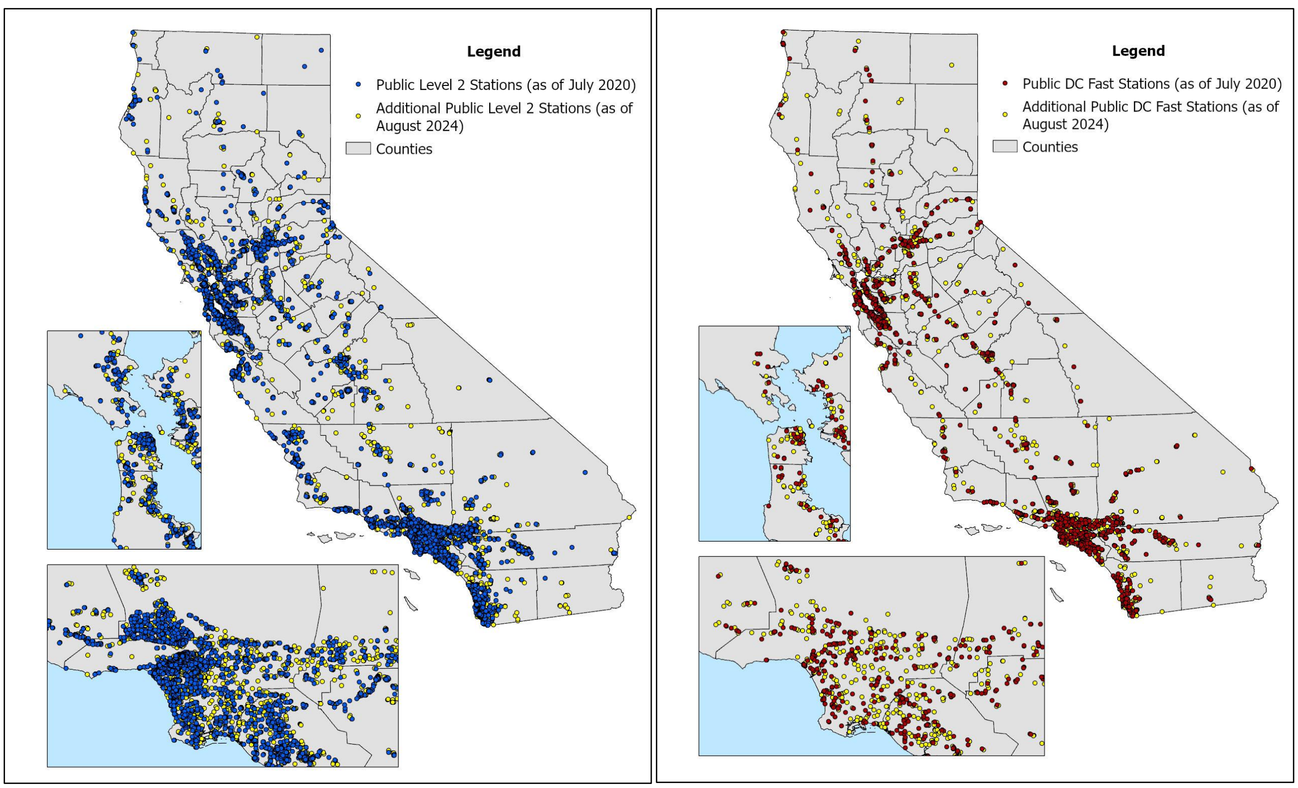
	Level 2 Chargers	DC Fast Chargers	Total Public Chargers
2024 Counts	51,533	13,943	65,476
2020 Counts	22,161	4,493	26,654

Tesla chargers are included in charger counts.

Source: CEC

The distribution of public Level 2 and DC fast charging stations in 2020 and those added since, up to August 2024, is shown in Figure B-1.

Figure B-1: Public Level 2 and DC Fast Charging Stations Added Since 2020



Source: CEC

The counties with the highest number of combined public L2 and DCFCs, in decreasing order, are:

1. Los Angeles County
2. Santa Clara County
3. Orange County

4. San Diego County.

These counties also have the highest number of public L2 and DCFCs, counted separately.

On the opposite end, the counties with the lowest number of combined public L2 and DCFCs, in increasing order, are:

1. Sierra County
2. Modoc County
3. Plumas County
4. Alpine County.

When public L2s are counted separately, Sierra, Modoc, Glenn, and Trinity have the lowest counts. Whereas Plumas, Modoc, Lassen, and Amador have the lowest counts when public DCFCs are counted separately.

Generally, the counties with the most chargers are in the southern region of California, whereas the counties with the fewest are in the northern region. Staff divided the state into four regions (northern, southern, central, and eastern) according to how regions are defined under the California Electric Vehicle Infrastructure Project (CALeVIP 2.0) Golden State Priority Project[70] to evaluate charger distribution by county across regions.

- In the northern region, Sacramento County has the most combined public L2 and DCFCs and Sierra County has the fewest.
- In the southern region, Los Angeles County has the most combined chargers and San Diego has the fewest. Considering public L2 separately, Orange County has the fewest public L2s.
- In the central region, Santa Clara County has the most combined public L2 and DCFCs and San Benito has the fewest.
- In the eastern region, Riverside County has the most combined public L2 and DCFCs and Alpine has the fewest. Considering public DC fast separately, San Bernardino has the most public DCFCs.

Los Angeles County saw the largest increase of any other county in California of combined public L2 and DCFC counts between 2024 and 2020. Following, in decreasing order, are Santa Clara, San Diego, and Orange counties. This order does not change for public L2s, counted separately. But for DCFCs, Santa Clara saw a smaller increase than Orange County or San Diego County.

On the other hand, Alpine County had no change in number of public chargers. Sierra, Plumas, and Modoc counties had an increase of less than 10 chargers combined.

[70] https://calevip.org/find-project-2

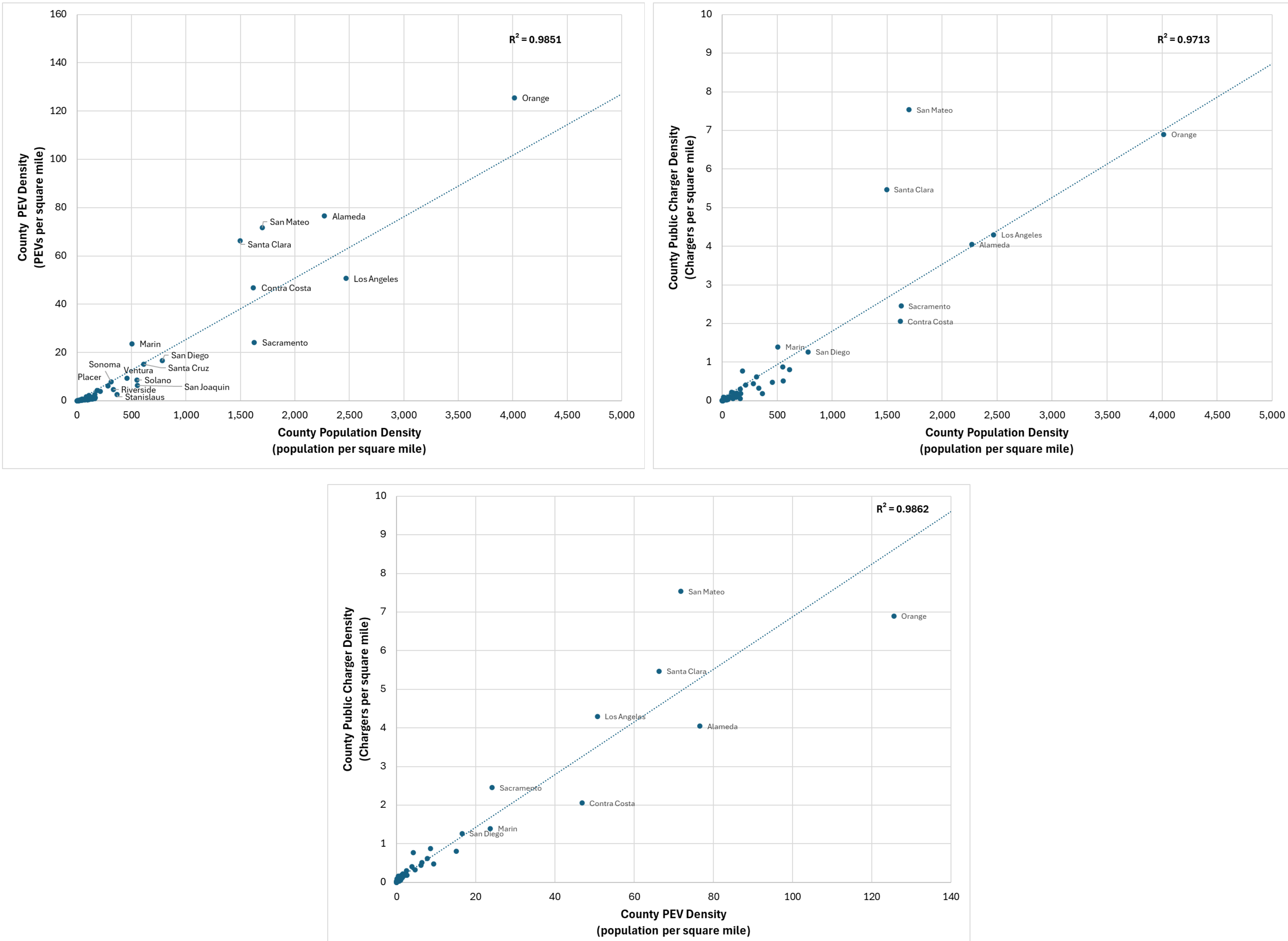
Population Distribution

For each county, staff retabulated population density (persons per square miles), plug-in electric vehicle (PEV) density (PEVs registered per square miles), and charger density (total public L2 and DCFCs per square miles) using the latest available data to assess whether PEVs follow population and whether population and PEVs continue to drive public infrastructure distribution at the county level.[71] Analysis indicates strong correlations between county population and PEV uptake (r-squared value of 0.985), county population and chargers deployed (r-squared value of 0.971), and county PEVs and chargers deployed (r-squared value of 0.986), as evident by Figure B-2. Figure B-3 shows that generally, at the county level, public chargers continue to be deployed where there are high concentrations of people and PEVs.

Zooming in, results show that San Francisco County continues to have the highest concentration of public chargers, PEVs, and residents in the state. San Mateo, Orange, Santa Clara, and Los Angeles counties also have high concentrations of chargers, registered PEVs, and residents. The counties with the lowest concentration of chargers (Modoc, Sierra, Lassen, Plumas) also have low concentrations of PEVs and residents.

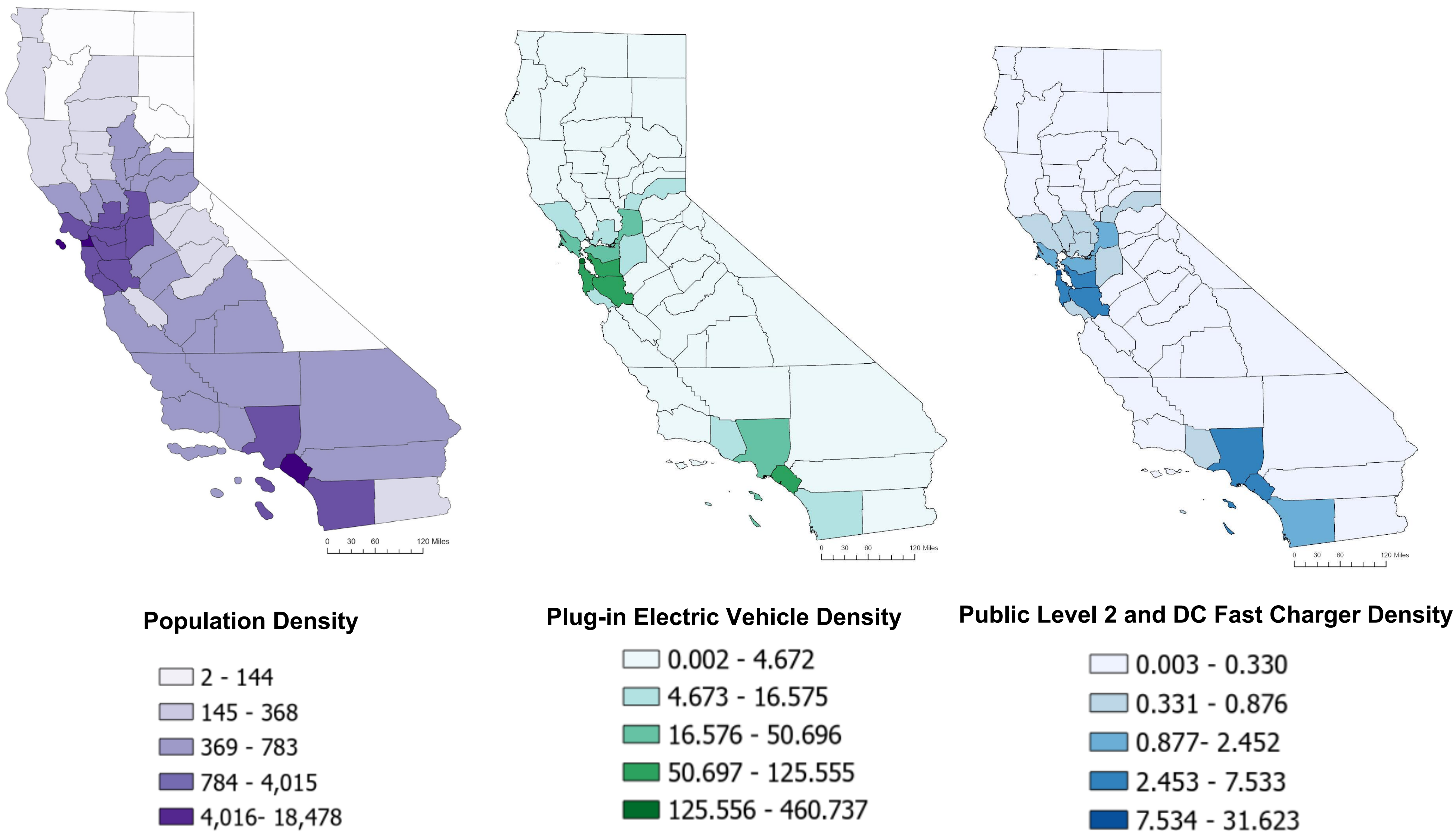
[71] County population counts are 2021 5-year estimates from the American Community Survey, PEV counts are 2021 PEV registrations from the Department of Motor Vehicle (DMV), and charger counts are from the U.S. Department of Energy Alternative Fuels Data Center and PlugShare as of August 2024.

Figure B-2: Correlations Between County Population, Plug-in Electric Vehicle, and Public Charger Density



Source: CEC

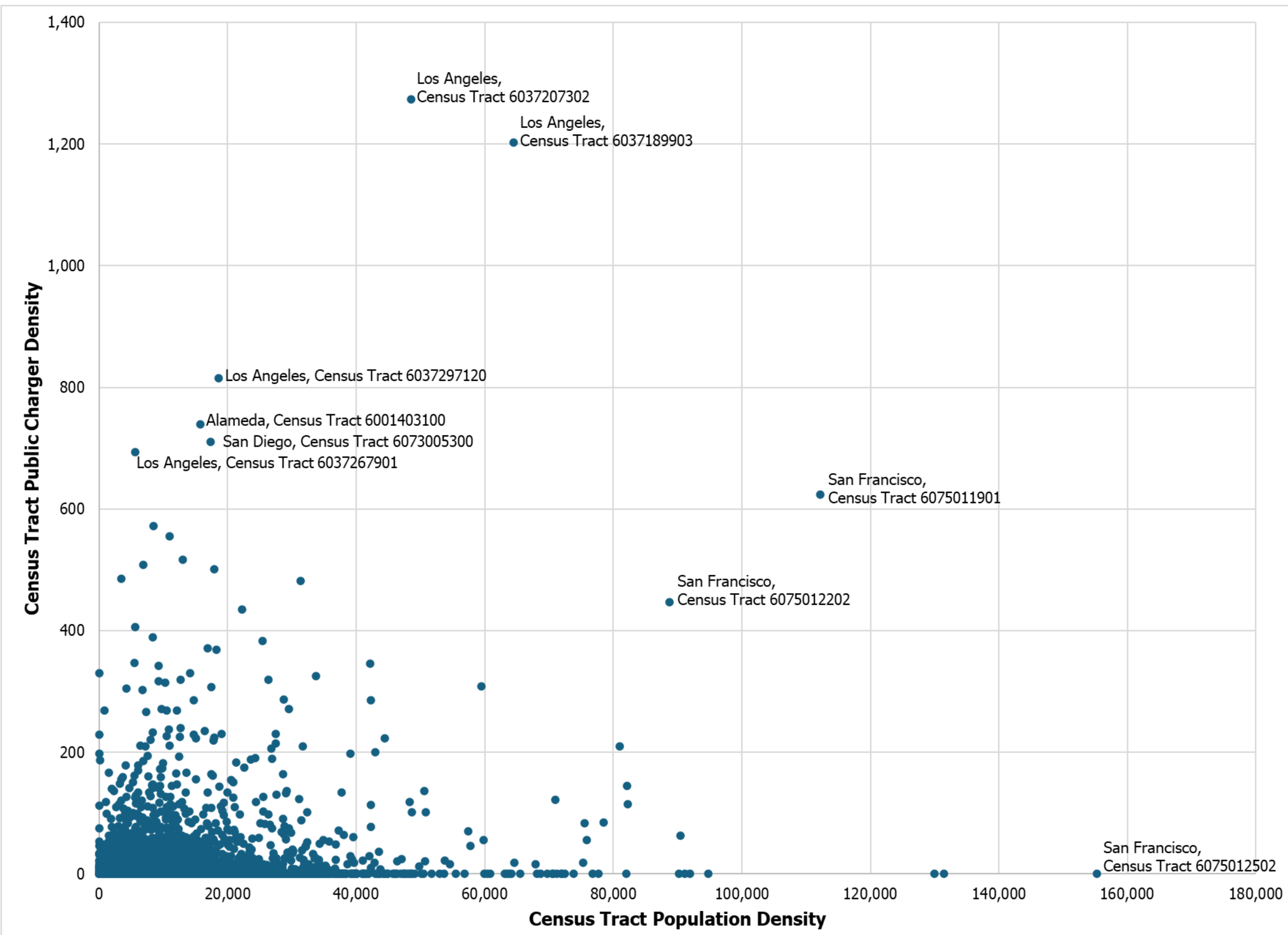
Figure B-3: County Population, Plug-in Electric Vehicle, and Public Charger Density



Source: CEC

On a finer scale, factors other than population appear to play a larger role in the distribution of public chargers. Staff tabulated public L2s and DCFCs by census tract area and evaluated these against census tract population density to study distribution in more geographic detail. As evident by Figure B-4, there is a weak correlation between census tract population density and public charger density. There are fewer public chargers per square mile in census tracts with high population density. Several census tracts with low population density appear to have high charger density. This is likely a result of zoning and land use where high-population-density tracts are zoned for housing, which often does not support public charging infrastructure, whereas low-density tracts are zoned for commercial use and can support public charging infrastructure.

Figure B-4: Public Level 2 and DC Fast Charger Density by Census Tract Population Density



Source: CEC

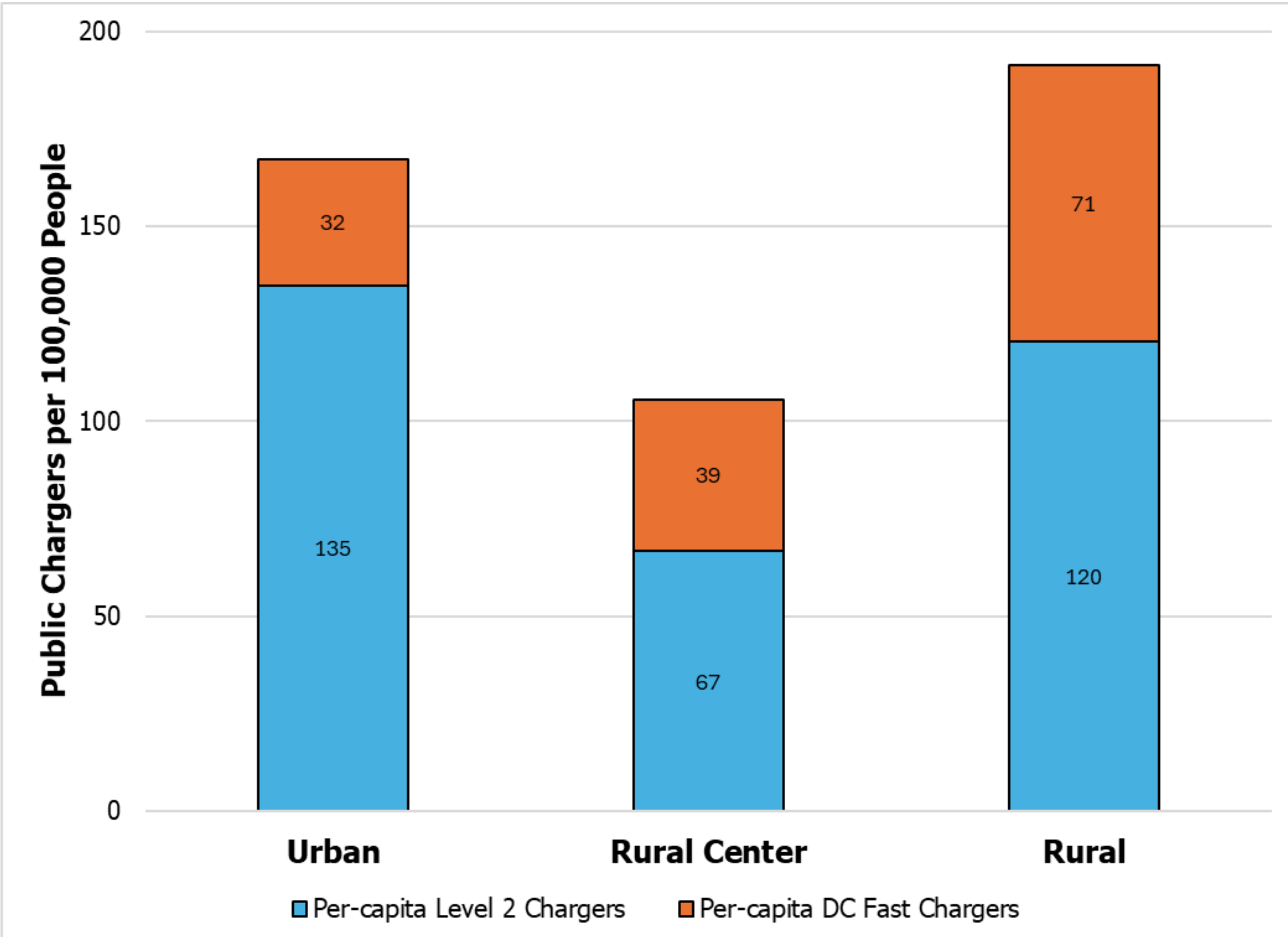
Census tracts were grouped into urban, rural center, and rural categories using the methodology described in Appendix A.

- About 89 percent of Californians live in an urban area where 91 percent of all public L2 and 81 percent of all public DCFCs in California are located. Urban areas make up about 7 percent of the state's geographic area.[72]
- About 4 percent of Californians live in a rural center area where 2 percent of public L2 and 4 percent of public DCFCs are deployed. Rural center areas make up 1 percent of the state's geographic area.
- About 7 percent of Californians live in a rural area where 7 percent of public L2 and 15 percent of public DCFCs are deployed. Rural areas make up 92 percent of the state's geographic area.

As a result, urban areas have more public L2 per capita but fewer public DCFCs per capita than in rural areas. Rural centers have the fewest public L2 per capita and more DCFCs per capita than urban areas but fewer than rural areas. On average, Rural California has more public chargers total per capita than urban areas of the state, as shown by Figure B-5.

[72] Population is calculated using the Census American Community Survey (ACS) 2019 5-year estimates for Total Population (Table B01003).

Figure B-5: Public Level 2 and DC Fast Chargers Per Capita in Urban, Rural Center and Rural California



Source: CEC

Income Distribution

Census tracts were designated as low-, middle-, or high-income using the methodology described in Appendix A. Since 2020, the percent of public L2s in California that are in low-income communities (LICs) has decreased from 50 to 49 percent. The percent of public DCFCs within LICs has also decreased from 53 to 51 percent. High-income communities (HICs) saw an increase in DCFCs as shown by Table B-2. The percent of DCFCs in middle-income communities (MICs) remained the same whereas the percent of L2s increased slightly.

Table B-2: Statewide Public Level 2 and DC Fast Chargers Deployed by Income in 2020 and 2024

Income Group	2020 Level 2	2024 Level 2	2020 DC Fast	2024 DC Fast
Low-income	50%	49%	53%	51%
Middle-income	23%	24%	28%	28%
High-income	24%	24%	18%	20%
Total*	**97%**	**97%**	**99%**	**99%**

*There are 79 census tracts that do not have an income group designation since the Census does not report median household income levels for those tracts. About 3 percent of public L2s and 1 percent of public DCFCs are deployed in those tracts.

Source: CEC

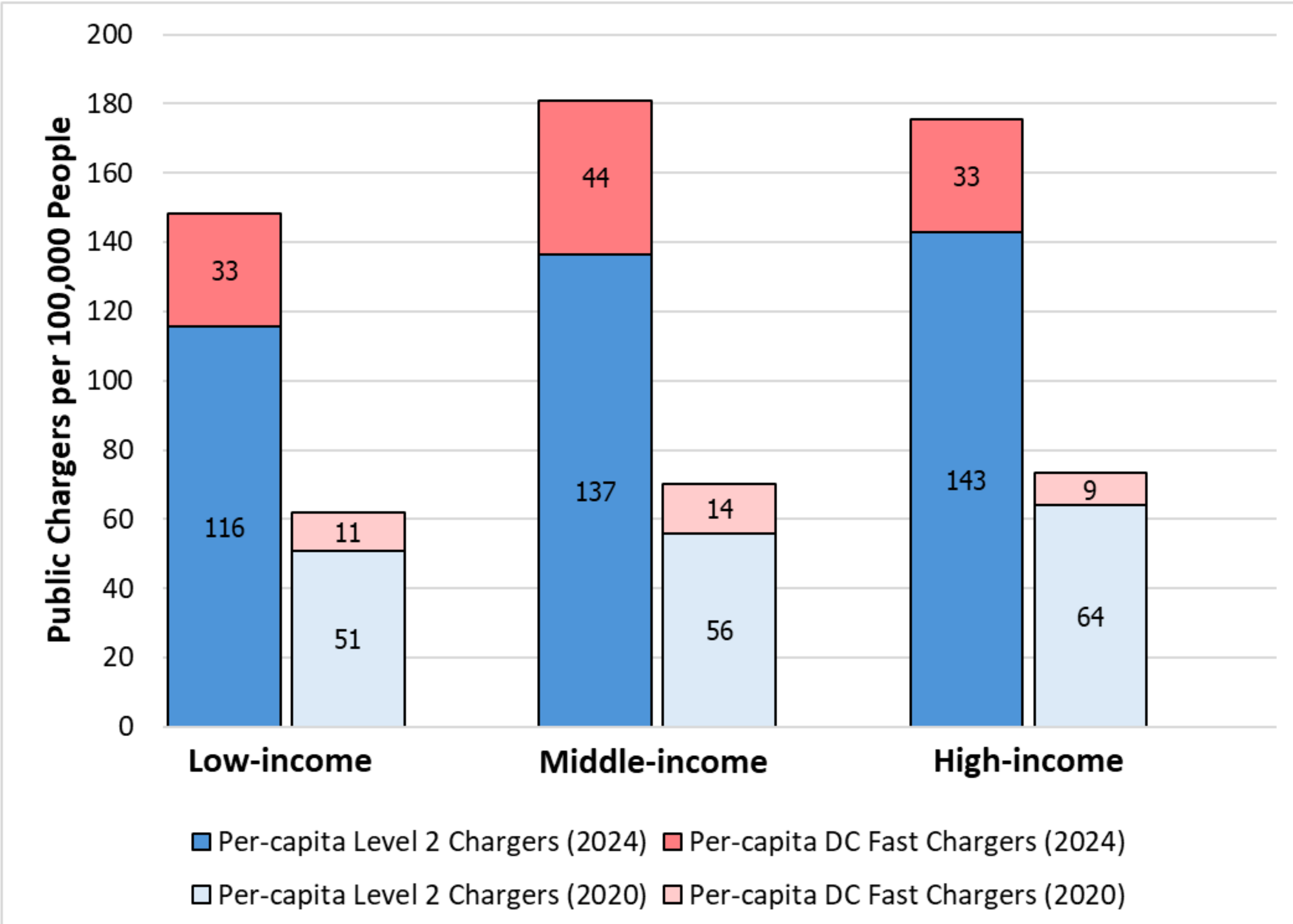
The percent of Californians that reside within low-, middle-, and high-income groups are as follows[73]:

- 55 percent of Californians live in LICs, which make up 72 percent of the state's geographic area.
- 23 percent of Californians live in MICs, which make up 22 percent of the state's geographic area.
- 22 percent of Californians live in HICs, which make up 7 percent of the state's geographic area.

Figure B-6 shows the average number of public L2s and DCFCs per 100,000 people by income group in 2020 and 2024. In 2020 and 2024, income and per-capita L2s are correlated. Per-capita DCFCs continue to be the higher in MICs on average than in HICs or LICs.

[73] About 1 percent of Californians lived within areas of the state that were not previously designated as low-, middle-, or high-income.

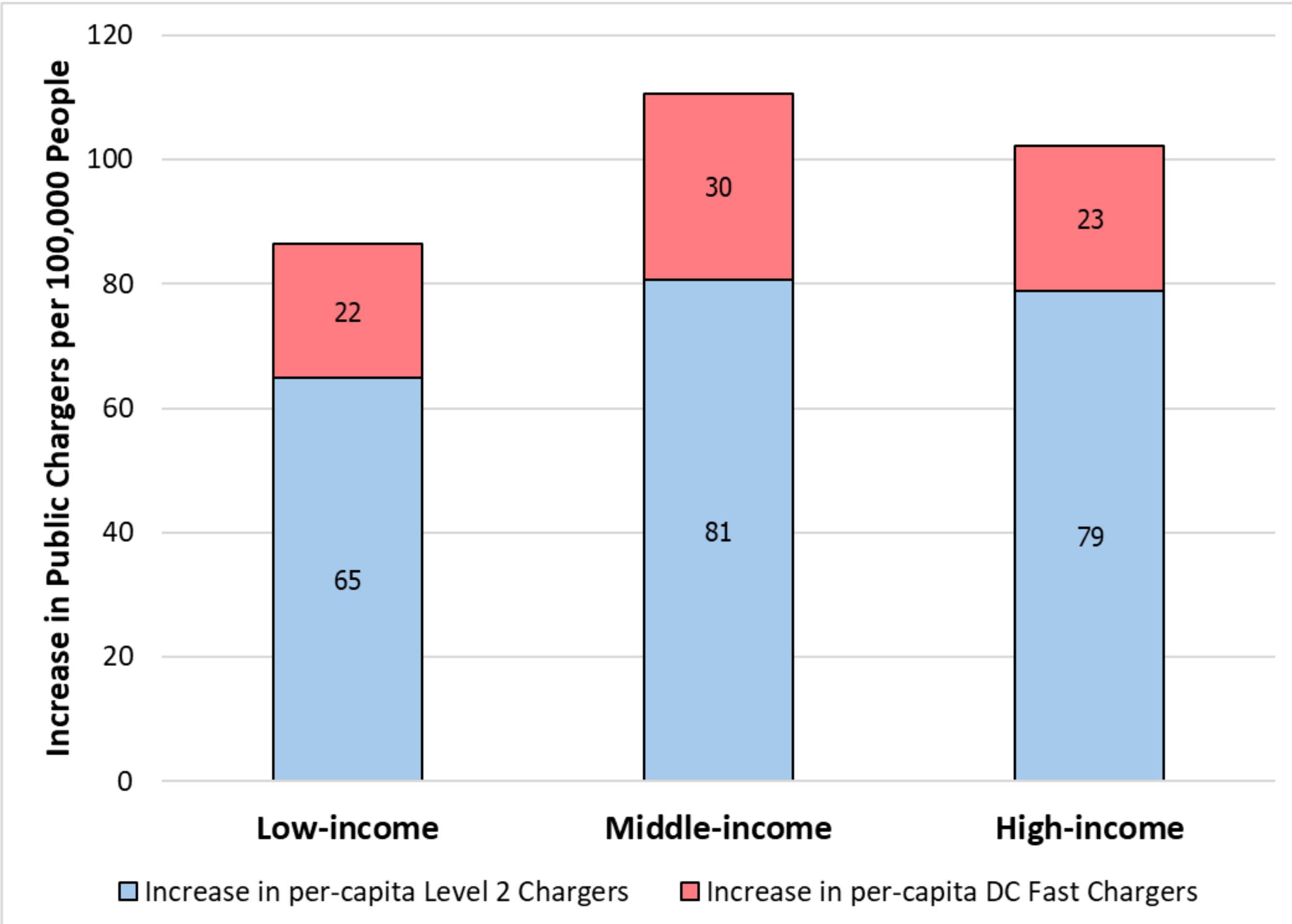
Figure B-6: Per-capita Public Level 2 and DC Fast Chargers by Income in 2020 and 2024



Source: CEC

Figure B-7 shows the increase in per-capita chargers by income. LICs saw the lowest increase in per-capita public L2s and per-capita public DCFCs and MICs saw the highest increase.

Figure B-7: Increase in Per-Capita Public Level 2 and DC Fast Chargers by Income from 2020 to 2024



Source: CEC

Distribution by Disadvantaged Community Designation

Appendix A describes the methodology used to designate census tracts as disadvantaged (DAC) or non-disadvantaged (non-DAC) communities. The percent of total public L2s and DCFCs in DACs has increased since 2020, as shown by Table B-3. As of 2024, about a third of all public L2s and DCFCs are located within DACs, an increase of about 5 percent.

Table B-3: Statewide Public Level 2 and DC Fast Chargers Deployed by Disadvantaged Community Status in 2020 and 2024

Disadvantaged Community Designation	2020 Level 2	2024 Level 2	2020 DC Fast	2024 DC Fast
Disadvantaged	23%	30%	22%	28%
Non-Disadvantaged	77%	70%	78%	72%
Total	**100%**	**100%**	**100%**	**100%**

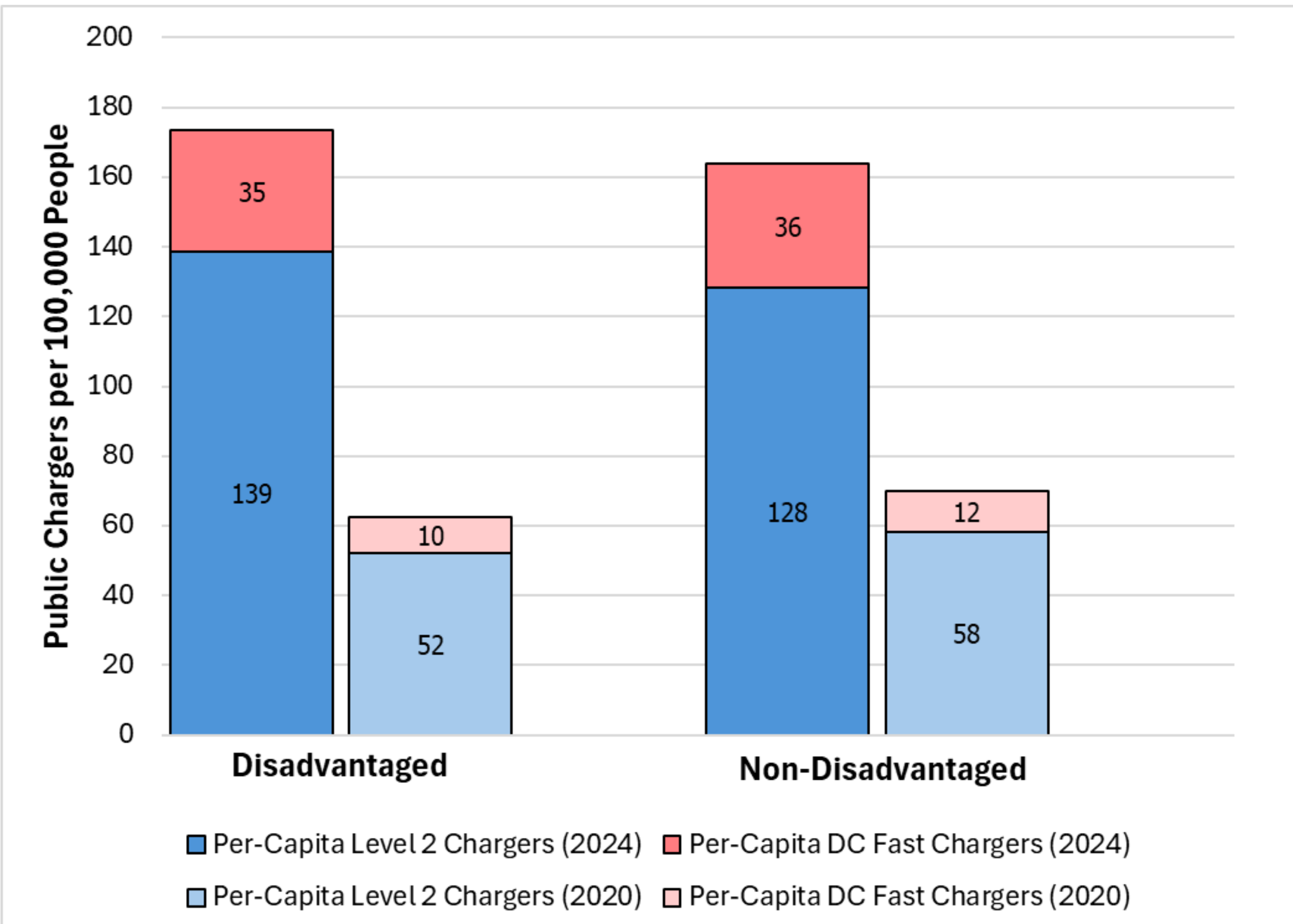
Source: CEC

The percent of Californians that reside within a DAC and non-DAC are as follows:

- 29 percent of Californians live in a DAC (this is an increase from the 25 percent reported in 2022). DACs make up about 16 percent of the state's geographic area.
- 71 percent of Californians do not live in a DAC (this is a decrease from the 75 percent reported in 2022). Non-DACs make up about 84 percent of the state's geographic area.

In 2020, there were slightly more public chargers per-capita in non-DACs on average than in DACs. But in 2024, there are slightly more public chargers per-capita in DACs than non-DACs on average. There are more per-capita L2s but fewer per-capita DCFCs in DACs, as indicated by Figure B-8.

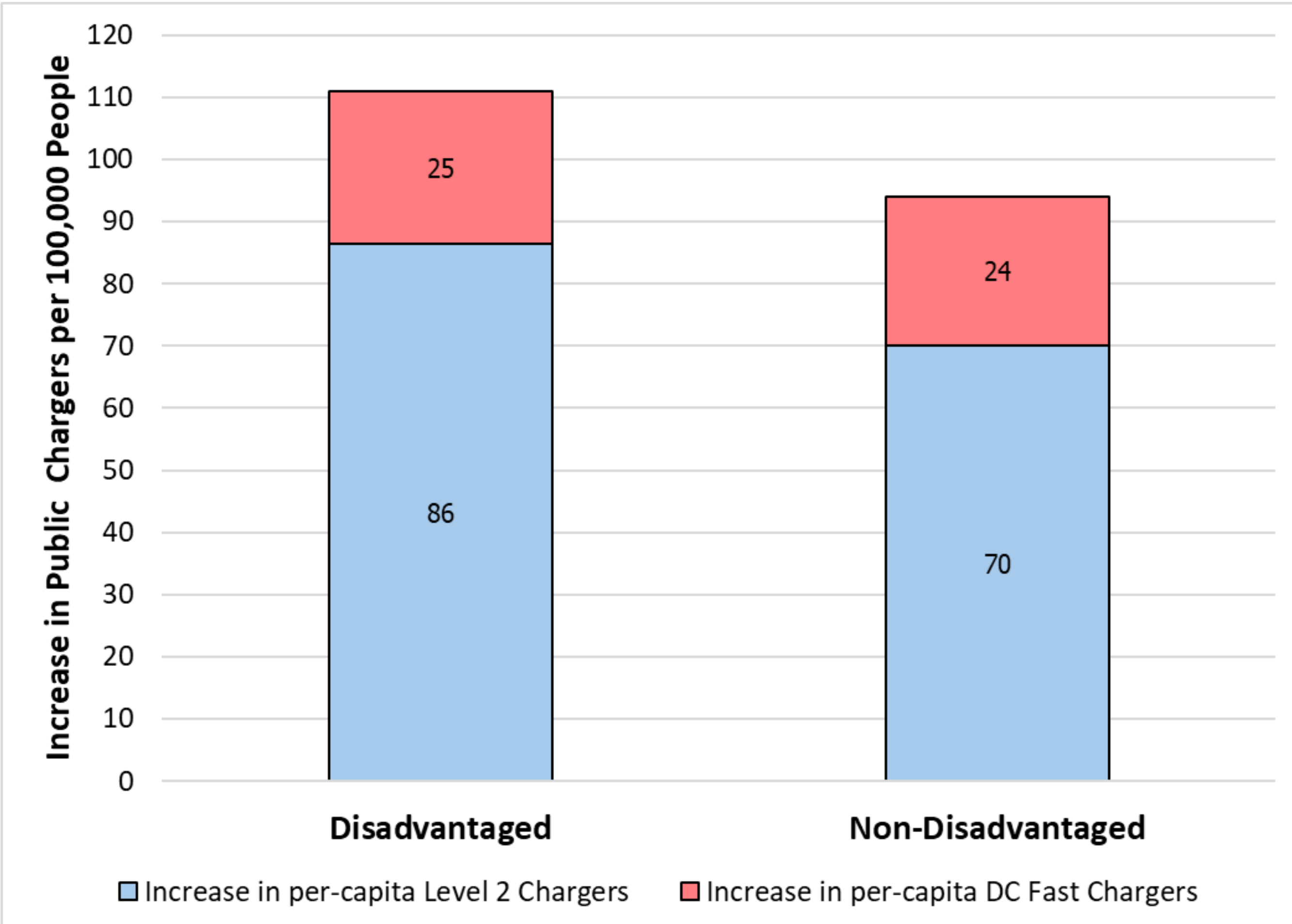
Figure B-8: Per-capita Public Level 2 and DC Fast Chargers by Disadvantaged Community Designation in 2020 and 2024



Source: CEC

DACs saw a higher increase in public DCFCs than non-DACs, as shown by Figure B-9. The reverse is true for public L2s where non-DACs saw a slightly higher increase than DACs.

Figure B-9: Increase in Per-Capita Public Level 2 and DC Fast Chargers by Disadvantaged Community Designation from 2020 to 2024



Source: CEC

Drive Time to Public DC Fast Charging Stations Update

The 2022 report evaluated drive times from residential population centers to public DC fast charging stations, including Tesla stations, using 2010 population centers, February 2021 charging data, and 2017 roadway data.[74] This report provides an update using August 2024 charging data and 2020 roadway data, which were the most recent data available at the time of analysis. Instead of using 2020 population centers as the origin for the drive time analysis, staff used 2010 population centers to report on charging access equity implications. The Census redrew census tract boundaries in 2020, which do not match the 2016 census tract boundaries that were used to designated low-income and disadvantaged communities.[75] Similar to the 2022 report, this update uses mapping software to find the quickest drive time routes from census tract population centers to the nearest public DC fast charging station. Staff grouped census tract average drive times into 3 categories: 0 to 5 minutes (good fast charging coverage), 6 to 9 minutes, and 10 minutes or more (sparse coverage). Census tracts with drive times of 10 minutes or more were further categorized as: 10 to 29 minutes, 30 to 59 minutes, and 60 minutes or more.

The 2022 drive time report found that about 81 percent of census tracts in California have population centers within a 10-minute drive of a public DC fast charging station – 54 percent were within 5 minutes and 27 percent were between 6 to 9 minutes. This represented about 81 percent of California's population (about 54 percent of Californians reside within 5 minutes of a station).

As of August 2024, the percent of census tracts within a 10-minute drive has increased to 94 percent – 79 percent are within 5 minutes and 15 percent are between 6 to 9 minutes from a station. This means that around 94 percent of Californians, on average, live within a 10-minute drive of a public DC fast charging station. About 79 percent of Californians live within 5-minutes. Census tracts within a 10-minute drive cover about 33 percent of the state's geographic area.

The sections below provide an update of drive time results by population density, income, and DAC designation. As of August 2024, about 6 percent of Californians live 10 minutes or further from a public DC fast charging station. This covers about 67 percent of the state's geographic area, meaning that public fast charging coverage is sparse throughout many areas of the state. Solutions for improving charging coverage and access will vary on the characteristics of the communities being served. These results will provide guidance for Clean Transportation Program staff to increase public fast charging coverage for all Californians, including for those that reside in LIC, DACs, and/or rural or rural center areas.

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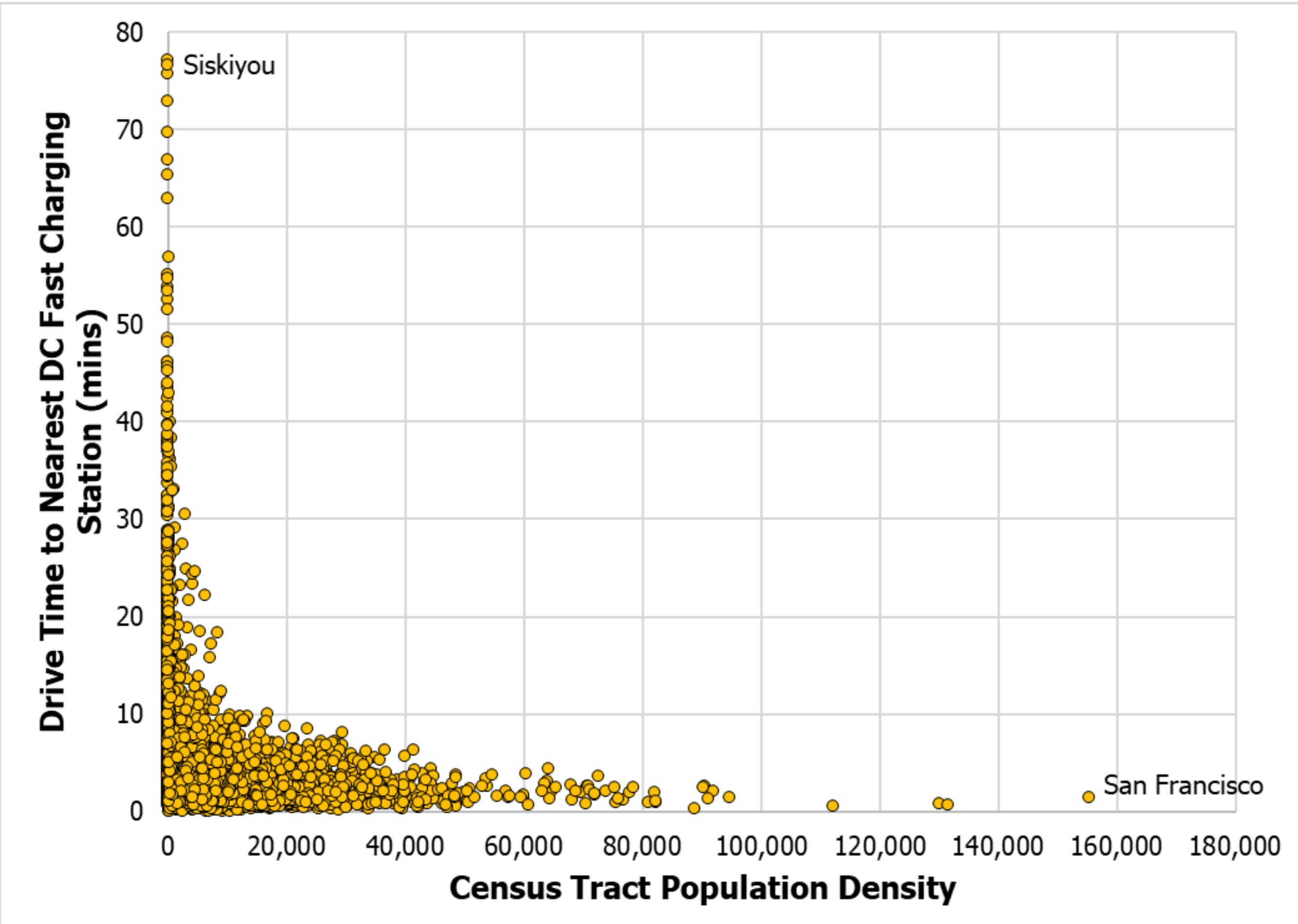
[74] Staff used the most recent data available at the time of analysis. Population centers represent mean centers of population and are updated every 10 years by the Census. The 2020 release was delayed because of the pandemic and anomalies found in the census data so staff used 2010 data. Charging data was downloaded from the U.S. Department of Energy Alternative Fuels Data Center. Roadway data was provided by the California Air Resources Board (CARB), who developed it for the California Hydrogen Infrastructure tool using roadway geometry from the Census and traffic data from Metropolitan Planning Organization traffic models.

[75] The 2020 Census delineates 9,129 census tracts in California, an increase of 1,072 census tracts since 2010. California DACs are designated by the California Environmental Protection Agency (CalEPA) and LICs are designated by CARB using 2016 census tract boundaries. CEC staff referred to the most recent designations by CARB and CalEPA for analysis.

Population Coverage

Census tracts with high-population-density have drive times of under 10-minutes to a station, which indicates that residents of these tracts, on average, have good fast charging coverage (see Figure B-10). On the other hand, several low-population-density census tracts have drive times that exceed 10 minutes. Some low-population-density tracts have average drive times that exceed an hour to the nearest station.

Figure B-10: Drive Time to the Nearest Public DC Fast Charging Station by Census Tract Population Density



Source: CEC

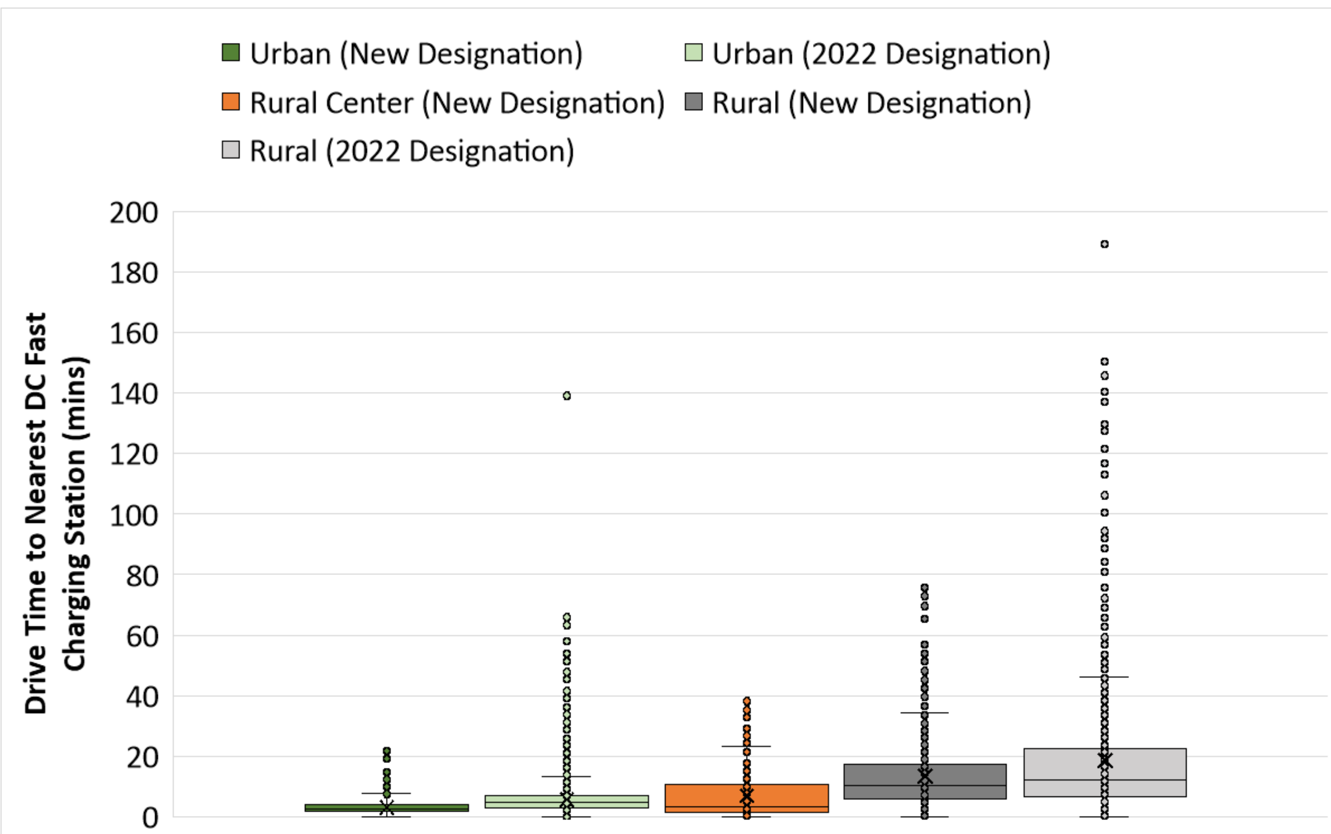
Staff grouped census tracts into urban, rural center, and rural communities using the methodology described in Appendix A.

Urban communities make up just 7 percent of California's geographic area but 89 percent of California's population. On average, a driver from an urban community will travel 3 minutes to reach the nearest public DC fast charging station. It takes an urban resident, on average, half the amount of time it takes for a rural center resident and a fourth the amount of time it takes for a rural resident to drive to a public DC fast charging station. Public fast charging coverage in urban communities, on average, also appears to be improving (in 2022, staff reported that urban residents travel 6 minutes on average to reach a station). The maximum average drive time to a station for urban communities is 23 minutes. In 2022, staff observed that this was 139 minutes with most urban community drive times falling under 66 minutes.

Rural centers make up about 1 percent of California's geographic area and 4 percent of the state's population. On average, a driver from a rural center will travel 7 minutes to reach the nearest public DC fast charging station. The maximum average drive time to a station for rural centers is 40 minutes.

Rural communities make up 92 percent of California's geographic area and 7 percent of California's population. On average, a driver from a rural community will travel 13 minutes to reach the nearest public DC fast charging station. In 2022, staff reported that it took rural communities, on average, 19 minutes, therefore, analysis suggests that public fast charging coverage appears to be improving in rural California, on average. Disaggregated, there is variability in drive times amongst rural, rural center, and urban communities, as shown in Figure B-11, which compares urban and rural community drive times from the 2022 report and this report.[76] For rural communities, the maximum average drive time to a station is 77 minutes. This is a significant improvement from the 189-minute maximum drive time staff observed for a rural community back in 2022.

Figure B-11: Drive Time to the Nearest DC Fast Charging Station by Rural and Urban Designation in 2022 and 2024



Source: CEC

[76] Rural centers are a new designation. The 2022 SB 1000 report did not evaluate drive times for rural centers.

The percentage of urban residents with good public fast charging coverage, measured by having access to at least one fast charging station within 5 minutes of driving, has increased since 2022 (see Table B-4). About half of rural center residents have a public fast charging station within a 5-minute drive of a population center. Fewer urban residents are 10 minutes or more from a station than in 2022 and about 1 percent of urban residents still have sparse coverage. In rural areas of the state, some live 60 minutes or further from a public fast charging station.

Table B-4: Drive Times by Rural, Rural Center, and Urban Designations in 2022 and 2024

Drive Time Category	2022 Rural Population	2024 Rural Population	2024 Rural Center Population	2022 Urban Population	2024 Urban Population
0 to 5 mins	22%	24%	63%	59%	84%
6 to 9 mins	23%	27%	10%	27%	15%
10 to 29 mins	42%	42%	24%	13%	1%
30 to 59 mins	11%	6%	2%	Less than 1%	0%
60 mins or more	2%	1%	0%	Less than 1%	0%
Total*	**100%**	**100%**	**100%**	**100%**	**100%**

*In 2022, drive times could not be calculated for 17 tracts that were designated as rural or urban due to disconnectivity with the roadway data used. Staff updated the roadway data used for analysis for this 2024 report. Drive times could not be calculated for 5 tracts that were redesignated as rural or urban.

Source: CEC

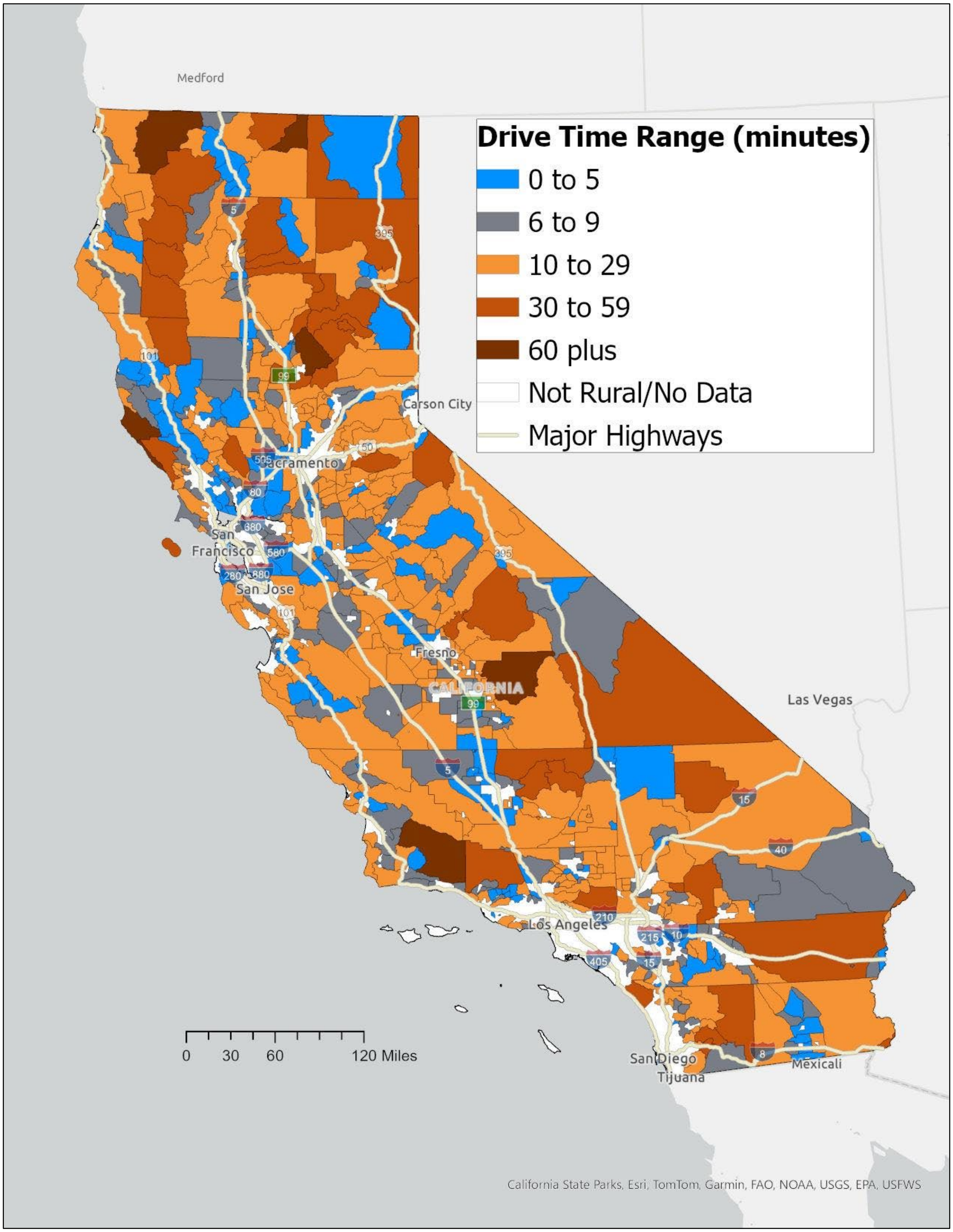
Updated drive times by rural communities are shown in the Figure B-12 map. Most rural communities with average drive times of less than 10 minutes are along or near a major highway. About 52 percent of all rural residents in California live in areas with drive times of less than 10 minutes, which make up about 28 percent of the state's geographic area. About 42 percent of all rural Californians live in areas where drive times are 10 to 29 minutes. These areas make up about 45 percent of the state's geographic area and several fall along a major highway. About 7 percent of rural residents live, on average, more than 30 minutes from a station; these areas make up about 27 percent of California's geographic area and stretch along US-395 North, I-10 and I-8 near the Arizona and Mexico borders, and coastal areas along State Route (SR) 1.

Average drive times from rural centers to a public DC fast charging station fall under an hour. Figure B-13 displays drive time results for several rural centers. About 63 percent of rural center residents live, on average, within 5 minutes of a public fast charging station and these communities tend to be along or near a major corridor. Several rural centers with drive times of 10 minutes or more are along SR-70 in Oroville, SR-29 in Clearlake, SR-28 and 89 in Tahoe, SR-180 and 63 east of Fresno, SR-108 in Sonora, SR-1 in Cambria and near Morro Bay, SR-43 and other corridors near Bakersfield, and SR-78 in Holtville.

Figure B-14 maps clusters of urban communities and their drive times to a station. Most urban communities surround major highways and have good fast charging coverage. However, there are several urban communities in parts of Sacramento, parts of the East Bay, in Modesto along

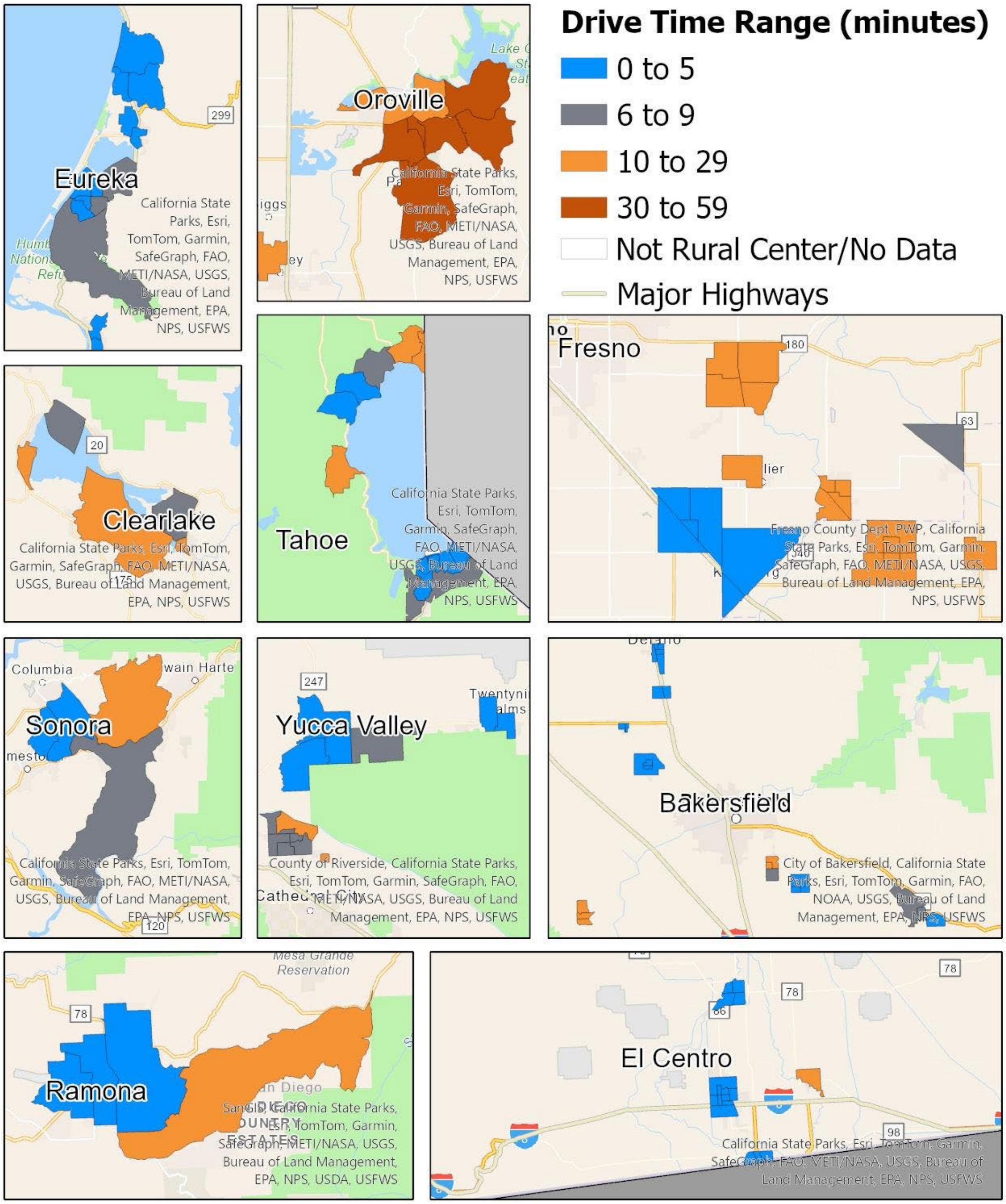
SR-132, south of Riverside, and surrounding San Diego that have drive times of 10 minutes or more.

Figure B-12: Map of Rural Community Drive Times



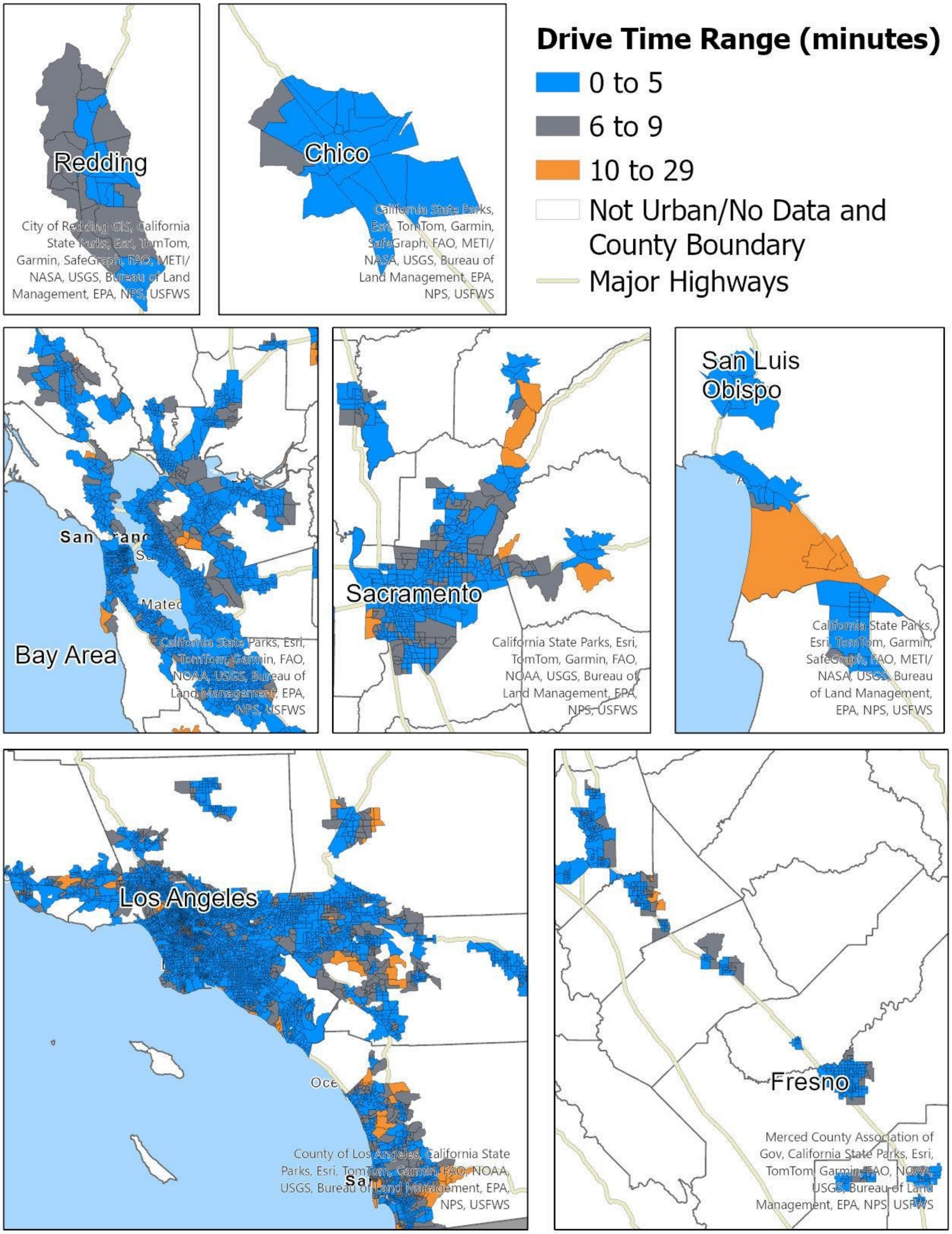
Source: CEC

Figure B-13: Map of Rural Center Drive Times



Source: CEC

Figure B-14: Map of Urban Community Drive Times



Source: CEC

Income Coverage

Drive time results by income level and urban, rural center, and rural designation were also updated to assess how fast charging coverage varies and has changed across communities with intersecting characteristics. With the new income designations (see Appendix A), LICs make up about 71 percent of California's geographic area and 55 percent of the state's population. About 4 percent of Californians live in a low-income rural community; these communities cover 68 percent of the state's geographic area. A driver from a low-income rural community will travel, on average, 15 minutes to reach the nearest public DC fast charging station. This is 3 minutes shorter than reported in 2022 indicating that drive times for low-income rural communities have improved on average. About 3 percent of Californians live in a low-income rural center; these areas cover less than 1 percent of the state's geographic area. On average, a driver from a low-income rural center will travel 7 minutes to reach the nearest public fast charger. Most low-income Californians live in urban areas of the state (about 49 percent of Californians live in a low-income urban community), which covers about 2 percent of the state's total land area. Drivers from low-income urban communities travel on average 3 minutes to a station, 3 minutes faster than in 2022.

MICs make up about 22 percent of California's area and 23 percent of the state's population. About 2 percent of Californians live in a middle-income rural community, which collectively cover 20 percent of the state's geographic area. On average, a driver from a middle-income rural community will travel 13 minutes to reach the nearest public DC fast charging station, which is 4 minutes faster than reported in 2022. About 1 percent of Californians live in middle-income rural centers, which make up less than 1 percent of the state's total area. Drivers from these areas travel 7 minutes, on average, to the nearest station. About 19 percent of Californians live in a middle-income urban community, which make up about 2 percent of the state's total area. Drivers from middle-income urban communities travel on average 3 minutes to a station, which is 3 minutes faster than in 2022.

HICs make up 7 percent of California's area and 22 percent of the state's population. About 1 percent of Californians live in a high-income rural community, which covers about 5 percent of the state's geographic area. A driver from a high-income rural community will travel on average 9 minutes to reach the nearest public DC fast charging station, which is 2 minutes faster than the amount of time reported in 2022. Less than 1 percent of Californians live in a high-income rural center, which makes up less than 1 percent of the state's geographic area. Drivers from high-income rural centers travel 7 minutes on average to a station. High-income urban communities on the other hand make up 2 percent of California's area and 21 percent of the state's population. Drivers from high-income urban communities travel on average 4 minutes to a station, which is 2 minutes faster than reported in 2022.

Updated analysis reveals that average drive times have dropped across rural groups, regardless of income. Low-income rural communities, however, continue to have the highest average drive time to a public DC fast charging station. The average drive time for low-income rural communities is 15 minutes, about 4 times longer than any urban community, regardless of income. Table B-5 shows average and maximum drive times by community income and urban, rural center, or rural designation. Previously, a low-income rural community in Modoc County had the longest drive time to a station (189 minutes). A Tesla station opened, which reduced the average drive time for drivers of this community to 30 minutes. Updated analysis shows that a low-income rural community in Siskiyou County has the longest drive time to a station (77 minutes).

Table B-5: Summary of Drive Time Statistics by Income Level and Urban and Rural Designation

Income & Urban/Rural Designation	Average Drive Time (mins)	Maximum Drive Time (mins)
Low Rural	15	77
Low Rural Center	7	38
Low Urban	3	19
Middle Rural	13	77
Middle Rural Center	7	40
Middle Urban	3	23
High Rural	9	25
High Rural Center	7	17
High Urban	4	22

The percentage of residents grouped within income and urban or rural designations with access to at least one fast charging station within 5 minutes of driving has changed since 2022 as follows:

- Low Rural: 18 to 25 percent (7 percent increase)
- Low Urban: 61 to 88 percent (27 percent increase)
- Middle Rural: 22 percent (same)
- Middle Urban: 62 to 82 percent (20 percent increase)
- High Rural: 29 percent (same)
- High Urban: 53 to 77 percent (24 percent increase)

The percent of residents grouped within income and urban or rural designations with drive times of 10 minutes or more has changed since 2022 as follows:

- Low Rural: 66 to 52 percent (14 percent decrease)
- Low Urban: 11 to 12 percent (1 percent increase)
- Middle Rural: 51 to 49 percent (2 percent decrease)
- Middle Urban: 14 to 1 percent (13 percent decrease)
- High Rural: 43 to 36 percent (7 percent decrease)
- High Urban: 16 to 23 percent (7 percent increase)

Drive times on average have generally improved, however analysis shows that low-income rural residents continue to have longer average drive times than any other group. About 65 percent of low-income rural residents have drive times of 10 minutes or more; 15 percent have drive times between a half hour to an hour; and 1 percent have drive times that exceed an hour (see Table B-6). Low-income urban communities, on the other hand, have a higher percentage of residents within 5 minutes of a station than any other group.

Table B-6: Drive Times by Income Level and Urban and Rural Designation

Income & Urban/Rural Designation	0 to 5 mins	6 to 9 mins	10 to 29 mins	30 to 59 mins	60 plus mins	Total*
Low Rural Population	25%	23%	41%	10%	1%	**100%**
Low Rural Center Population	62%	10%	25%	2%	1%	**100%**
Low Urban Population	88%	11%	1%	0%	0%	**100%**
Middle Rural Population	22%	28%	46%	2%	1%	**100%**
Middle Rural Center Population	69%	11%	19%	2%	0%	**100%**
Middle Urban Population	82%	17%	1%	0%	0%	**100%**
High Rural Population	29%	35%	36%	0%	0%	**100%**
High Rural Center Population	57%	4%	40%	0%	0%	**100%**
High Urban Population	77%	21%	2%	0%	0%	**100%**

*Drive times could not be calculated for 5 tracts that were designated as rural or rural center, including 3 tracts that was designated as low-income.

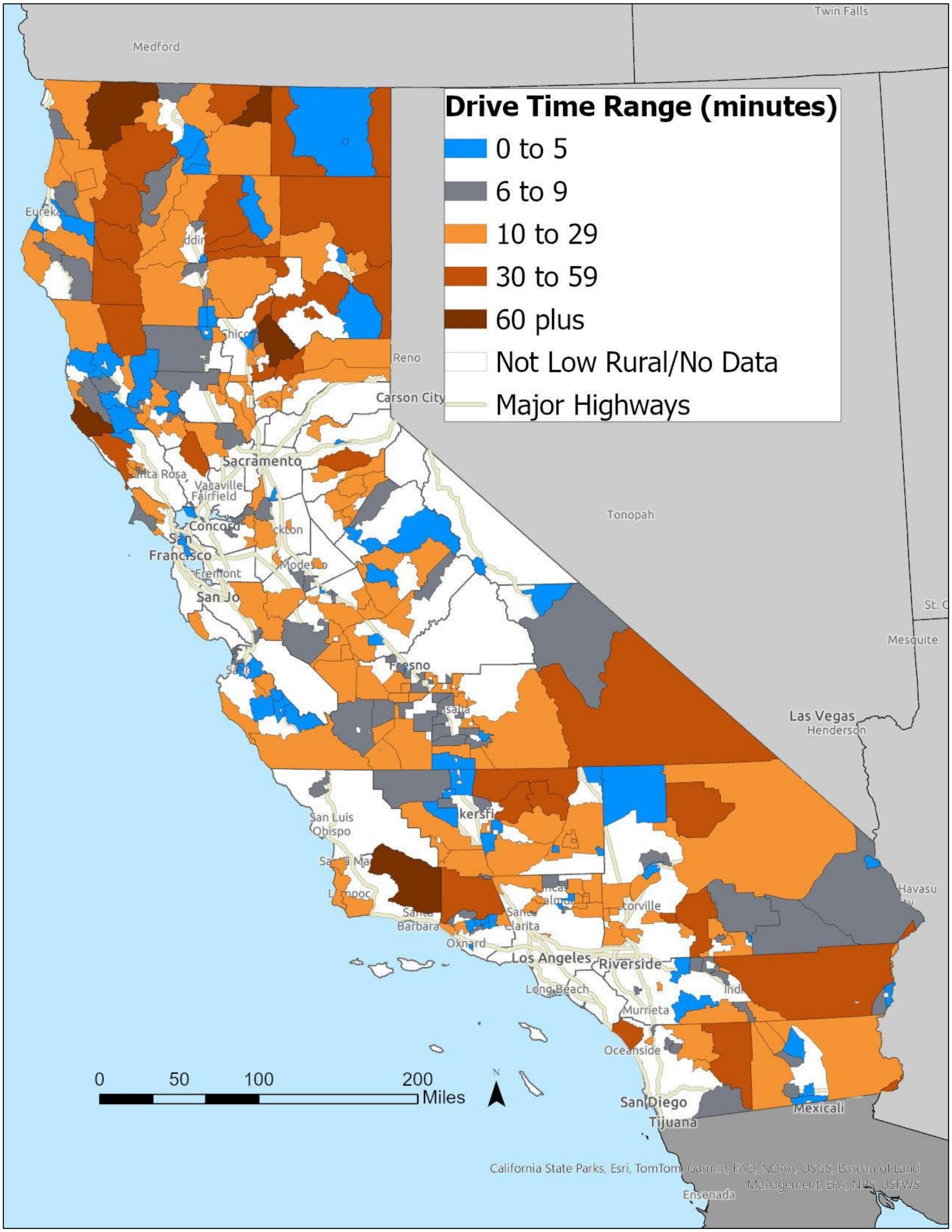
Source: CEC

Updated drive times by low-income rural communities are shown in the Figure B-15 map. Low-income rural communities with drive times under 10 minutes make up about 19 percent of California's geographic area, whereas low-income rural communities with drive times equal to or over 10 minutes make up 49 percent of the state's area. This indicates that just under half of the state is low-income and rural and has sparse fast charging coverage. About 2 percent of California residents live in these areas. Low-income rural residents just east of Paradise and Oroville, west of Ukiah, north of Santa Barbara, and near the California-Oregon state border have especially long drive times of an hour or more.

Figure B-16 shows low-income rural center drive times. About 1 percent of Californians live in a low-income rural center with drive times equal to or over 10 minutes; these areas make up less than 1 percent of the state's area. Low-income rural center residents with drive times of

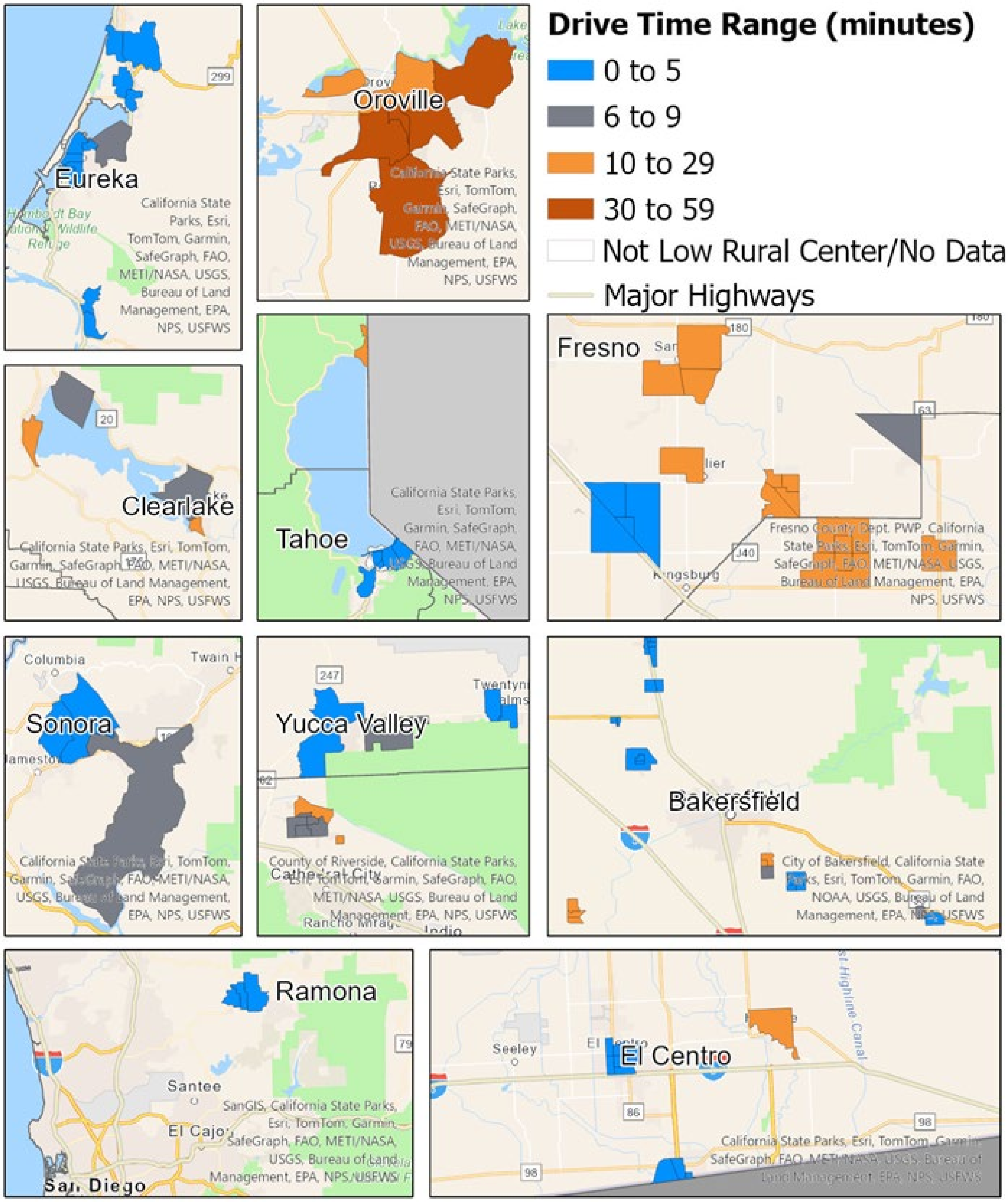
30 minutes or more to the nearest fast charger are in Oroville, north of Paradise, Clearlake, and east of Fresno.

Figure B-15: Map of Low-Income Rural Community Drive Times



Source: CEC

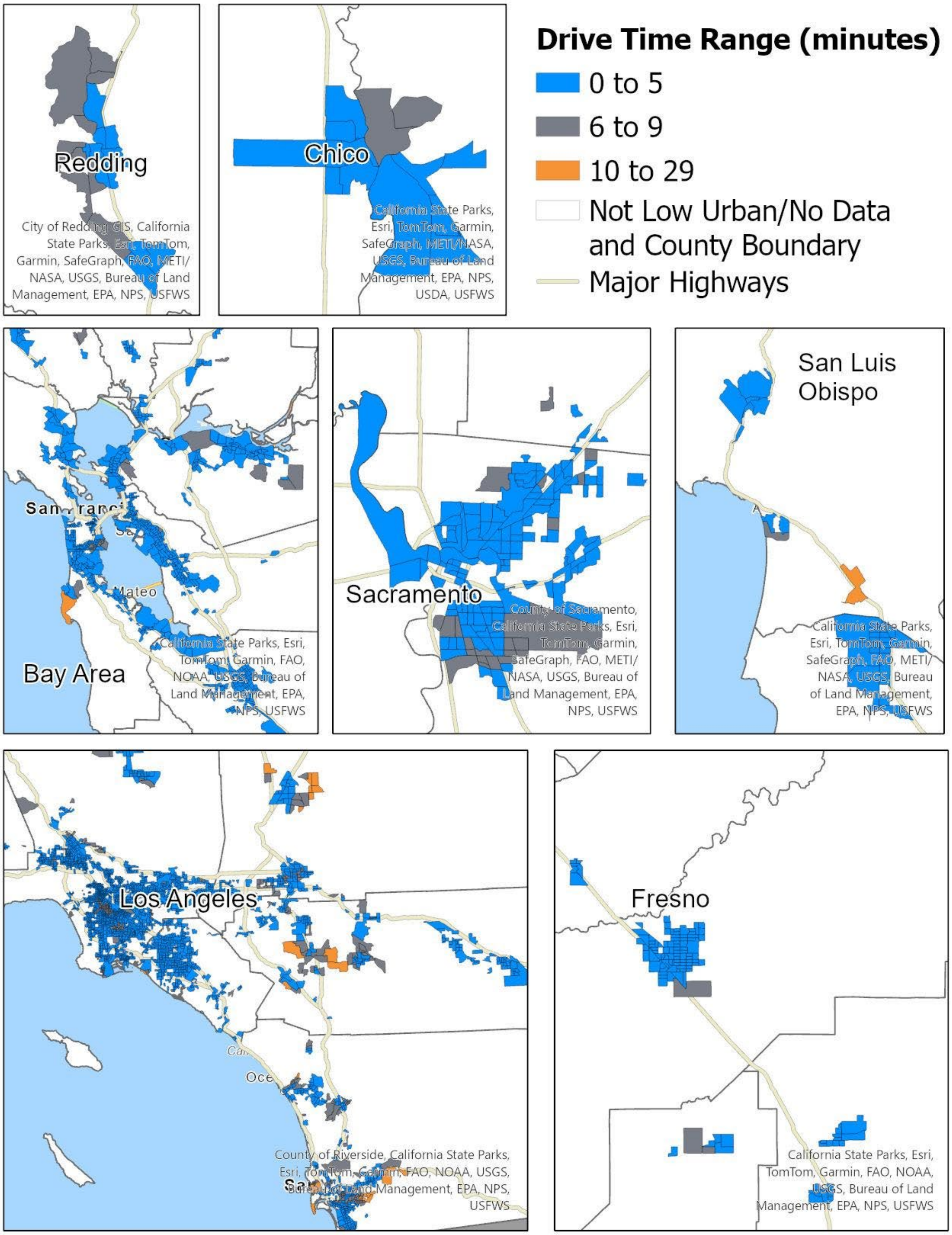
Figure B-16: Map of Low-Income Rural Center Drive Times



Source: CEC

Low-income urban community drive times are displayed in Figure B-17. About half of Californians live in a low-income urban community with most within 10 minutes of a public DC fast charging station. Less than 1 percent of low-income urban residents live 10 to 29 minutes from one.

Figure B-17: Map of Low Urban Community Drive Times



Source: CEC

Disadvantaged Community Coverage

Drive times by DAC and urban, rural center, and rural designation were also updated using CalEPA's new DAC designations using CalEnviroScreen 4.0 (see Appendix A for the methodology on designating DACs). DACs make up about 16 percent of California's geographical area and 29 percent of the state's population. About 14 percent of California's geographic area is comprised of disadvantaged rural communities, which make up about 2 percent of the state's population. A driver from a disadvantaged rural community will travel, on average, 11 minutes to reach the nearest public DC fast charging station, which is 5 minutes shorter than reported in 2022. About 1 percent of Californians live in disadvantaged rural centers, which cover less than 1 percent of the state's area. On average, drivers from disadvantaged rural centers will travel 7 minutes to the nearest station. Most DAC residents live in urban areas of the state (26 percent of Californians live in a disadvantaged urban community), which cover about 1 percent of California's geographic area. Drivers from disadvantaged urban communities travel on average 3 minutes to a station, 3 minutes faster than in 2022.

Non-disadvantaged communities make up about 84 percent of California's area and 71 percent of the state's population. Non-disadvantaged rural communities make up about 78 percent of the state's geographical area and 6 percent of the state's population. A driver from a non-disadvantaged rural community will travel, on average, 14 minutes to reach the nearest public DC fast charging station, which is 5 minutes shorter than reported in 2022. About 3 percent of Californians live in non-disadvantaged rural centers, which cover less than 1 percent of the state's area. On average, drivers from non-disadvantaged rural centers will travel 7 minutes to the nearest station. Most non-DAC residents live in urban areas of California (about 63 percent of Californians live in a non-disadvantaged urban community), which cover about 5 percent of the state's geographic area. Drivers from non-disadvantaged urban communities travel on average 3 minutes to a station, 3 minutes faster than in 2022.

Updated analysis shows that the average drive time to a public DC fast charging station for non-disadvantaged rural communities is more than 4 times longer than any urban community, regardless of DAC designation, and higher than any other group (see Table B-7). The maximum drive time for a disadvantaged rural community is 6 minutes shorter than reported back in 2022. The longest drive time for any disadvantaged urban community has decreased from 46 to 13 minutes. Similarly, the longest drive time for any non-disadvantaged rural and urban community has decreased from 189 to 77 minutes and 139 to 13 minutes, respectively. This result is attributed to installation of EV connect chargers at the Porterville Transit Center in a disadvantaged urban community, Tesla Superchargers in a non-disadvantaged rural community in Alturas, and Tesla Superchargers at Diamond Mountain Casino and Hotel in Susanville, which was previously considered a non-disadvantaged urban community but under the new urban and rural designations is considered a non-disadvantaged rural center.

Table B-7: Summary of Drive Time Statistics by Disadvantaged Community and Urban and Rural Designation

Disadvantaged & Urban/Rural Designation	Average Drive Time (mins)	Maximum Drive Time (mins)
Disadvantaged Rural	11	46
Disadvantaged Rural Center	7	25
Disadvantaged Urban	3	13
Non-Disadvantaged Rural	14	77
Non-Disadvantaged Rural Center	7	40
Non-Disadvantaged Urban	3	23

Source: CEC

The percent of residents grouped within DAC and urban or rural designation with access to a fast charging station within a 5-minute drive time has changed since 2022 as follows:

- Disadvantaged Rural: 19 to 29 percent
- Disadvantaged Urban: 57 to 89 percent
- Non-Disadvantaged Rural: 23 percent
- Non-Disadvantaged Urban: 60 to 82 percent

The percentage of residents grouped within DAC and urban or rural designation with drive times of 10 minutes or more has changed since 2022 as follows:

- Disadvantaged Rural: 56 to 40 percent
- Disadvantaged Urban: 12 to 11 percent
- Non-Disadvantaged Rural: 55 to 51 percent
- Non-Disadvantaged Urban: 14 to 2 percent

Non-disadvantaged rural communities have the highest average and maximum drive times of any other community grouped by DAC and urban or rural designation. They also have the highest percentage of residents with drive times of 10 minutes or more with 51 percent living that far from a station. About 40 percent of residents from disadvantaged rural communities have drive times of 10 minutes or more. As shown by Table B-8, about 7 and 3 percent of residents, respectively, from non-disadvantaged rural communities and non-disadvantaged rural centers have drive times between 30 and 59 minutes and about 1 percent of residents from non-disadvantaged rural areas have drive times that exceed an hour. Most residents from disadvantaged urban communities live within 5 minutes of a station.

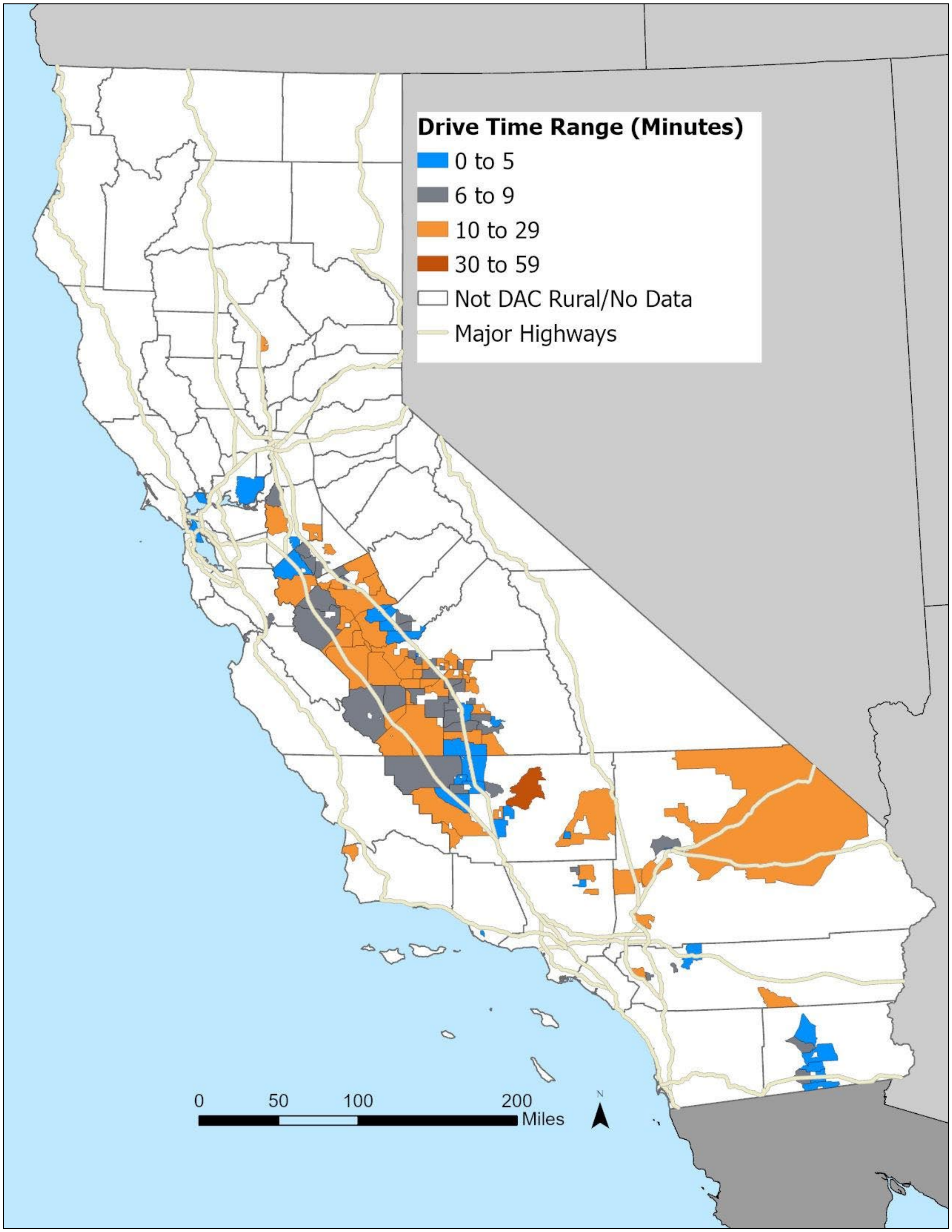
Table B-8: Drive Times by Disadvantaged Community and Urban and Rural Designation

Disadvantaged Community & Urban/Rural Designation	0 to 5 mins	6 to 9 mins	10 to 29 mins	30 to 59 mins	60 plus mins	Total
Disadvantaged Rural Population	29%	30%	39%	1%	0%	**100%**
Disadvantaged Rural Center Population	63%	4%	34%	0%	0%	**100%**
Disadvantaged Urban Population	89%	11%	0%	0%	0%	**100%**
Non-Disadvantaged Rural Population	23%	26%	43%	7%	1%	**100%**
Non-Disadvantaged Rural Center Population	64%	14%	19%	3%	1%	**100%**
Non-Disadvantaged Urban Population	82%	16%	2%	0%	0%	**100%**

Source: CEC

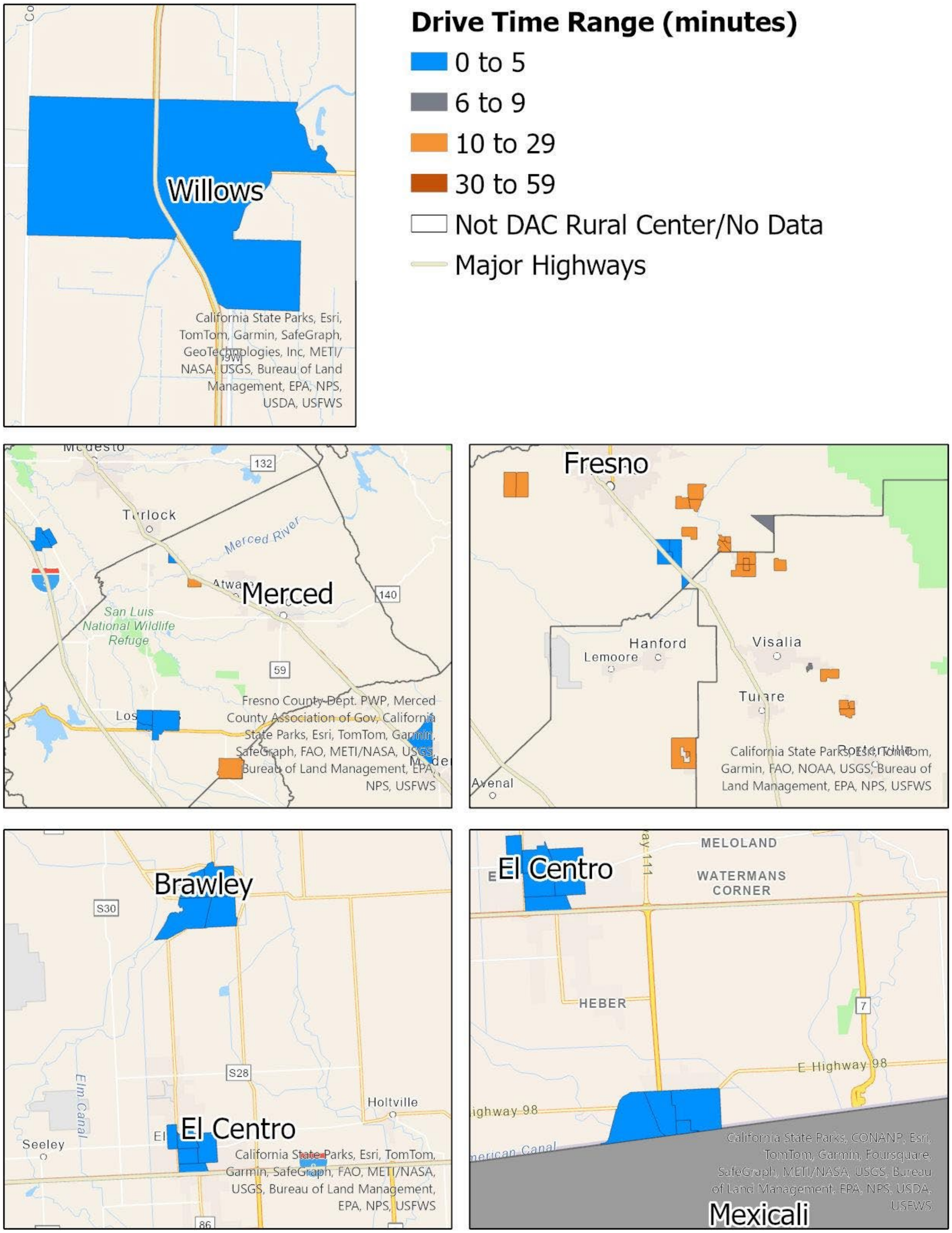
Updated drive times by disadvantaged rural communities are shown in Figure B-18. Disadvantaged rural communities with drive times of 10 minutes or more make up about 10 percent of California's geographic area and less than 1 percent of the state's population. Figure B-19 shows updated drive times by disadvantaged rural centers. Less than 1 percent of California's area and population are in disadvantaged rural centers with drive times of 10 minutes or more. Figure B-20 shows updated drive times by disadvantaged urban communities. Similarly, less than 1 percent of the state's area and population are in a disadvantaged urban community with drive times of 10 minutes or more.

Figure B-18: Map of Disadvantaged Rural Community Drive Times



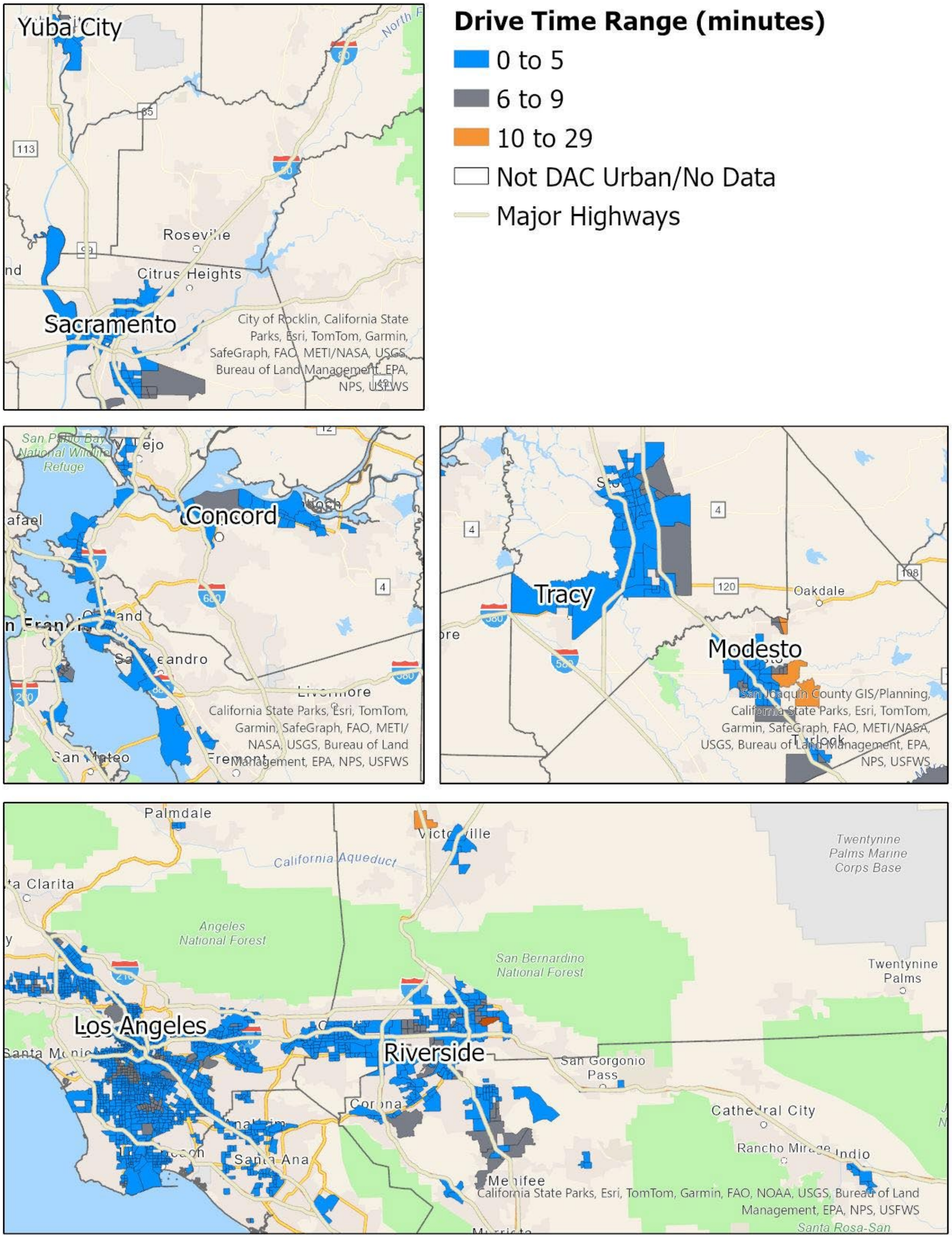
Source: CEC

Figure B-19: Map of Disadvantaged Rural Center Drive Times



Source: CEC

Figure B-20: Map of Disadvantaged Urban Community Drive Times



Source: CEC

Conclusions

Updates show that per-capita public chargers have increased by about 2.5 times since 2020 yet low-income communities continue to have the fewest per-capita chargers of any other income group. Disadvantaged communities on average continue to have slightly fewer per-capita chargers than communities not designated as disadvantaged. Drive times to the nearest DC fast charging station have significantly improved. In 2020, it took a driver from a low-income rural area, on average, 77 minutes to reach the nearest public DC fast charging station but in 2024 it took just 15 minutes. Similarly, for disadvantaged rural areas, the average drive time was 46 minutes whereas in 2024 it is estimated to be 11 minutes. In urban areas, it takes a driver from a disadvantaged or low-income community about 3 minutes to reach a station.

Both the per-capita and drive time analyses used population as a metric, which does not consider people who may rely on other modes of transportation. The home charging access analysis, on the other hand, estimates vehicle population and EV adoption in 2024 and in a full EV penetration scenario. By evaluating EV adoption, staff observed that EVs in disadvantaged or low-income communities on average have worse access to home charging than other communities and would therefore need to rely on public charging. Among EVs that lack home charging in disadvantaged or low-income communities, about 83 percent have access to a nearby charger within two miles of home. However, only 7 percent of EVs in disadvantaged or low-income communities that lack home charging have access to public charging within an eighth mile walking distance from home. On average, drive times to charging in rural areas are longer than in urban areas but fewer EVs in urban areas have home charging resulting in higher reliance on public charging to meet demand. Among EVs that lack home charging in urban areas, about 81 percent have nearby public charging within two miles but only 6 percent have a charger within walking distance.

This report improves previous analyses by focusing on current needs by EV owners across communities that lack home charging and therefore rely on public charging. Further, this report evaluates where there may be barriers to home charging for future EV owners. Fine scale estimates of home charging among EV owners allow for more precise targeting of public charging need.

APPENDIX C: Panel Size Inference

Residential electric service panels are where electricity is distributed throughout the home from a set of wires that connect to the utility grid. In the panel, there is a main breaker that distributes power to other small breakers that power individual circuits or appliances within the home. The size of the electric panel is determined by the main breaker and typically ranges between 100 – 400 Amps (A) in SFHs.[77] Panel size requirements for homes are often determined using a formula from the National Fire Protection Association's (NFPA) National Electric Code (NEC). This formula considers the home's electrical loads and typical usage patterns to ensure that the main breaker can provide the amount of electricity required to meet typical demand.

Analysis by Pecan Street estimates that most SFHs would require at least a 200A electric panel to electrify all appliances and install an 18 kW high-power EV charger. This assessment evaluates EVs and households in 2024, under the assumption that most households have mixed gas and electric appliances and EVs can likely meet demand with a moderate-power 8 kW EV charger. Staff estimate that most SFHs would require 100 – 150A electric panels to support electric appliances, an 8 kW EV charger, and two-way heat pump.

CEC staff collaborated with CARB staff and researchers from the University of California, Los Angeles California Center for Sustainable Communities (UCLA) to estimate panel capacity at single-family homes.[78] UCLA researchers implemented quality control and standardization procedures to the CoreLogic data to obtain household use type, construction vintage year, and total living area square footage, which were key attributes for estimating panel capacity. At a high-level, UCLA, in collaboration with CARB, obtained historical building permit data, including permitted panel upgrades to assign panel size. If there was no permit that showed an upgrade and panel size, panel size was inferred using construction vintage year and total living area square footage. Based on empirical probably density functions, households were either assigned an as-built condition panel size or a level up from the as-built condition if related work, such as solar photovoltaic panel installations, appeared on a permit.

[77] Pecan Street. 2021. Addressing an Electrification Roadblock: Residential Electric Panel Capacity. Available at https://www.pecanstreet.org/2021/08/panel-size/.

[78] Fournier, Eric, Robert Cudd, Samantha Smithies, and Stephanie Pincetl. June 2024. "Quantifying the electric service panel capacities of California's residential buildings." Energy Policy, Vol. 192, https://www.sciencedirect.com/science/article/pii/S0301421524002581.

APPENDIX D: Survey Instrument

Residential Parking Facility Survey Among CA Residents

Consent Form

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Purpose of the Study
This study is intended to investigate the availability of residential parking facilities for California residents and how residential parking options are associated with housing type and potential for electric vehicle charging.

The estimated time of completion of this survey is 7-10 minutes.

Research Statement
The purpose of this consent form is to give you the information you will need to help you decide whether to participate in this study. Please read the form carefully. This process is called "informed consent." You should keep a copy of this form for your records. You should only complete this form if you understand it in full. If you have any questions about this form, please contact the researchers listed above.

Study Procedures
If you volunteer to participate in this study, we would ask you to do the following things: Provide your background information (gender, age, education level, etc.). Answer questions related to your vehicle ownership, residential parking options, how many vehicles you own, where each vehicle is parked, and whether there is an electrical outlet available at each residential parking location.

Cessation of Participation
Your participation in this study is voluntary and you can stop participating at any time if you do not wish to answer a question or for any other reason.

Benefits of the Study
This survey will provide insights into the availability of residential parking facilities and advance the knowledge on future electric vehicle charging infrastructure planning.

Confidentiality of Research Information
Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission or as required by law. No system for protecting confidentiality is completely secure and the information about you could be inadvertently accessed or seen by someone outside the research team. Government or university staff sometimes review studies such as this one to make sure they

are being done safely and legally. If a review of this study takes place, your records may be examined. The reviewers will protect your privacy. The study records will not be used to put you at legal risk of harm.

Subject's Statement

I volunteer to take part in this research. If I have questions later about the research, or if I have been harmed by participating in this study, I can contact one of the researchers listed on this consent form.

ELECTRONIC CONSENT: Please select your choice below.

Clicking on the "Next" button below indicates that:

- You understand the information above.
- You voluntarily agree to participate, and have not been pressured to do so.
- You are at least 18 years of age.

1. What is the Zip Code of your home location?

2. What is your age?
   a. 18-24
   b. 25-34
   c. 35-44
   d. 45-54
   e. 55-64
   f. >=65
   g. Prefer not to answer

3. What is your annual household income?
   a. $9,999 or less
   b. $10,000 to $14,999
   c. $15,000 to $19,999
   d. $20,000 to $24,999
   e. $25,000 to $29,999
   f. $30,000 to $34,999
   g. $35,000 to $39,999
   h. $40,000 to $44,999
   i. $45,000 to $49,999
   j. $50,000 to $59,999
   k. $60,000 to $74,999
   l. $75,000 to $99,999
   m. $100,000 to $124,999
   n. $125,000 to $149,999
   o. $150,000 to $199,999
   p. $200,000 to $249,999

q. $250,000 or more
r. Prefer not to answer

4. What is your highest level of education?
    a. Less than high school
    b. High school graduate
    c. 2-year college/Associate degree
    d. Bachelor's degree
    e. Master's degree
    f. Doctoral and professional degree
    g. Prefer not to answer

5. What is your gender?
    a. Male
    b. Female
    c. Other
    d. Prefer not to answer

6. Which of the following can best describe your race/ethnicity?
    a. Hispanic or Latino or Spanish Origin of any race
    b. American Indian or Alaskan Native
    c. Asian
    d. Native Hawaiian or Other Pacific Islander
    e. Black or African American
    f. White
    g. Two or more races
    h. Prefer not to answer

7. How many adults (including yourself) are there in your household? (Adults: at least 16 years old)
    a. 1
    b. 2
    c. 3
    d. 4
    e. 5
    f. 6
    g. 7
    h. 8+

8. How many children are there in your household? (Children: younger than 16 years old)
    a. 0
    b. 1
    c. 2
    d. 3
    e. 4
    f. 5

g. 6
h. 7
i. 8+

9. How many people in your household own a driver's license?
    a. 0
    b. 1
    c. 2
    d. 3
    e. 4
    f. 5
    g. 6
    h. 7
    i. 8+

10. In which type of housing do you currently live?
    a. Mobile home or trailer
    b. Single family home (attached; e.g. rowhome, townhome, condo, etc.)
    c. Single family home (detached; e.g. ranch, split-level, two-story, etc.)
    d. 2 units apartment
    e. 3-4 units apartment
    f. 5-9 units apartment
    g. 10-19 units apartment
    h. 20-49 units apartment
    i. 50 or more units apartment
    j. Boat, RV, van, etc.
    k. Other

11. Do you rent or own the place where you live?
    a. Own
    b. Rent
    c. Neither (Please specify)

12. How long have you been living at your current housing location?
    a. Less than 1 year
    b. 1-3 years
    c. More than 3 years

13. At home, which of the following parking options are currently available to you (Please check all that apply)?
    a. On-street (permitted or metered)
    b. On-street (free)
    c. Driveway/carport
    d. Personal garage
    e. Parking garage (public)
    f. Parking garage (private)

g. Parking lot (reserved space)
h. Parking lot (no reserved space)
i. RV park/yard/field
j. None

14. At home, which of the following parking options of yours have an electrical outlet available (Please check all that apply)?
    a. On-street (permitted or metered)
    b. On-street (free)
    c. Driveway/carport
    d. Personal garage
    e. Parking garage (public)
    f. Parking garage (private)
    g. Parking lot (reserved space)
    h. Parking lot (no reserved space)
    i. RV park/yard/field
    j. None

15. At home, which of the following parking options of yours either have electrical outlets available "OR" possible to have one installed if necessary (please check all that apply)?
    a. On-street (permitted or metered)
    b. On-street (free)
    c. Driveway/carport
    d. Personal garage
    e. Parking garage (public)
    f. Parking garage (private)
    g. Parking lot (reserved space)
    h. Parking lot (no reserved space)
    i. RV park/yard/field

16. Could you please provide some details about your parking options at home? (Please skip those that do not apply to you.)

	Number of stalls/parking lots (even if they are used for purposes other than parking currently)	Is there reliable Wi-Fi at this parking option?	Is there reliable cellular service at this parking option?
On-street (permitted or metered)	a. 0 b. 1 c. 2 d. 3 e. 4+	a. Yes b. No c. Don't Know	a. Yes b. No c. Don't Know
On-street (free)			

Driveway/carport			
Personal garage			
Parking garage (public)			
Parking garage (private)			
Parking lot (reserved space)			
Parking lot (no reserved space)			
RV park/yard/field			

17. How many vehicles are there in your household? (Please count street-legal motor vehicles, such as cars, SUVs, and pickup trucks)
    a. 0
    b. 1
    c. 2
    d. 3
    e. 4
    f. 5
    g. 6
    h. 7
    i. 8+

18. In your opinion, is it possible to charge an electric vehicle from the type of electrical outlet shown below?

    a. No

b. Probably Not
c. Possibly Yet
d. Probably Yes
e. Yes

19. In your opinion, is it possible to charge an electric vehicle from the type of electrical outlet shown below?

a. No
b. Probably Not
c. Possibly Yet
d. Probably Yes
e. Yes

20. If you have a personal garage, do you have an operational electric clothes dryer in (or adjacent to) your garage?
a. Yes
b. No
c. I don't have a garage

21. On what device are you doing this survey?
a. Desktop
b. Laptop
c. Tablet
d. Smartphone
e. Other (Please specify)

22. Are you currently working as a driver for a ride-hailing service (e.g. Uber, Lyft)?
a. Yes
b. No

23. Have you seen any electric vehicle charging stations at public locations?
a. Yes, frequently
b. Yes, a few times
c. Yes, once or twice
d. Never seen one
e. Don't know what an EV charger looks like

Please provide the following info of your vehicle #1 [#2, #3, #4, #5, #6, #7, #8+]

24. What is the make of this vehicle?

25. What is the model of this vehicle?

26. What is the model year of this vehicle?

27. Is this vehicle ____?
    a. Plug-in hybrid electric vehicle
    b. Battery electric vehicle
    c. Neither

28. When at home, where is this vehicle typically parked?
    a. On-street (permitted or metered)
    b. On-street (free)
    c. Driveway/carport
    d. Personal garage
    e. Parking garage (public)
    f. Parking garage (private)
    g. Parking lot (reserved space)
    h. Parking lot (no reserved space)
    i. RV park/yard/field
    j. Other (please specify)

APPENDIX E:
Residential Parking Survey Results

The *Home Charging Access in California Report* examined five home charging access scenarios, defined in Table E-1.

Table E-1: Home Charging Access Scenario Definitions

Scenario	Definition
Existing Access with 120 volt (V) Perception	Share of vehicles that currently park near 120V electricity and where respondent believes a standard 120V outlet can be used to charge an EV.
Existing Access	Share of vehicles that currently park near 120V electricity.
Potential Access	Share of vehicles that currently park near 120V electricity or park in a location where respondents think new 120V electrical installation could occur.
Existing Access with Parking Behavior Modification	Share of vehicles that currently park near 120V electricity or could park near 120V electricity if they changed their parking behavior.
Potential Access with Parking Behavior Modification	Share of vehicles that currently park near 120V electricity or could park in locations where respondents think new electrical installation could occur.

Source: CEC and NREL

Table E-2 displays home charging access results for first and second plus vehicles in a household. CEC staff averaged potential access results for the first vehicle in households for all single-family homes and all multi-family homes to estimate households with and without home charging.

Table E-2: Calculated Home Charging Access for First and Second Plus Vehicles in a Household

Housing Type	Vehicle Order	Existing Access With 120V Perception	Existing Access	Potential Access	Existing Access With Parking Behavior Modification	Potential Access With Parking Behavior Modification
SFH Detached; Owned	1st Vehicle	21%	50%	68%	70%	85%
SFH Detached; Owned	2nd+ Vehicle	10%	22%	37%	70%	85%
SFH Detached; Rented	1st Vehicle	12%	31%	50%	55%	72%
SFH Detached; Rented	2nd+ Vehicle	9%	15%	31%	55%	72%

SFH Attached; Owned	1st Vehicle	17%	44%	63%	55%	75%
SFH Attached; Owned	2nd+ Vehicle	7%	19%	32%	55%	75%
SFH Attached; Rented	1st Vehicle	15%	32%	53%	46%	66%
SFH Attached; Rented	2nd+ Vehicle	10%	15%	28%	46%	66%
High-Rise Apartment; Rented	1st Vehicle	7%	16%	25%	20%	28%
High-Rise Apartment; Rented	2nd+ Vehicle	3%	8%	14%	20%	28%
Mid-Rise Apartment; Rented	1st Vehicle	5%	16%	30%	19%	35%
Mid-Rise Apartment; Rented	2nd+ Vehicle	4%	8%	8%	19%	35%
Low-Rise Apartment; Rented	1st Vehicle	6%	15%	29%	19%	35%
Low-Rise Apartment; Rented	2nd+ Vehicle	5%	11%	21%	19%	35%
All	1st Vehicle	14%	33%	50%	47%	62%
All	2nd+ Vehicle	8%	18%	31%	47%	62%

Source: CEC and NREL

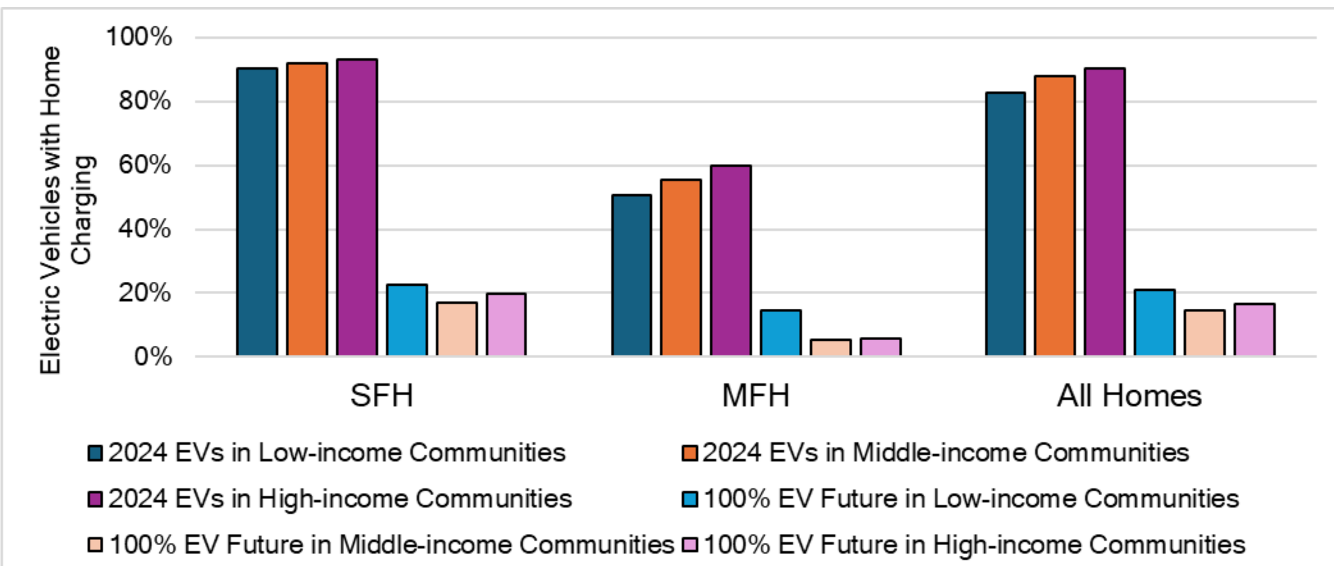
APPENDIX F: Home and Near-Home Charging by Income Level

This appendix includes results for home charging and near-home charging among EVs without sufficient home charging by income level, including low-, mid-, and high-income levels.

Electric Vehicles in Low-Income Communities Today on Average Have Less Access to Home Charging Than Middle- or High-Income Communities

Results were aggregated to assess EVs estimated to have home charging by communities designated as low-income (LIC), middle-income (MIC), or high-income (HIC). Appendix A defines income levels. About 55 percent of Californians live in a LIC, 23 percent in a MIC, and 22 percent in a HIC. About 29 percent of EVs in 2024 are estimated to be from LICs, about 25 percent from MICs, and 46 percent from HICs. Figure F-1 shows the percent of EVs in 2024 estimated to have home charging by income level and the percent of EVs in a hypothetical 100 percent EV future estimated to have access. Results indicate that on average, LICs have less access to home charging today than other income groups and HICs have the highest access. In a hypothetical future, LICs have better access than other income groups but no more than 23 percent of future EVs, split by income and housing type, have access.

Figure F-1: Electric Vehicles in 2024 Estimated to Have Home Charging by Income Level

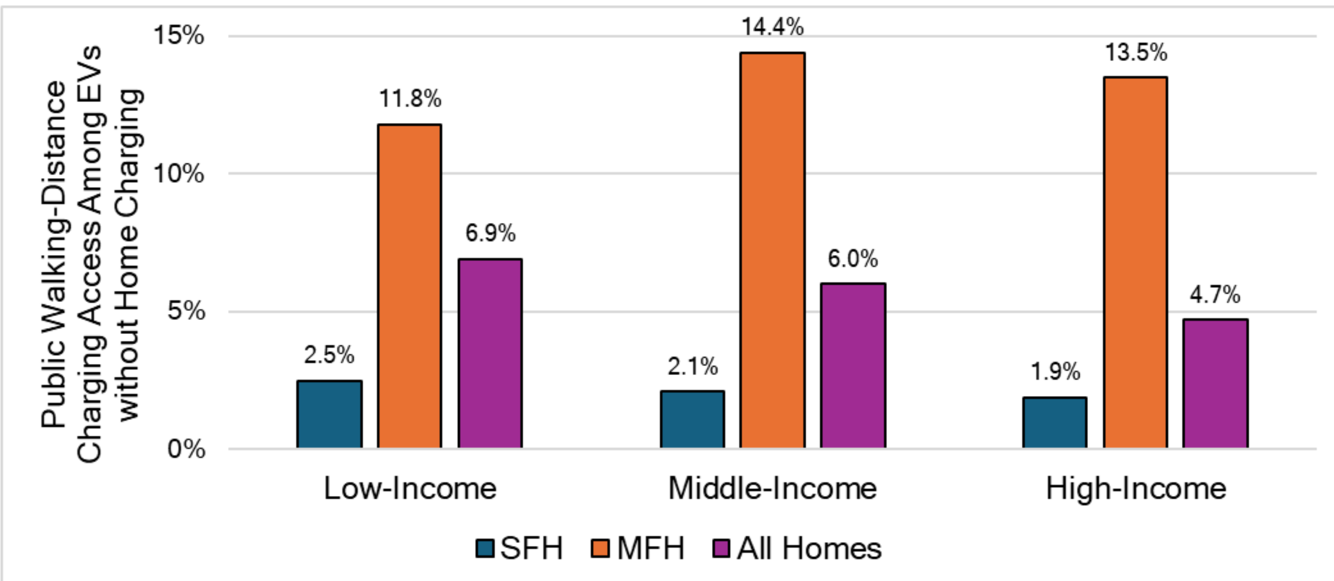


Source: CEC

Electric Vehicles at Multi-Family Homes Without Sufficient Home Charging in Low-Income Communities on Average Have Less Access to Walking-Distance Public Charging Than Middle- or High-Income Communities

As previously reported, EVs in LICs are estimated to have less access, on average, to sufficient home charging than in MICs or HICs. This is true for SFHs only, MFHs only, and all homes across income groups. Notably, among EVs at MFHs estimated to lack sufficient home charging, those in LICs, on average have less access to public L2 charging within walking-distance (eighth of a mile) than other income groups, as shown by Figure F-2. But among EVs at SFHs estimated to lack sufficient home charging, those in LICs, have better access to walking-distance public chargers than other income groups.

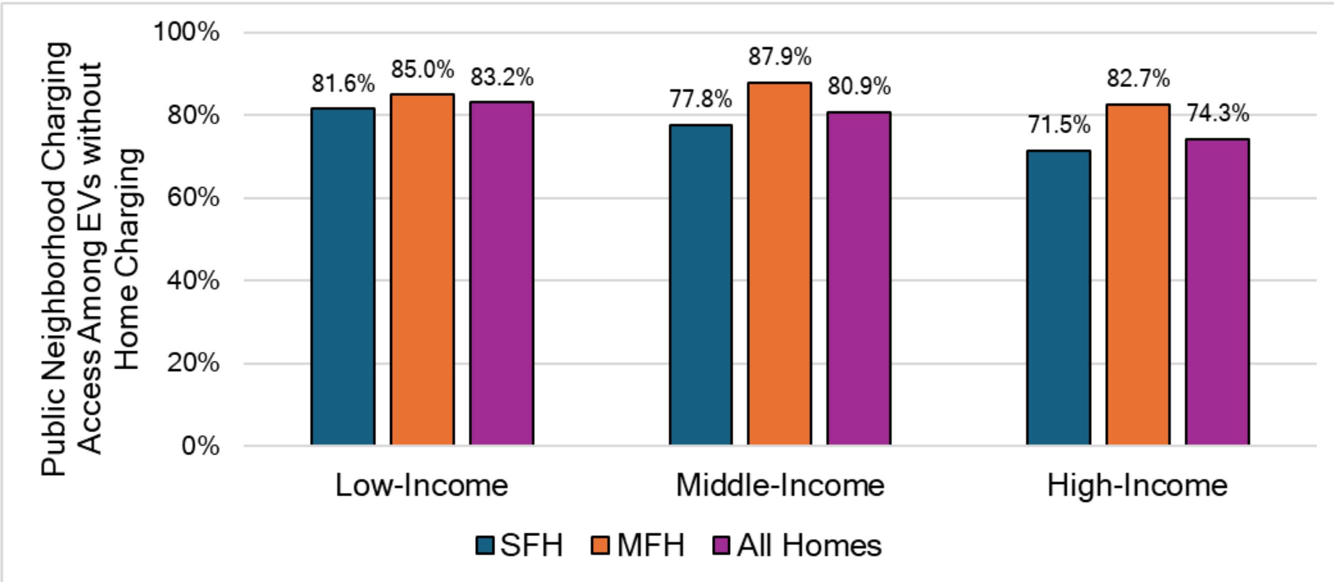
Figure F-2: Electric Vehicles in 2024 Served by Public Charging Within Walking-Distance Among Electric Vehicles Without Sufficient Home Charging by Income Level



Source: CEC

Access to neighborhood public charging near-home (two miles from home) among EVs without sufficient home charging is lowest for those within HICs on average, as shown by Figure F-3. The difference between LICs and MICs on average is small. It is important to note that access to home charging is highest in high-income communities and lowest in low-income communities.

Figure F-3: Electric Vehicles in 2024 Served by Neighborhood Public Charging Among Electric Vehicles Without Sufficient Home Charging by Income Level



Source: CEC

APPENDIX G: Detailed Results

Table G-1: Percentage of Households and Electric Vehicles by Barrier Category and Housing Type

	Low Barriers	Moderate Barriers	High Barriers	No Access	Total
Single-Family Homes					
Homes	42.8%	41.6%	10.7%	4.9%	100%
Electric Vehicles	58.3%	36.6%	3.9%	1.1%	100%
Electric Vehicles With Home Charging	60.5%	36.5%	2.9%	0%	100%
Electric Vehicles Without Home Charging	32.7%	37.7%	15.4%	14.2%	100%
Multi-Family Homes					
Homes	13.6%	21.6%	56.5%	8.3%	100%
Electric Vehicles	23.3%	24.2%	47.4%	5.1%	100%
Electric Vehicles With Home Charging	34.4%	29%	36.6%	0%	100%
Electric Vehicles Without Home Charging	10%	18.5%	60.2%	11.3%	100%

Source: CEC

Table G-2: Percentage of Households and Electric Vehicles by Barrier Category, Housing Type, and Low-Income or Disadvantaged Community Designation

	LIC/DAC	Low Barriers	Moderate Barriers	High Barriers	No Access	Total
Single-Family Homes						
Homes	LIC/DAC	36.2%	43.1%	14.4%	6.3%	100%
Homes	Not LIC/DAC	48.3%	40.4%	7.7%	3.7%	100%
EVs	LIC/DAC	51.1%	41.1%	6.3%	1.6%	100%
EVs	Not LIC/DAC	61.3%%	34.8%	3%	0.9%	100%
EVs With Home Charging	LIC/DAC	53.7%	41.6%	4.7%	0%	100%
EVs With Home Charging	Not LIC/DAC	63.2%	34.5%	2.2%	0%	100%

	LIC/DAC	Low Barriers	Moderate Barriers	High Barriers	No Access	Total
EVs Without Home Charging	LIC/DAC	25.7%	36.4%	20.8%	17.1%	100%
EVs Without Home Charging	Not LIC/DAC	36.4%	38.3%	12.6%	12.7%	100%
Multi-Family Homes						
Homes	LIC/DAC	9.2%	20.3%	61.7%	8.9%	100%
Homes	Not LIC/DAC	21.4%	24%	47.5%	7.2%	100%
EVs	LIC/DAC	15.2%	23.9%	55%	6%	100%
EVs	Not LIC/DAC	30.8%	24.5%	40.3%	4.3%	100%
EVs With Home Charging	LIC/DAC	23.9%	30.6%	45.5%	0%	100%
EVs With Home Charging	Not LIC/DAC	42.9%	27.6%	29.5%	0%	100%
EVs Without Home Charging	LIC/DAC	6.1%	16.9%	64.9%	12.1%	100%
EVs Without Home Charging	Not LIC/DAC	14.2%	20.2%	55.2%	10.4%	100%

Source: CEC

Table G-3: Percentage of Households and Electric Vehicles by Barrier Category, Housing Type, and Income Level

	Income Level	Low Barriers	Moderate Barriers	High Barriers	No Access	Total
Single-Family Homes						
Homes	Low	36.2%	42.4%	14.7%	6.7%	100%
Homes	Middle	40.6%	45.4%	10.3%	3.7%	100%
Homes	High	53.9%	36.9%	5.7%	3.5%	100%
EVs	Low	51%	40.9%	6.4%	1.7%	100%
EVs	Middle	54.3%	40.5%	4.2%	0.9%	
EVs	High	64.4%	32.3%	2.4%	0.9%	100%
EVs With Home Charging	Low	53.7%	41.4%	4.9%	0%	100%
EVs With Home Charging	Middle	56.4%	40.5%	3.2%	0%	100%
EVs With Home Charging	High	66.2%	32%	1.8%	0%	100%

	Income Level	Low Barriers	Moderate Barriers	High Barriers	No Access	Total
EVs Without Home Charging	Low	25.4%	35.7%	21%	17.9%	100%
EVs Without Home Charging	Middle	30.6%	41.2%	16.4%	11.8%	100%
EVs Without Home Charging	High	39.5%	37%	10.7%	12.8%	100%
Multi-Family Homes						
Homes	Low	8.9%	20.1%	62.1%	8.9%	100%
Homes	Middle	18.3%	24.8%	49.5%	7.4%	100%
Homes	High	24.5%	23.4%	45%	7%	100%
EVs	Low	15%	23.5%	55.5%	5.9%	100%
EVs	Middle	24.3%	26%	44.8%	4.8%	100%
EVs	High	35.1%	24%	36.9%	4.1%	100%
EVs With Home Charging	Low	23.7%	30.2%	46%	0%	100%
EVs With Home Charging	Middle	35.2%	30.7%	34.1%	0%	100%
EVs With Home Charging	High	47.4%	26.3%	26.3%	0%	100%
EVs Without Home Charging	Low	6%	16.6%	65.3%	12.1%	100%
EVs Without Home Charging	Middle	10.7%	20.3%	58.1%	10.9%	100%
EVs Without Home Charging	High	16.7%	20.6%	52.6%	10.1%	100%

Source: CEC

Table G-4: Percentage of Households and Electric Vehicles by Barrier Category, Housing Type, and Population Density

	Urban/Rural	Low Barriers	Moderate Barriers	High Barriers	No Access	Total
Single-Family Homes						
Homes	Urban	44.7%	41%	9.8%	4.6%	100%
Homes	Rural	32.7%	45%	15.8%	6.5%	100%
EVs	Urban	59.1%	36.1%	3.7%	1.1%	100%
EVs	Rural	48.7%	43.6%	6.6%	1.1%	100%
EVs With Home Charging	Urban	61.2%	36%	2.8%	0%	100%
EVs With Home Charging	Rural	51.1%	43.9%	5%	0%	100%
EVs Without Home Charging	Urban	33.4%	37.5%	14.8%	14.3%	100%
EVs Without Home Charging	Rural	24.2%	40%	23.1%	12.7%	100%
Multi-Family Homes						
Homes	Urban	13.6%	21.3%	56.8%	8.3%	100%
Homes	Rural	12.8%	29.9%	49.6%	7.8%	100%
EVs	Urban	23.2%	24.2%	47.5%	5.1%	100%
EVs	Rural	29.3%	30.2%	36.1%	4.3%	100%
EVs With Home Charging	Urban	34.3%	28.9%	36.8%	0%	100%
EVs With Home Charging	Rural	40.3%	33.8%	25.9%	0%	100%
EVs Without Home Charging	Urban	9.9%	18.4%	60.4%	11.3%	100%
EVs Without Home Charging	Rural	14.3%	25.3%	50.2%	10.2%	100%

Source: CEC

Table G-5: Percentage of Single-Family Households and Electric Vehicles by Panel Size

	≥ 150A Panel	100A or 125A Panel	< 100 A Panel	Total
Homes	55.5%	40.8%	3.7%	100%
Electric Vehicles	68.3%	30.5%	1.3%	100%
Electric Vehicles With Home Charging	69.6%	29.5%	0.9%	100%
Electric Vehicles Without Home Charging	52.2%	42.1%	5.6%	100%

Source: CEC

Table G-6: Percentage of Single-Family Households and Electric Vehicles by Panel Size and Low-Income or Disadvantaged Community Designation

	LIC/DAC	≥ 150A Panel	100A or 125A Panel	< 100 A Panel	Total
Homes	LIC/DAC	49.8%	43.7%	6.5%	100%
Homes	Not LIC/DAC	60.3%	38.3%	1.4%	100%
EVs	LIC/DAC	61.9%	35.3%	2.8%	100%
EVs	Not LIC/DAC	70.9%	28.5%	0.6%	100%
EVs With Home Charging	LIC/DAC	64.6%	34.4%	2%	100%
EVs With Home Charging	Not LIC/DAC	72%	27.5%	0.4%	100%
EVs Without Home Charging	LIC/DAC	45.7%	43.7%	10.6%	100%
EVs Without Home Charging	Not LIC/DAC	55.7%	41.3%	3%	100%

Source: CEC

Table G-7: Percentage of Single-Family Households and Electric Vehicles by Panel Size and Income Level

	Income Level	≥ 150A Panel	100A or 125A Panel	< 100 A Panel	Total
Homes	Low	50.3%	42.8%	6.8%	100%
Homes	Middle	53%	45%	2%	100%
Homes	High	65%	33.9%	1.1%	100%
EVs	Low	62.2%	34.8%	3%	100%
EVs	Middle	64.5%	34.6%	0.9%	100%
EVs	High	73.5%	26%	0.5%	100%
EVs With Home Charging	Low	74.6%	25%	0.4%	100%
EVs With Home Charging	Middle	65.9%	33.5%	0.6%	100%
EVs With Home Charging	High	63.9%	34%	2.2%	100%
EVs Without Home Charging	Low	46%	43%	11%	100%
EVs Without Home Charging	Middle	48.9%	47.1%	3.9%	100%
EVs Without Home Charging	High	58.9%	38.6%	2.5%	100%

Source: CEC

Table G-8: Percentage of Single-Family Households and Electric Vehicles by Panel Size and Population Density

	Urban/Rural	≥ 150A Panel	100A or 125A Panel	< 100 A Panel	Total
Homes	Urban	56.5%	39.9%	3.6%	100%
Homes	Rural	50.4%	45%	4.6%	100%
EVs	Urban	68.6%	30.2%	1.2%	100%
EVs	Rural	64.1%	34.5%	1.4%	100%
EVs With Home Charging	Urban	69.9%	29.2%	0.9%	100%
EVs With Home Charging	Rural	65.9%	33.1%	1%	100%
EVs Without Home Charging	Urban	52.8%	41.6%	5.6%	100%
EVs Without Home Charging	Rural	45.5%	48.8%	5.7%	100%

Source: CEC

Table G-9: Percentage of Multi-Family Households and Electric Vehicles by Housing Vintage

	≥ 1980 Year Built	< 1980 Year Built	Total
Homes	37.7%	62.3%	100%
Electric Vehicles	49.1%	50.9%	100%
Electric Vehicles With Home Charging	63.4%	36.6%	100%
Electric Vehicles Without Home Charging	32.1%	67.9%	100%

Source: CEC

Table G-10: Percentage of Multi-Family Households and Electric Vehicles by Housing Vintage and Low-Income or Disadvantaged Community Designation

	LIC/DAC	≥ 1980 Year Built	< 1980 Year Built	Total
Homes	LIC/DAC	31.8%	68.2%	100%
Homes	Not LIC/DAC	48.1%	51.9%	100%
Electric Vehicles	LIC/DAC	40.6%	59.4%	100%
Electric Vehicles	Not LIC/DAC	57%	43%	100%
Electric Vehicles With Home Charging	LIC/DAC	54.5%	45.5%	100%
Electric Vehicles With Home Charging	Not LIC/DAC	70.5%	29.5%	100%
Electric Vehicles Without Home Charging	LIC/DAC	26.3%	73.7%	100%
Electric Vehicles Without Home Charging	Not LIC/DAC	38.4%	61.8%	100%

Source: CEC

Table G-11: Percentage of Multi-Family Households and Electric Vehicles by Housing Vintage and Income Level

	Income Level	≥ 1980 Year Built	< 1980 Year Built	Total
Homes	Low	31.4%	68.6%	100%
Homes	Middle	45.9%	54.1%	100%
Homes	High	50.8%	49.2%	100%
Electric Vehicles	Low	40.1%	59.9%	100%
Electric Vehicles	Middle	52%	48%	100%
Electric Vehicles	High	60.7%	39.3%	100%
Electric Vehicles With Home Charging	Low	54%	46%	100%
Electric Vehicles With Home Charging	Middle	65.9%	34.1%	100%

	Income Level	≥ 1980 Year Built	< 1980 Year Built	Total
Electric Vehicles With Home Charging	High	73.7%	26.3%	100%
Electric Vehicles Without Home Charging	Low	25.8%	74.2%	100%
Electric Vehicles Without Home Charging	Middle	34.8%	65.2%	100%
Electric Vehicles Without Home Charging	High	41.4%	58.5%	100%

Source: CEC

Table G-12: Percentage of Multi-Family Households and Electric Vehicles by Housing Vintage and Population Density

	Urban/Rural	≥ 1980 Year Built	< 1980 Year Built	Total
Homes	Urban	37.4%	62.6%	100%
Homes	Rural	46%	54%	100%
Electric Vehicles	Urban	49%	51%	100%
Electric Vehicles	Rural	61.8%	38.2%	100%
Electric Vehicles With Home Charging	Urban	63.2%	38.6%	100%
Electric Vehicles With Home Charging	Rural	74.1%	25.9%	100%
Electric Vehicles Without Home Charging	Urban	31.9%	68.1%	100%
Electric Vehicles Without Home Charging	Rural	44.9%	55.1%	100%

Source: CEC