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STAFF REPORT

2024 Zero-Emission Vehicle Infrastructure Plan

Deployment Strategy 2025 to 2030

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ABSTRACT

Zero-emission vehicle charging and hydrogen fueling infrastructure are critical to meeting California's clean transportation goals. Public, private, and utility investments have played essential roles in deploying the existing and upcoming charging and fueling infrastructure.

To effectively invest public dollars into zero-emission vehicle charging and hydrogen fueling stations, staff conducted analyses to better understand existing operational charging ports and hydrogen fueling stations, future charging ports and hydrogen fueling stations funded by other entities or resulting from code compliance, and how many additional charging ports and hydrogen stations are needed year by year to meet state goals.

The first Zero-Emission Vehicle Infrastructure Plan (ZIP), released in December 2022, was intended to support decision-making in the public and private sectors by describing the state's short- and long-term actions to ensure that zero-emission vehicle infrastructure deployment will meet the needs of the growing zero-emission vehicle market. This second ZIP describes California's infrastructure deployment plan to meet the goals of the light-duty passenger vehicle market and medium-duty and heavy-duty truck and bus market.

Keywords: ZIP, zero-emission vehicles, electric vehicle charging, hydrogen fueling

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EXECUTIVE SUMMARY

Greenhouse gas and criteria pollutant emissions from transportation are significant contributors to the climate crisis and to negative health consequences, especially in low-income and disadvantaged communities. Zero-emission vehicle (ZEV) charging and hydrogen fueling infrastructure are critical to meeting California's clean transportation goals. Infrastructure investments increase access and equitable adoption and accelerate the transition away from fossil fuels.

The first *Zero-Emission Vehicle Infrastructure Plan* (ZIP) documented the state's near- and long-term actions to ensure that zero-emission vehicle infrastructure deployment will meet the needs of the growing zero-emission vehicle market. This second *Zero-Emission Vehicle Infrastructure Plan* describes a deployment strategy for Clean Transportation Program funding.

The Clean Transportation Program Has Been Essential to Making California a Leader in Zero-Emission Transportation

In 2018, Executive Order B-48-18 set a goal of having 250,000 chargers (including 10,000 DC fast chargers) by 2025. In 2020, Governor Newsom issued Executive Order N-79-20 which expanded zero-emission vehicle adoption targets, including 100 percent zero-emission vehicle sales for light-duty vehicles and 100 percent zero-emission vehicle operations for drayage trucks and off-road vehicles and equipment by 2035 where feasible; and 100% zero-emission MDHD vehicle sales and operations by 2045 where feasible.

The California Energy Commission (CEC) is the lead agency on ZEV charging infrastructure investment and analysis. To help address climate change and air pollution, the California Legislature passed Assembly Bill (AB) 118 (Núñez, Chapter 750, Statutes of 2007), which created the Clean Transportation Program, administered by the CEC. As part of the Clean Transportation Program, the CEC prepares and adopts an annual Investment Plan Update that identifies the funding priorities for the coming fiscal years. The Investment Plan Update includes base Clean Transportation Program funding and additional ZEV package investments, which draw from the general fund and Greenhouse Gas Reduction Fund (GGRF). Funding is allocated by category such as light-duty (LD) charging infrastructure, medium- and heavy-duty (MDHD) infrastructure, school bus infrastructure, and workforce training and development. The CEC can make category allocations within base Clean Transportation Program funding, however funding categories for ZEV package investments are more prescriptive and set in law.

Since the first Clean Transportation Program Investment Plan was released in 2009, the CEC has invested more than $2.23 billion in projects supporting zero-emission vehicle infrastructure, alternative fuels, and advanced vehicle technologies. To effectively invest public dollars into ZEV charging and hydrogen fueling stations, CEC staff conducted analyses to better understand existing operational charging ports and hydrogen fueling stations, future charging ports and hydrogen fueling stations funded by other entities or resulting from code compliance, and how many additional charging ports and hydrogen stations are needed each year to meet state goals.

Public and Private Funding is Essential to Supporting ZEV Charging and Hydrogen Fueling Deployments in California

The CEC tracks operational ZEV charging and hydrogen fueling infrastructure in the state through available data from the federal government and private sector, reporting from funding projects, and data requests to other public agencies, station developers, operators, automakers, and other industry stakeholders. The number of electric vehicle (EV) charging ports in California is estimated based on available data. The CEC is working on data regulations to capture better data for EV charging inventory.

The ZEV charging and hydrogen fueling station counts are published on the CEC's ZEV Dashboard website. Currently operational ZEV infrastructure includes:

- Over 152,000 public and shared private Level 2 and direct current fast charging (DCFC or DC fast charging) ports serving light-duty (LD) EVs in the state.
- 62 open retail hydrogen stations serving light-duty fuel cell electric vehicles (FCEVs).
- 2,082 charging ports and 23 hydrogen fueling nozzles serving MDHD vehicles including over 200 school bus charging ports.

ZEV Infrastructure Expected through Building Codes and Funding from the Federal Government and Utilities

This report estimates the amount of expected ZEV infrastructure through California's building codes and funding from the federal government and utilities. In a later section, we compare the amount of expected ZEV infrastructure with modeling needs to inform funding priorities for the CEC's Clean Transportation Program.

The California Green Building Standards Code is expected to play a large role in the deployment of future Level 2 chargers at new non-residential construction and multifamily housing, potentially deploying over 161,000 chargers by 2030. The building code requirements will increase Level 2 charging access at new or substantially retrofitted apartments, condos, multi-unit dwellings, and office spaces.

CEC staff estimates roughly 7,500 EV charging ports will be deployed from federal funding through the National Electric Vehicle Infrastructure (NEVI) Program. The recently awarded $102 million Tri-State West coast Truck Charging and Fueling Corridor Project will deploy 12 charging stations and 1 hydrogen fueling station in California. Utility ratepayer programs are estimated to result in over 21,000 LD EV charging ports and over 10,000 MDHD charging ports.

Modeling and Analytical Tools Help Inform Investment Decisions

The CEC and state agencies, in partnership with national labs and academia and informed by stakeholders, have developed strong modeling and analytical tools to help inform investment decisions and are the subject of reports to inform the public and policy makers. The ZIP uses results from previous needs assessments to analyze the state of ZEV charging and hydrogen fueling infrastructure to develop a deployment strategy for the Clean Transportation Program's funding. For EV charging, this report uses charging port needs estimates from the Assembly Bill (AB) 2127 (Ting, Chapter 365, Statutes of 2018) modeling assessment and focuses on the

estimates from the baseline modeling scenario and the gas station alternative future modeling scenario. For hydrogen fueling stations, this report uses analysis from AB 8 (Perea, Chapter 401, Statutes of 2013)/AB 126 (Reyes, Chapter 319, Statutes of 2023) for progress towards establishing a hydrogen fueling network) SB 671 (Gonzalez, Chapter 769, Statutes of 2021) which identified priority freight corridors and infrastructure needed to support), and SB 643 (Archuleta, Chapter 646, Statutes of 2021) assessed existing and planned MDHD hydrogen fueling infrastructure in California.

Business Case for Light-Duty EV Charging

The need to invest public funding for EV charging infrastructure depends upon how the markets for public EV charging mature. It is essential that CEC monitors maturation of the market as it makes funding decisions for ZEV infrastructure deployment. California is still in the early stages of ensuring there is sufficient infrastructure to support the ZEV transition, and the state continues to have a role in supporting the deployment of EV charging infrastructure to ensure drivers are comfortable adopting a ZEV and access to charging is no longer an impediment.

This report explored a business case for LD EV charging by developing a methodology to assess the levelized cost-of-service in dollars per kilowatt-hour (kWh) – affecting how a LD station operator would have to price energy to cover its capital and operating costs and make a profit. Initial outcomes of the draft methodology show that DC fast charger levelized cost per kWh could be similar to or even lower than Level 2 cost per kWh for passenger vehicles. Utilization and speed will be two factors that lower the cost per kWh somewhat independent of charger technology. The appropriate charger technology will vary based on site conditions that affect costs and utilization. The levelized cost provides a framework to help understand the market and the role of public funding. As part of the deployment strategy, the state intends to support both technologies, but CEC staff explored the impacts of a balanced deployment and a fast charger focused deployment.

Deployment Strategy for Clean Transportation Program Funding

In this report, CEC staff explored multiple scenarios on how to allocate Clean Transportation Program base funding for deploying EV charging ports. While the ZIP focuses on the CEC's Clean Transportation Program funding, the ZIP deployment plan strategy will also impact how the CEC spends one-time funding, subject to legislative requirements on how those funds may be spent.

Primary AB 2127 Funding Scenario for LD Passenger EVs

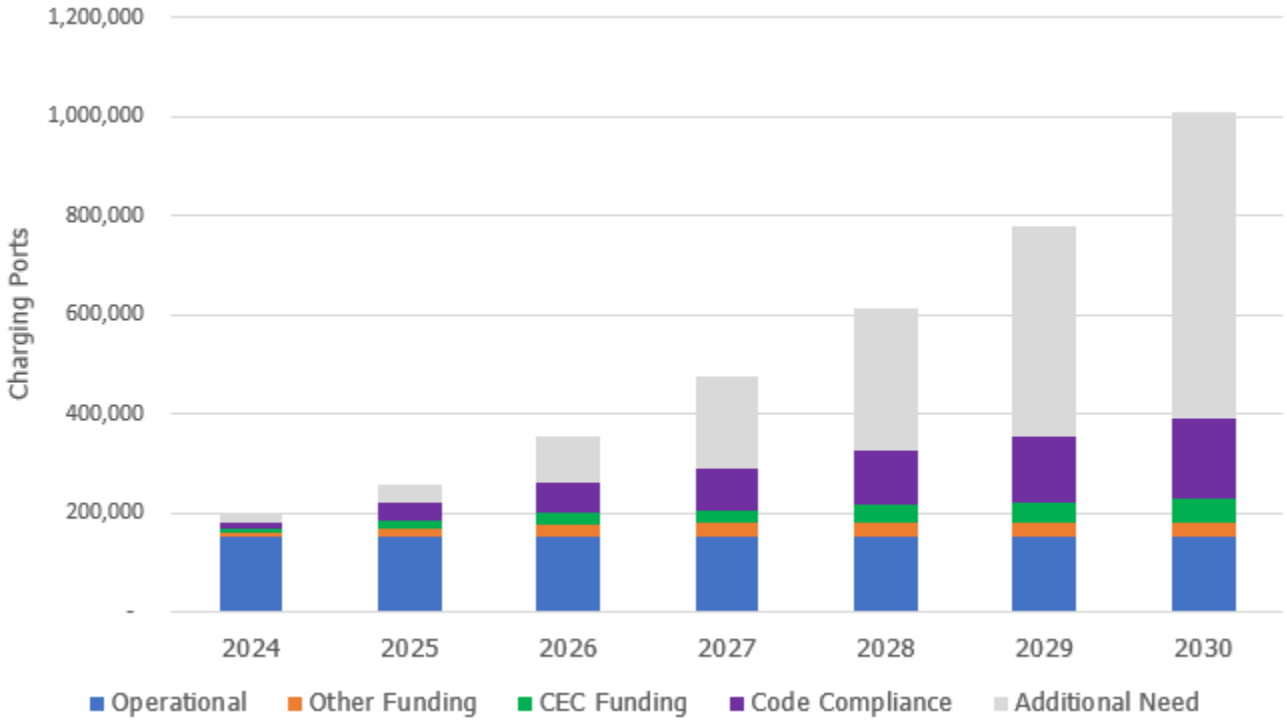
In the Primary AB 2127 Funding Scenario, the second Assembly Bill 2127 assessment finds California will need 1.01 million chargers, including 39,000 direct current (DC) fast chargers in 2030. For this funding scenario, base annual Clean Transportation Program funding is evenly split between Level 2 and DC fast charging. Level 2 deployments are prioritized for multifamily and workplace deployments. The analysis combined operational and estimated anticipated charger deployments year by year to look at impacts from different funding entities and where additional need exists. This analysis is further broken down by different segments, including multifamily, workplace, public Level 2 and DC fast charging across the state.

Under this scenario, CEC staff explored the impacts of reallocating base annual Clean Transportation Program for a specific sector, for example only funding multifamily or only funding workplace Level 2. Due to the limited amount of base Clean Transportation Program funds, directing funding towards one specific sector meant increasing the gap in another sector. Taking into consideration roles played by other funding entities, code compliance, and where private sector investments are likely to go, CEC staff proposed the following strategy for light-duty electric vehicle charging ports if the Primary AB 2127 Funding Scenario is adopted:

- Prioritize Level 2 deployments serving multifamily households
- Prioritize DC fast charging in rural areas of the state
- Prioritize increasing the presence of DC fast charging to meet equity needs
- Prioritize harder to reach workplaces and commute destinations (where drivers live in one region and commute to another region for work)

Figure 1 below shows the year-by-year statewide need and anticipated charging port deployments through code compliance and existing state and utility funding for light-duty EV charging between 2024 through 2030. About 40 percent of 2030 charging needs would be met through existing state, federal and utility programs. The private sector has played an important role and will continue to play an important role in deploying infrastructure to help meet state goals. For example, over half of the state's fast charging network has been fully funded by Tesla. However, we do not estimate private sector contributions, since there is too much uncertainty about future deployments.

Figure 1: Statewide Level 2 and DCFC Needs and Anticipated Charging Port Deployments for Light-Duty under the Primary Funding Scenario

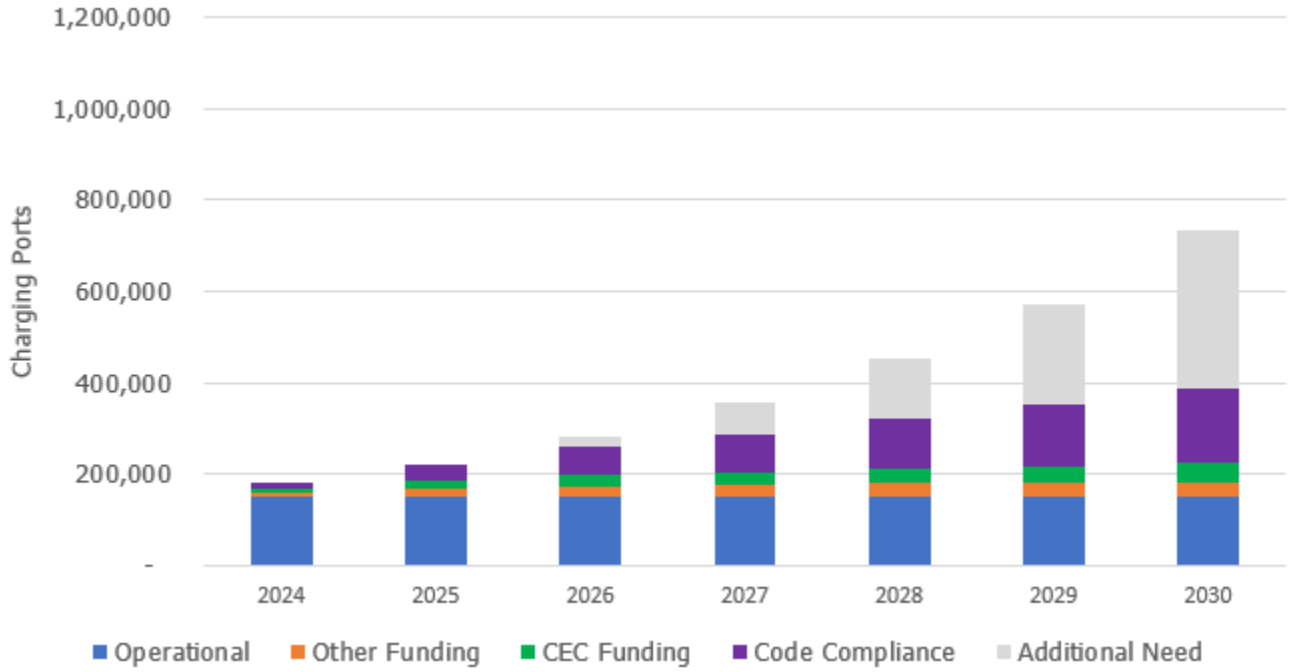


Source: CEC Staff Analysis

Alternative Funding Scenario with Increased DC Fast Charger Deployment for LD Passenger EVs

An alternative funding scenario proposes an expanded presence of DC fast chargers and leverages the second AB 2127 assessment's "gas station model" alternative future scenario to explore the potential for DC fast charging to meet a larger share of future charging needs. CEC staff notes the "gas station model" does not imply converting existing gas stations to EV charging stations but models future charging needs where a driver prefers DC fast charging over all other away-from-home charging options. Under this scenario, installing 63,000 additional DC fast charging ports by 2030 would decrease the need for Level 2 charging ports at workplaces and public locations by about 400,000. This reduces the total number of sites that need to be developed and the associated work to develop those sites, including permitting, energization, and other site-specific activities. In this funding scenario, the primary focus of CEC's funding will be to deploy public DC fast charging and shared Level 2 chargers at multi-unit dwellings. The base Clean Transportation Program funding is allocated for DC fast charging port deployments. In addition, General Fund and Greenhouse Gas Reduction Fund (GGRF) funding will primarily be allocated to DC fast charging and Level 2 ports for multi-unit dwellings. Figure 2 below shows the year-by-year statewide need and anticipated charging port deployments for light-duty between 2024 through 2030. Under this scenario, more than half of 2030 charging needs are met through existing state, federal and utility programs.

Figure 2: Statewide Level 2 and DCFC Needs and Anticipated Charging Port Deployment for Light-Duty under the Increased DC Fast Charger Funding Scenario



Source: CEC Staff Analysis

The CEC is seeking feedback on whether to use the DCFC focused scenario to plan for infrastructure needs.

MDHD Deployment Strategy for EV Charging

In the second AB 2127 assessment, the Medium- and Heavy-Duty Electric Vehicle Infrastructure Load, Operations, and Deployment (HEVI-LOAD) model estimated that to support 155,000 MDHD EVs in 2030, California will need about 109,000 lower-speed depot chargers (20 kW to 150 kW) and 5,500 higher-speed en route chargers (350 kW to 1,500 kW). This estimate assumes that depot charging is an option for all vehicles, which may not be the case. Low-speed depot charging may not be an option for certain types of vehicles such as drayage trucks used for multiple shifts, leased vehicles that do not return to depots overnight, and owner-operator vehicles without dedicated depots.

The second AB 2127 assessment explored a high-speed depot alternative future scenario where 20 percent of depot charging is shifted from slower chargers to fast chargers (350 kW to 1,500 kW). This scenario calls for over 98,000 charging ports to support MDHD EV vehicles by 2030.

There are uncertainties about what a mature MDHD EV charging system will look like, so it is difficult to prioritize one charging type over another at this time. To support the needs of these vehicles, high-speed local charging ports will need to be installed near their existing destinations. These high-speed local charging ports may be installed by fleet operators, third-party depot operators, or charging-as-a-service operators near MDHD vehicle destinations. The state has a role to help ensure fleets, especially those with more urgent targets under Advanced Clean Fleets (ACF)/Advanced Clean Trucks (ACT), transition successfully to ZEVs.

For MDHD EV charging ports, the CEC will:

- Prioritize both depot and public (en route) EV charging
- Prioritize infrastructure investments serving vehicle classes and fleets with more urgent targets under ACF/ACT

Hydrogen Fueling Station Deployment Strategy for LD and MDHD

The state continues to play a role in deploying light-duty hydrogen refueling stations until there is a sufficient network of stations in operation in California to support existing and expected hydrogen vehicles. The light-duty fuel cell electric vehicle (FCEV) market has slowed down with approximately 300 vehicles sold in the first half of 2024, resulting in a total of 14,185 FCEVs on the road in California. For comparison, approximately 227,000 light-duty EVs were sold in the same time period. The light duty FCEV market has been impacted by hydrogen station closures, hydrogen supply disruptions, station performance challenges and high hydrogen prices. However, hydrogen could play an important role for MDHD decarbonization, and as clean hydrogen is scaled for trucks and buses, the light duty market could benefit as well. California is planning to leverage federal hydrogen funding to deploy clean hydrogen at reduced costs. The Alliance for Renewable Clean Hydrogen Energy Systems (ARCHES), a public-private partnership, was awarded $1.2 billion by the U.S. Department of Energy to establish a clean hydrogen hub in California, to reach a total in-state clean hydrogen production capacity of 45,000 tons per day by 2045. With the idea that a strong MDHD hydrogen market and its larger fuel demand would have a positive impact on hydrogen prices as well as fuel supply for the light-duty market. Some transit agencies, including AC transit, Sunline, and Humboldt Transit, are counting on hydrogen fuel cells as a key decarbonization strategy. The NorCal Zero Project is deploying 50 class 8 trucks and the largest public hydrogen station for MD/HD in the world is operating near the Port of Oakland. However, there remains uncertainty regarding the type of zero-emission technology fleet owners will choose for their operations, and estimating the future demand for MDHD hydrogen refueling stations is challenging.

For hydrogen, CEC staff proposes the following strategy:

- Continue to monitor the light-duty hydrogen FCEV market and make infrastructure investments to support current and expected future drivers.
- Focus on improving the driver experience and fueling supply in California so that the existing network is more reliable and affordable.
- Encourage development of depot and publicly accessible MDHD hydrogen fueling network and MDHD depot refueling.

CHAPTER 1: Background

California has set goals of high levels of ZEV adoption across mobile sectors including light-duty, medium-duty, heavy-duty, and off-road. Many actors are deploying plug-in electric vehicle (PEV or EVs) charging and hydrogen FCEV fueling infrastructure. Public funding, electric utility ratepayer investment, and private investment have contributed to California's ZEV charging and fueling infrastructure networks, and all will continue to be essential to meeting future goals.

California's Zero-Emission Vehicle and Infrastructure Goals

ZEVs and ZEV infrastructure for EV charging and FCEV fueling are key components in achieving California's greenhouse gas (GHG) reduction targets, petroleum reduction goals, and air quality standards.

In 2018, Executive Order B-48-18 set a goal of having 250,000 chargers (including 10,000 DC fast chargers) by 2025. In 2020, Governor Newsom issued Executive Order N-79-20 which expanded zero-emission vehicle adoption targets, including 100 percent zero-emission vehicle sales for light-duty vehicles and 100 percent zero-emission vehicle operations for drayage trucks and off-road vehicles and equipment by 2035 where feasible; and 100% zero-emission MDHD vehicle sales and operations by 2045 where feasible.

Per AB 2127, the CEC is required to publish a biennial report on the charging infrastructure needed for California to meet its zero-emission vehicle targets by 2030. The 2023 AB 2127 report projects 1.01 million public and shared private chargers are needed to support 7.1 million passenger plug-in electric vehicles in 2030, and 2.11 million public and shared private chargers are needed to support 15.2 million passenger plug-in electric vehicles in 2035. An additional 114,500 chargers are needed to support the 157,000 MDHD EVs anticipated for 2030. [1] This is the primary modeling scenario. The AB 2127 report also modeled an alternative future scenario that assumes EV drivers use DC fast charging as their primary means of charging away from home, referred to as the "gas station model" alternative future. To meet the state's charging needs under this alternative future scenario, California would need 63,000 additional DC fast charging ports by 2030 and about 400,000 fewer Level 2 charging ports at workplaces and public locations compared to the primary modeling scenario. CEC is seeking input on which modeling scenario the state should consider.

AB 126 (Reyes, Chapter 319, Statutes of 2023) reauthorized the Clean Transportation Program until July 1, 2035, and directed the CEC to allocate no less than 15 percent of the amount of funds appropriated by the Legislature to fund hydrogen fueling stations until there is a

1 Davis, Adam, Tiffany Hoang, Thanh Lopez, Jeffrey Lu, Taylor Nguyen, Bob Nolty, Larry Rillera, Dustin Schell, Micah Wofford. 2023. *Assembly Bill 2127 Second Electric Vehicle Charging Infrastructure Assessment: Assessing Charging Neets to Support Zero-Emission Vehicles in 2030 and 2035.* California Energy Commission. Publication Number: CEC-600-2024-003-CMR. Available at https://www.energy.ca.gov/publications/2024/assembly-bill-2127-second-electric-vehicle-charging-infrastructure-assessment.

sufficient network of stations in operation in California to support existing and expected hydrogen vehicles until July 1, 2030. AB 126 also removed the 100-station requirement that was in AB 8 (Perea, Chapter 401, Statutes of 2013). CARB and CEC are required, on an annual basis, to jointly review and report on progress toward establishing a hydrogen fueling network that provides the coverage and capacity to fuel vehicles requiring hydrogen fuel that are being placed into operation in the state.

Purpose of the ZIP

The previous 2022 ZIP provided a fuller description of the "infrastructure" market pillar within the California Zero-Emission Vehicle Market Development Strategy.[2] The 2022 ZIP was intended to support decision-making in the public and private sectors by describing the state's short- and long-term actions to ensure that ZEV infrastructure deployment will meet the needs of the growing market. This shows where ZEV charging and fueling infrastructure investments are going and where the state is headed as entities plan for future deployments. The CEC coordinated with several agencies to develop the 2022 ZIP, including the California Public Utilities Commission (CPUC), California Air Resources Board (CARB), California State Transportation Agency (CalSTA), California Department of Transportation (Caltrans), Governor's Office of Business and Economic Development (GO-Biz), Department of General Services (DGS), Department of Housing and Community Development (HCD), and the California Building Standards Commission (CBSC).

The 2022 ZIP divided ZEV infrastructure into five market segments to address the specific challenges and opportunities unique to each sector. Highlights include:

- Emphasizing charging and hydrogen fueling for MDHD vehicles to increase equity by rapidly transitioning the most polluting vehicles to zero emission.
- Continuing to collaborate with private actors to address challenges for public hydrogen fueling for light-duty vehicles such as high prices at the pump, station reliability, fueling standards, and others.
- Maximizing access to home charging including for multifamily housing residents and potential funding for incentives for charging at low-income single-family homes.
- Phasing out public support for chargers with CHAdeMO connectors to adapt to market trends. Improve customer experience, focusing on charging speeds, reliability, and costs to drivers.
- Monitoring demonstration of emerging technologies such as battery swapping, wireless charging, and mobile charging units.

The 2022 ZIP focused on what California has done and will do in the near and longer term to support both ZEV charging and hydrogen fueling infrastructure deployment. The 2022 ZIP highlighted important roles various state agencies have in the deployment of ZEV charging and fueling infrastructure across the state and the importance of coordination to ensure each

2 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/sites/default/files/20222-12/600-2022-054-REV.pdf.

program is complimentary, makes strategic use of state funds and maximizes the benefits to all Californians.

Since the release of the first ZIP in late 2022, the CEC has:

- Awarded 190 projects for more than $107.4 million in ZEV charging and fueling infrastructure incentives through Energy Infrastructure Incentives for Zero-Emission Commercial Vehicles (EnergIIZE Commercial Vehicles).
- Released targeted grant funding opportunities to provide zero-emission charging and hydrogen fueling infrastructure for transit buses and drayage trucks (includes direct partnership with CARB to provide vehicle funding incentives).
- Released new grant funding opportunities targeting high-priority or underserved EV charging needs, including grid integration, multifamily housing, and rural communities.
- Released block grant projects offering rebates for high-powered DC fast charging ports and Level 2 charging ports prioritized in disadvantaged and low-income communities, including tribal lands. Priority sites for Level 2 include multifamily housing, faith-based organizations, schools, health care facilities, community nonprofits, local governments, and workplaces.
- Funded projects to produce 100 percent renewable hydrogen from in-state renewable resources.

This report has a primary focus of being a deployment plan to complement the Clean Transportation Program Investment Plan to meet state goals. As detailed in the 2022 ZIP, the state plays a role in ensuring accelerated and equitable deployment of ZEV charging and fueling infrastructure to meet state goals. This report will assess the current state of ZEV infrastructure assessments and strategies to deploy charging and fueling infrastructure through the Clean Transportation Program. The strategy will extend to general fund and GGRF allocations but may have some constraints per legislative direction.

The CEC is the lead agency on ZEV charging infrastructure investment and analysis. To help address - climate change and air pollution, the California Legislature passed AB 118 (Núñez, Chapter 750, Statutes of 2007). This legislation created the Clean Transportation Program, which the CEC administers. Fees collected for vehicle registration, vehicle identification plates, and smog abatement fund Clean Transportation Program projects that will "transform California's fuel and vehicle types to help attain the state's climate change policies." [3] The CEC seeks to provide more than 50 percent of Clean Transportation Program funding towards projects that will benefit low-income and disadvantaged communities.

In addition to Clean Transportation Program base funding, the Budget Acts of 2021, 2022, and 2023 added funding to the state's general fund and the Greenhouse Gas Reduction Fund (GGRF) for zero-emission transportation and related activities. These Budget Acts were

3 Assembly Bill 8 (Perea, Chapter 401, Statutes of 2013) extended the collection of fees that support the Clean Transportation Program to January 1, 2024. Assembly Bill 126 (Reyes, Chapter 319, Statutes of 2023) extended the program to July 1, 2035.

amended in 2024 and changed many of these funds, including reassigning most allocations from the general fund to the GGRF. Details of this funding can be found in Appendix A.

The Clean Transportation Program has been essential to making California a leader in zero-emission transportation. Since the first Clean Transportation Program Investment Plan was released in 2009, the CEC has invested more than $2.23 billion in projects supporting zero-emission vehicle infrastructure, alternative fuels, and advanced vehicle technologies.

Structure of the ZIP

Chapter 1 introduces California's ZEV goals and describes the purpose of this report. Chapter 2 describes efforts to track current inventory of operational ZEV infrastructure and anticipated future ZEV infrastructure deployments from existing programs. Chapter 3 discusses the various modeling and analysis efforts to assess ZEV infrastructure needs for light-, medium-, and heavy-duty vehicles; describes the analysis for the projected additional needs; analysis of scenarios for funding deployment; and barriers for infrastructure. Chapter 4 discusses exploring a business model for light-duty, public, pedestal-based EV charging stations. Chapter 5 discusses the infrastructure deployment strategy by technology and sector. This includes two funding scenario proposals.

CHAPTER 2:
Status of ZEV Infrastructure Deployments

Current State of ZEV Infrastructure

Effectively investing public dollars into ZEV infrastructure requires a detailed understanding of how many operational charging ports and hydrogen fueling stations exist, how many will be deployed in the future, and how many more are needed to meet state goals.

This report will discuss efforts to track ZEV infrastructure that is operational, in the planning/construction process, and anticipated in the future from current funding sources.

Tracking Existing Operational ZEV Infrastructure

Both public and private funding have been essential to supporting ZEV infrastructure deployment in California. Currently operational ZEV infrastructure includes:

- More than 152,000 public and shared private Level 2 and direct current fast charging (DCFC or DC fast charging) ports serving light-duty EVs in the state.
- 62 open retail hydrogen stations serving light-duty FCEVs.
- 2,082 charging ports and 23 hydrogen fueling nozzles serving MDHD vehicles including over 200 school bus charging ports.

Electric Vehicle Charging Stations

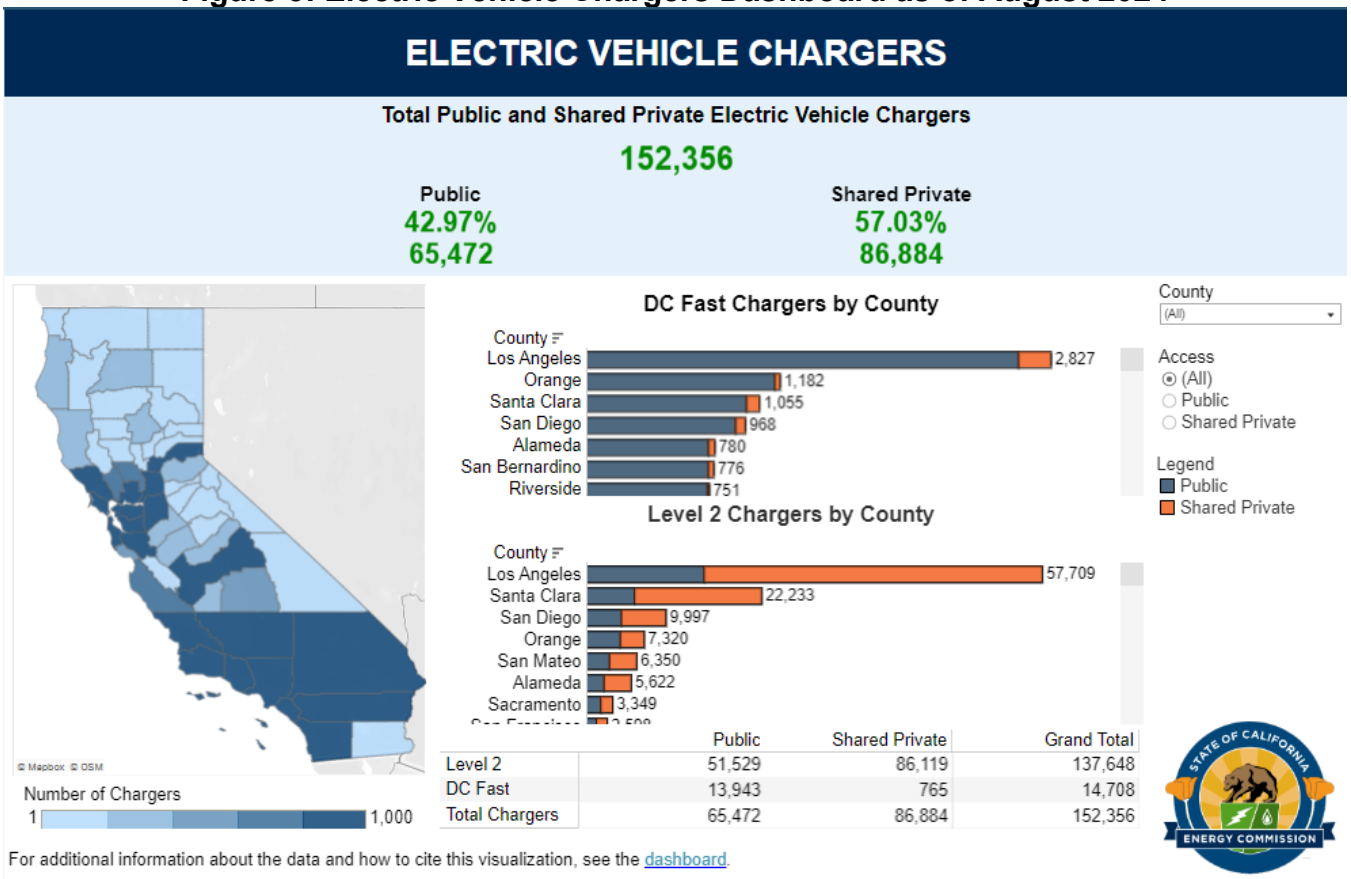
As of August 2024, there are an estimated 152,356 public and shared private charging ports in California serving light-duty EVs and an estimated 2,082 charging ports serving MDHD vehicles. These are undercounts due to the fact that fully privately funded chargers on private property are not always visible. For example, if an MDHD fleet operator adds depot charging to their site using only private funds, the CEC may not be aware of those chargers. Likewise, the private market is making significant investments in LD and MDHD infrastructure with much of it currently under development or construction. Those infrastructure projects can be difficult to quantify.

To track operational light-duty EV charging ports, the CEC relies upon data from the federal government (Alternative Fuels Data Center), PlugShare, reporting from funding projects, data requests to other public agencies, and a voluntary survey sent to charger providers, public agencies with fleets, and utilities on a semi-annual basis. The results are published on the CEC online ZEV Dashboard (see Figure 3). For MDHD operational charging ports, the CEC requests data input from other agencies, the public, station developers, and other interested parties. The CEC recently launched a beta MDHD dashboard for battery electric vehicle (BEV) and FCEV infrastructure in May 2024 (see Figure 4).

Tracking the number of EV charging ports in California has relied on estimation based on available data, and reporting requirements vary widely. The 250,000-charger goal for light-duty vehicles includes both public and shared private chargers, the latter typically found at workplaces, fleets, multifamily dwellings (i.e., apartments, condominiums), and other non-public venues. Service providers for public charging ports must report the station location,

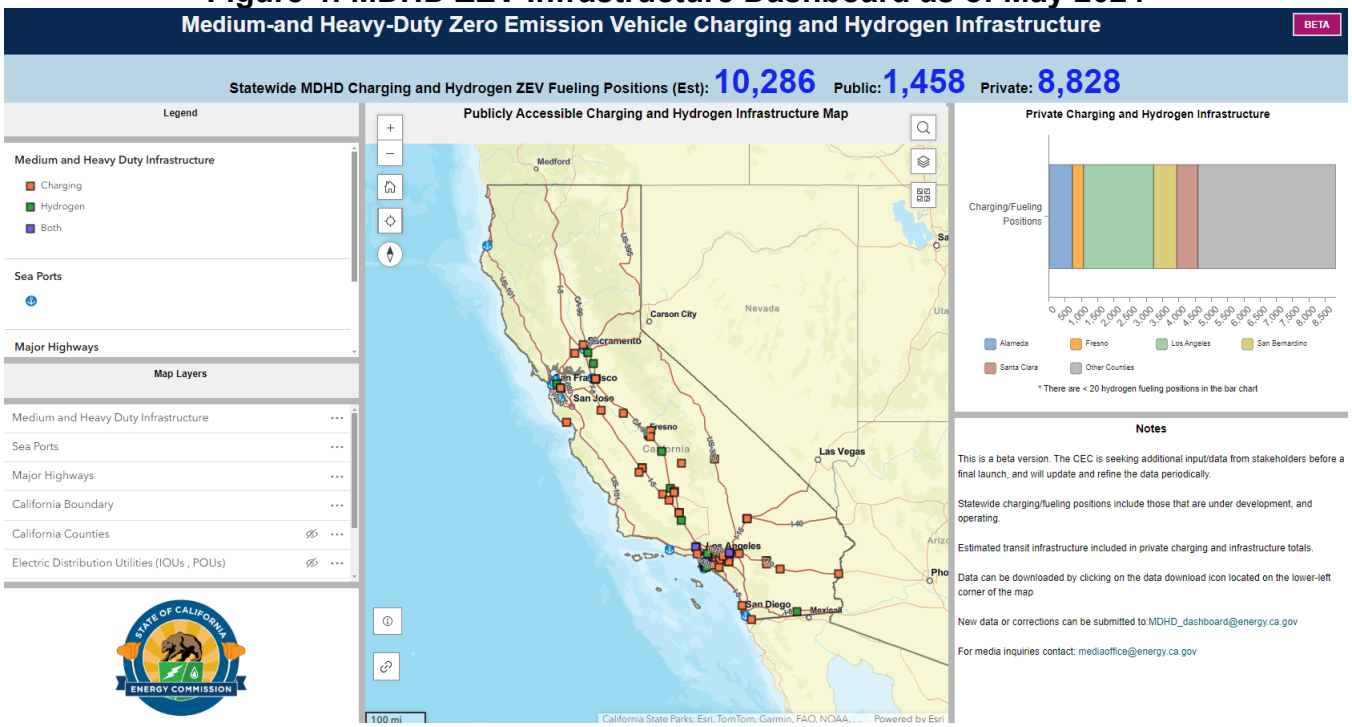
schedule of fees, accepted methods of payment, and fees for nonmember use (if any) to the National Renewable Energy Laboratory (NREL). Shared private charging ports do not have to report any of the previously listed information. This lack of data on shared private chargers creates challenges for policy and planning. An accurate count of the number of public and shared private charging ports in a region can improve public and private investment decisions. The state is undergoing an effort through data regulations to capture better data for charging inventory.

Figure 3: Electric Vehicle Chargers Dashboard as of August 2024



Source: CEC Electric Vehicle Chargers in California Dashboard. Data last updated August 26, 2024. Retrieved August 30, 2024, from https://www.energy.ca.gov/zevstats.

Figure 4: MDHD ZEV Infrastructure Dashboard as of May 2024



Note: Screenshot of MDHD ZEV Charging and Hydrogen Infrastructure Dashboard includes operational and planned infrastructure.

Source: California Energy Commission

Hydrogen Fueling Stations

As of August 2024, there were 42 hydrogen fueling stations open to the public for LD FCEVs in California, and an additional 20 stations are considered temporarily nonoperational (TNO), which means that they previously achieved open retail status but have been unavailable for customers for a period greater than 30 days for various reasons, with no estimated time frame for reopening. The 62 stations are generally concentrated in the San Francisco Bay Area, the Greater Los Angeles Area, and the San Diego Area, with one connector station in the Central Valley and a few destination stations.

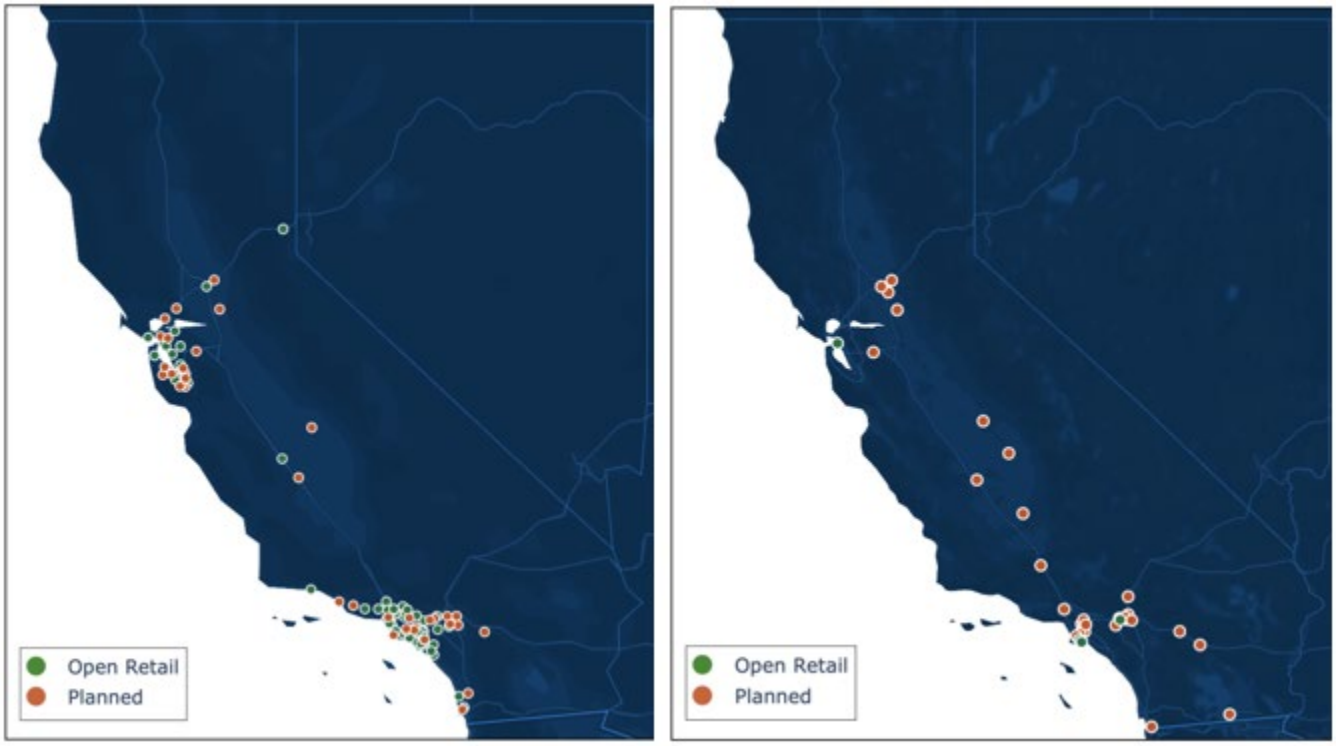
There are barriers that need to be addressed to give FCEV drivers confidence in the refueling network. Barriers to the FCEV market growth include spiking prices of hydrogen and station reliability and availability that are caused by supply constraints, hydrogen supply disruptions, and equipment failures. Improving station reliability and availability are key to providing all stakeholders, most notably FCEV drivers and auto manufacturers, confidence in the FCEV market. The CEC is taking actions to address each of these barriers such as funding opportunities to support operations and maintenance of existing stations and requiring commitment to achieving 95 percent uptime as a condition for receiving grant funding.

California plans to leverage federal hydrogen funding to deploy clean hydrogen at reduced costs. The Alliance for Renewable Clean Hydrogen Energy Systems (ARCHES), a public-private partnership, was awarded $1.2 billion by the U.S. Department of Energy to establish a clean hydrogen hub in California, to reach a total in-state clean hydrogen production capacity of 45,000 tons per day by 2045. With the idea that a strong MDHD hydrogen market and its

larger fuel demand would have a positive impact on hydrogen prices as well as fuel supply for the light-duty market.

The publicly available MDHD hydrogen fueling network is still in its infancy with four retail stations (11 nozzles) and 5 private depots (12 nozzles) in California as of July 2024. Three of the public stations are in Southern California and have a capacity of 1,140 kilograms per day each. The fourth station, jointly funded by CARB and the CEC, is located near the Port of Oakland and is the world's largest MDHD station constructed to date, with fast-fill capability. The station has a capacity of 18,000 kilograms per day and is able to fuel 70 kilograms for a Class 8 truck in under 10 minutes. The private fueling depots are located at transit agencies across the state. Alameda County (AC Transit) has two refueling stations, one in Oakland and the other in Emeryville. Golden Empire Transit has refueling infrastructure that is closed for repair. San Mateo County Transit has a mobile refueler and is currently operating. Foothill Transit has a state-of-the-art hydrogen refueling station with two refueling dispensers.[4] Orange County Transit's station is open and operating, as is Sunline Transit's refueling station.

Figure 5: Hydrogen Fueling Network in California



Note: Light-Duty network on the left, MDHD network on the right (end of 2023).

Source: California Energy Commission

Nikola, producer of fuel cell and battery electric semi-trucks, is building out its HYLA hydrogen refueling network to support its Class 8 hydrogen fuel cell electric trucks. To date, the HYLA

4 Center for Transportation and the Environment (CTE). October 2023. "Foothill Transit and CTE Achieve Groundbreaking Refueling Efficiency at Hydrogen Station." Available at https://cte.tv/post/foothill-transit-and-cte-achieve-groundbreaking-refueling-efficiency-at-hydrogen-station.

network consists of 4 open stations in Long Beach, Ontario, Oakland, and Sante Fe Springs. There is 1 planned station in Wilmington coming soon.

Tracking Pipeline ZEV Infrastructure through 2030

In addition to tracking operational ZEV infrastructure, the CEC is also tracking charging and hydrogen station infrastructure deployments in the pipeline, meaning projects that are currently funded by state/federal, ratepayer, settlement program, or any other public incentive and will become operational in the future. Table 1 below represents current state, federal, utility ratepayer, and other local funding for EV charging and hydrogen fueling station deployment and does not include the significant funding for necessary distribution and transmission infrastructure to support the chargers that utility ratepayers fund.

Table 1: ZEV Infrastructure Funding Programs

Funding Source	Program
State	• Clean Transportation Program administered by the CEC • State general funds for zero-emission transportation and related activities through the Budget Acts of 2021, 2022, 2023, and 2024 • Low Carbon Fuels Standard (LCFS) • Clean Off-Road Equipment Vouchers administered by CARB
Federal	• National Electric Vehicle Infrastructure (NEVI) Formula Program • Charging and Fueling Infrastructure Discretionary Grant Program (CFI Program) • Electric Vehicle Charger Reliability and Accessibility Accelerator (EVC RAA) • U.S. EPA Clean Ports Funding • U.S. EPA Climate Pollution Reduction Grants
Utility Ratepayer	• CPUC authorized IOU Transportation Electrification Programs • Publicly Owned Utility/Community Choice Aggregator ZEV Infrastructure Programs
Settlement Agreements	• Volkswagen Diesel Emissions Settlement (CARB) • Stellantis Settlement (CARB)
Air District and Other Local Governments	• Bay Area Air Quality Management's ChargeUp Program • San Joaquin Valley Air Pollution Control District

Source: CEC Staff Analysis

The data comes from public award announcements, data requests to public agencies and utilities, and outreach to program CEC staff for known ZEV infrastructure funding programs. More information about estimated anticipated ZEV infrastructure deployments from these

programs can be found in Appendix B. The CEC is working on development of a public dashboard to show tracking of pipeline ZEV Infrastructure anticipated in early 2025.

Information on privately funded ZEV infrastructure is limited. The private sector has historically funded about half of the state's chargers and is expected to continue contributing significantly to the buildout of the state's infrastructure. Privately funded chargers make up a significant portion of the EV charging infrastructure deployed across the state.

Flexible ZEV Infrastructure Funding through 2030

In addition to tracking ZEV infrastructure, the state also estimates future deployments from ongoing funding sources that have yet to be allocated to specific programs. For example, the Clean Transportation Program must prepare and adopt an annual Investment Plan Update that identifies funding priorities for the coming fiscal years. The program averages up to $100 million per year and the Investment Plan Update guides the allocation of base program funding for the upcoming fiscal year. More information on this estimation can be found in Appendix A.

Strategies to Improve Tracking of Existing/Pipeline ZEV Infrastructure

The CEC is proposing regulations that include requirements for charger inventory recordkeeping and reporting, which will apply to all charging ports installed in California, except those used solely for private use at single-family homes or at multifamily dwellings with four or fewer units. Under the proposed regulations, operators must report the location, number, and other characteristics of charging ports on a quarterly basis. This will improve the surveying for shared private/depot charging ports in California.

For the hydrogen fueling stations that are funded by the CEC, CEC staff works closely with the recipients throughout the entire station construction and deployment process and therefore gets notified when the stations are commissioned and become open retail. To improve tracking hydrogen refueling infrastructure deployment that is not funded by the CEC, the CEC collaborates closely with GO-Biz, CARB, and industry stakeholders to track any new deployments of hydrogen fueling stations in the state.

CHAPTER 3:
Assessment of Infrastructure Needs and Challenges

ZEV Infrastructure Assessments

This report uses results from previous needs assessments to analyze the state of ZEV infrastructure to develop a deployment strategy for the Clean Transportation Program's funding. Assessments this report will refer to include:

- AB 2127 Second EV Charging Infrastructure Assessment examines charging needs to support California's plug-in electric vehicles in 2030 and 2035.[5]
- Senate Bill 1000 (Lara, Chapter 368, Statutes of 2018) EV Infrastructure Deployment Assessment assesses whether charging infrastructure is disproportionately deployed by population density, geographical area, or population income level, including low-, middle-, and high-income levels and drive times to public fast chargers.[6] [7]
- AB 8 Joint Agency Staff Report on Assessment of the Hydrogen Refueling Network in California reports on progress toward establishing a hydrogen-fueling network that provides the coverage and capacity to fuel vehicles requiring hydrogen fuel that are being placed into operation in the state.[8]

5 Davis, Adam, Tiffany Hoang, Thanh Lopez, Jeffrey Lu, Taylor Nguyen, Bob Nolty, Larry Rillera, Dustin Schell, Micah Wofford. 2023. *Assembly Bill 2127 Second Electric Vehicle Charging Infrastructure Assessment: Assessing Charging Neets to Support Zero-Emission Vehicles in 2030 and 2035*. California Energy Commission. Publication Number: CEC-600-2024-003-CMR. Available at https://www.energy.ca.gov/publications/2024/assembly-bill-2127-second-electric-vehicle-charging-infrastructure-assessment.

6 Hoang, Tiffany. 2020. *California Electric Vehicle Infrastructure Deployment Assessment: Senate Bill 1000 Report*. California Energy Commission. Publication Number: CEC-600-2020-009. Available at https://www.energy.ca.gov/publications/2020/california-electric-vehicle-infrastructure-deployment-assessment-senate-bill.

7 Hoang, Tiffany. 2022. *2022 Senate Bill 1000 California Electric Vehicle Infrastructure Deployment Assessment*. California Energy Commission. Publication Number: CEC-600-2022-059. Available at https://www.energy.ca.gov/publications/2022/2022-senate-bill-1000-california-electric-vehicle-infrastructure-deployment.

8 Crowell, Mikie and Martinez, Andrew. 2023. *Joint Agency Staff Report on Assembly Bill 8: 2023 Annual Assessment of the Hydrogen Refueling Network in California*. California Energy Commission and California Air Resources Board. Publication Number: CEC-600-2023-069. Available at https://www.energy.ca.gov/publications/2023/joint-agency-staff-report-assembly-bill-8-2023-annual-assessment-hydrogen.

- SB 671 Clean Freight Corridor Efficiency Assessment identifies specific priority freight corridors, the infrastructure needed to support the deployment of zero-emission MDHD vehicles, and barriers and potential solutions to their deployment. [9]
- 2023 Staff Report on Senate Bill 643 assesses the existing and planned fueling infrastructure for MDHD FCEVs in California. It also assesses clean hydrogen production, off-road uses for hydrogen, and global developments in the hydrogen sector.[10]
- CARB Technical Analysis: EV Charging Infrastructure Nonresidential CALGreen 2019/2020 Intervening Code Cycle estimates the number of Level 2 charging ports that may be installed due to current CALGreen Code requirements.[11]

Defining Goals in the ZEV Transition

Many assessments have outlined 2030 targets for the state to meet infrastructure needs. CEC staff looked at various scenarios and the outcomes that can be achieved by distinct funding efforts to meet these goals. Deployment conditions are expected to change over time with new technologies, shifts in the market, and changes to regulations.

In late 2023, CEC conducted interviews with staff from the CEC, CARB, CPUC, and GO-Biz to discuss trends and needs for the future of charging infrastructure. The interviews focused on visions for the future of charging, barriers to reaching these visions, and state agency goals. These interviews helped shape the deployment strategy. The CEC is seeking additional public and stakeholder feedback through this draft report and comment period.

For light-duty vehicles, most interviewees agreed upon the need for a seamless consumer experience that is as or more convenient than today's gasoline refueling experience in terms of competition, reliability, widespread availability, ease of payment, and a standardized connector. Beyond the charging transaction itself, several interviewees highlighted safety, cleanliness, restrooms, and food options as important features of shared charging sites.

The comparison to gas stations applies regardless of charging speed but aligns with an expectation that certain charging sites will become larger and more centralized as the market evolves. While some aspects of the comparison (such as the need for convenience stores and restrooms) are more relevant for high-speed charging locations where drivers expect to wait

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9 California Transportation Commission. 2023. *SB 671 Clean Freight Corridor Efficiency Assessment*. Available at https://catc.ca.gov/-/media/ctc-media/documents/programs/sb671/sb671-final-clean-freight-corridor-efficiency-assessment-dor.pdf.

10 Villareal, Kristi. 2024. *2023 Final Staff Report on Senate Bill 643: Clean Hydrogen Fuel Production and Refueling Infrastructure to Support Medium- and Heavy-Duty Fuel Cell Electric Vehicles and Off-Road Applications*. California Energy Commission. Publication Number: CEC-600-2023-053-SF. Available at https://www.energy.ca.gov/publications/2023/senate-bill-643-clean-hydrogen-fuel-production-and-refueling-infrastructure.

11 Waters, Dana Papke. November 2019. *EV Charging Infrastructure: Nonresidential Building Standards – 2019/2020 Intervening Code Cycle: CARB Staff Technical and Cost Analysis*. California Air Resources Board. Available at https://ww2.arb.ca.gov/resources/documents/carb-technical-analysis-ev-charging-infrastructure-nonresidential-calgreen.

while they charge, the reliability and ease of use concerns apply equally to lower speed chargers where drivers leave their vehicle to pursue another activity. Other interviewees felt it would be a missed opportunity if the state replicated gas stations with EV charging. Liquid fuels can be transferred much more quickly than current chargers transfer electricity, but the flexibility and ubiquitous nature of electricity provides other benefits. Charging could be much less centralized than liquid fuel delivery is and locating charging at destinations rather than centralized locations may be more convenient, but potentially harder to make sustainable.

Several interviewees highlighted widespread vehicle-to-grid integration (VGI) as a necessity to make charging profitable (and thus self-sustaining) while also benefiting customers and the grid.

For MDHD, interviewees discussed how to build a charging network from the ground up into something that works well enough for California's fleets to comply with the ambitious trajectories set by Advanced Clean Trucks (ACT) and Advanced Clean Fleets (ACF) in 2030, 2035, and beyond. There was consensus that MDHD electrification poses a greater challenge than light-duty electrification and that the state should prioritize MDHD infrastructure to ensure that the transition takes place in a seamless manner. Interviewees highlighted the unique challenges of MDHD electrification, including the need for faster chargers, which are more expensive to buy and harder to install and get connected to the grid than charging ports serving light-duty vehicles.

Interviewees identified a range of benchmarks for MDHD charging that need to be met on shorter timescales (2030) to ensure that the state is on track to meet its longer-term goals. Providing infrastructure along major freight corridors will ensure that long distance goods movement by ZEVs is possible. Finding early charging solutions for drayage vehicles will provide immediate benefits to communities living near ports. Settling on a charging standard to ensure interoperability will give fleet operators the confidence to pursue electrification. Finally, working in relatively early years with large fleets, especially those with urgent ACF targets, to accelerate their electrification will help establish the market for ZEV trucks and improve the business case for smaller fleets, which may need continued support.

Goals and themes resulting from these interviews were used to guide assessments and determine deployment priorities for ZEV infrastructure by sector in Chapter 5.

Projected Charging Infrastructure Deployments

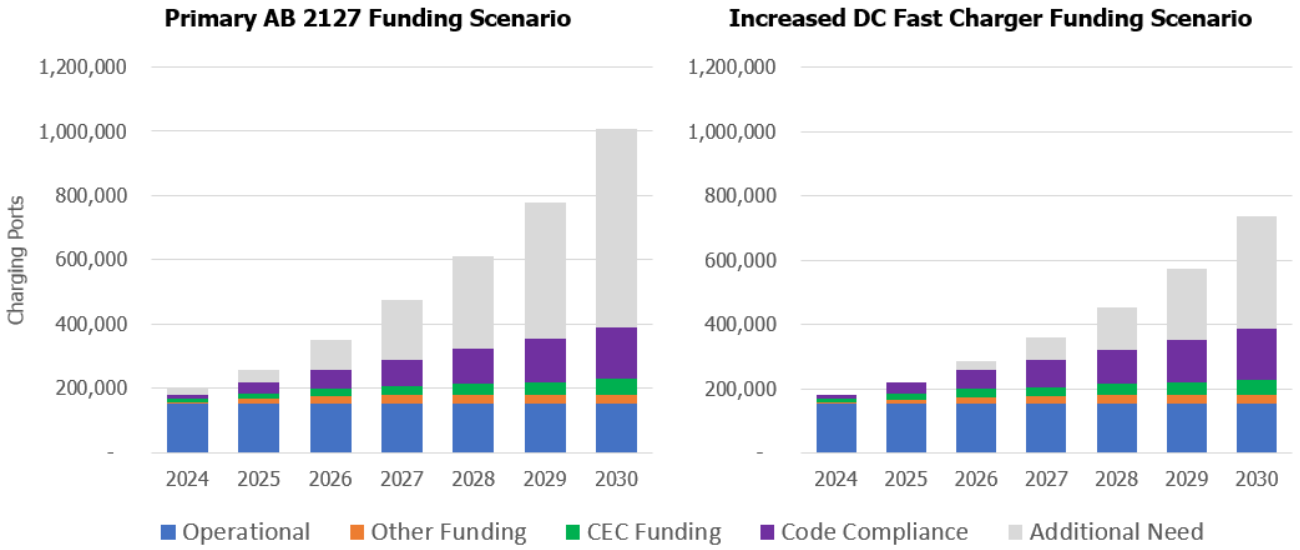
To understand the planned state of ZEV infrastructure, CEC staff looked at operational charging ports, charging ports expected to be operational by funding sources or code compliance, and the remaining additional need. This analysis includes estimates of projected charging infrastructure from future years of base Clean Transportation Program funding, GGRF, and state general funds. Details and assumptions can be found in Appendix A.

CEC staff explored several scenarios to examine how to invest future funding for ZEV. This analysis includes assessing the impact of shifting funds between sectors, varying funding levels by technology and sector, and potential updates to building codes.

This analysis provides a picture of how many charging ports are expected from existing funding and anticipated from future funding. Figure 6 below shows expected charging port

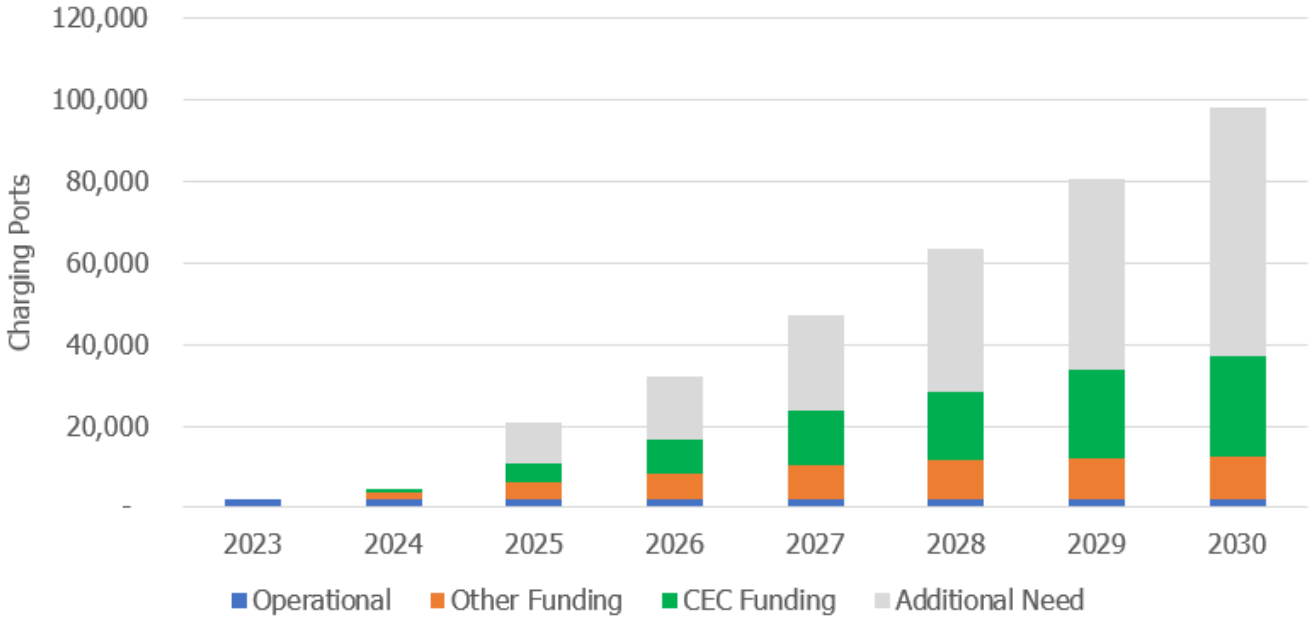
deployments annually through 2030 under two proposed funding scenarios, a Primary AB 2127 funding scenario and an Increased DC Fast Charger funding scenario that will be discussed in more detail in Chapter 5. This analysis is also broken down by sectors in Chapter 5.

Figure 6: Light Duty Charging Port Deployments by Year



Source: CEC Staff Analysis

Figure 7: Medium- and Heavy-Duty Charging Ports by Year



Source: CEC Staff Analysis

For operational charging ports and hydrogen fueling stations, CEC staff used updates from the various tracking dashboards discussed in Chapter 2.

This analysis considers funding from sources other than the CEC, such as state/federal government, ratepayers, settlement programs, or any other public incentives.

Settlement Agreements

Volkswagen Diesel Emissions Settlement (CARB)

Volkswagen has an $800 million ZEV Investment Commitment in the state and must offer and sell additional battery-electric vehicle models in California between 2019 and 2025. The ZEV Investment Commitment will occur over a 10-year period via Volkswagen's subsidiary Electrify America, divided into four 30-month, $200 million ZEV investment plans. Electrify America outlined their deployments in their Cycle 4 investment plans, and the CARB Board subsequently approved the plan at the January 2024 CARB Board hearing.[12] A portion of Cycle 4 investments will go towards upgrading under-performing legacy equipment to improve customer experience and reliability, while continuing to deploy new high-powered DC fast charging stations.

Stellantis Settlement Agreement (CARB)

In early 2024, CARB and Stellantis announced an agreement where Stellantis, as part of a larger settlement with the vehicle GHG emissions standards, will invest $4 million in California to deploy public charging infrastructure in places such as tribal areas and in federal, state, and county parks.[13]

Federal/State/Local Government Funding

National Electric Vehicle Infrastructure (NEVI) Formula Program

President Joseph R. Biden Jr. signed the $1.2 trillion Infrastructure Investment and Jobs Act (IIJA) into law in November 2021. The law invests in a wide array of infrastructure categories, including electric vehicle charging infrastructure. The $5 billion National Electric Vehicle Infrastructure (NEVI) Formula Program will accelerate EV infrastructure deployment nationally. California's share of NEVI funding is expected to be $384 million, allocated over five years. The CEC is collaborating with Caltrans to administer the funds. The CEC has released a notice of proposed awards totaling $37.7 million to install nearly 500 DC fast charging ports. While NEVI funding is jointly administered by the CEC and Caltrans, NEVI is considered other funding as it falls under federal funding.[14]

Charging and Fueling Infrastructure Discretionary Grant Program

The Charging and Fueling Infrastructure Discretionary Grant Program (CFI Program) is a competitive grant program created by IIJA to strategically deploy publicly accessible electric vehicle charging and alternative fueling infrastructure in the places people live and work –

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12 Electrify America. October 2023. *California ZEV Investment Plan: Cycle 4*. Available at: https://media.electrifyamerica.com/assets/documents/original/1086-10202023PUBLICCycle4ZIPPlanCARBFINAL.pdf.

13 CARB. March 2024. "California Announces Partnership with Stellantis to Further Emissions Reductions." Available at https://ww2.arb.ca.gov/news/california-announces-partnership-stellantis-further-emissions-reductions.

14 CEC. "National Electric Vehicle Infrastructure (NEVI) Formula Program." Accessed on August 28, 2024. Available at https://www.energy.ca.gov/programs-and-topics/programs/national-electric-vehicle-infrastructure-nevi-formula-program.

urban and rural areas alike – in addition to along designated Alternative Fuel Corridors (AFCs) as part of NEVI. In January 2024, the Federal Highway Administration (FHWA) announced Round 1A grant recipients for fiscal year 2022 and 2023 grant awards.[15] Local agencies and a university were awarded $168 million in California. In August 2024, FHWA announced Round 1B recipients, including nearly $150 million for California. This includes the tri-state West Coast Truck Charging and Fueling Corridor Project for both heavy-duty charging and hydrogen fueling stations.[16]

Electric Vehicle Charger Reliability and Accessibility Accelerator Program

The Electric Vehicle Charger Reliability and Accessibility Accelerator (EVC RAA) is an initiative to fix or replace nonfunctional EV charging stations and bring older stations into compliance with recent minimum standards established under the NEVI formula program. In early 2024, Caltrans was awarded $63.7 million in federal funding to repair or replace and install an estimated 1,302 charging ports. The CEC is collaborating with Caltrans on this effort.[17]

Local Government

Bay Area Air Quality Management District's Charge! Program provides grant funding to offset a portion of the cost to deploy publicly accessible chargers for light-duty EVs along transportation corridors, multifamily housing facilities, destinations, transit parking locations, and workplaces across the Bay Area.[18]

San Joaquin Valley Air Pollution Control District's Charge Up! Electric Vehicle Charger Incentive Program provides funding for public agencies, businesses, and property owners of multifamily housing in the San Joaquin Valley to install electric vehicle charging ports.[19]

Investor-Owned Utility (IOU) Programs

The CPUC approves and oversees IOU investments. A majority of the LD programs will fund Level 2 charging and some DC fast charging ports at workplaces, multifamily housing, and some destination centers, and MDHD programs will fund depot and some public charging. Table 2 below lists existing programs in progress.

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15 FHWA. January 2024. Charging and Fueling Infrastructure Program Grant Recipients FY 2022 and 2023 Grant Award Recipients. Available at: https://www.fhwa.dot.gov/environment/cfi/grant_recipients/round_1a/cfi-awardees-project-description-table.pdf.

16 FHWA. August 2024. Charging and Fueling Infrastructure Program Grant Recipients Round 1B Grant Award Recipients. Available at: https://www.fhwa.dot.gov/environment/cfi/grant_recipients/round_1b/cfi-awardees-project-description-table_round_1b.pdf.

17 CEC. March 2024. "Joint Workshop on California Electric Vehicle Charger Reliability and Accessibility Accelerator (EVC RAA) Program Concepts." Available at: https://www.energy.ca.gov/event/workshop/2024-03/joint-workshop-california-electric-vehicle-charger-reliability-and.

18 Bay Area Air Quality Management District. FYE 2023 Charge! Program. Accessed August 28, 2024. Available at https://www.baaqmd.gov/en/funding-and-incentives/businesses-and-fleets/charge.

19 San Joaquin Valley Air Pollution Control District. Charge Up! Electric Vehicle Charger Incentive Program. Accessed August 28, 2024. Available at https://ww2.valleyair.org/grants/charge-up/.

Table 2: CPUC Authorized Utility Transportation Electrification Programs

Program	Authorized Amount	Scope of Program
Southern California Edison's (SCE) Charge Ready 2	$436 million	Fund approximately 37,800 EV chargers. Majority of funds are going towards Level 2 make-ready infrastructure at apartments, workplaces, and some destination centers.
San Diego Gas & Electric's (SDGE&) Power Your Drive Extension	$43.5 million	Fund at least 2,000 Level 2 chargers at apartments, site serving apartment dwellers, and workplaces.
Pacific Gas & Electric Company (PG&E) EV Fast Charge	$22.4 million	Install infrastructure for 234 DCFC charging ports.
SDG&E's Power Your Drive for Fleets	$107 million	Installation of charging infrastructure for MDHD EVs
PG&E's EV Fleet	$210 million	Infrastructure to support MDHD EVs such as semi-trucks, transit, and school buses, fleet delivery trucks, and port equipment.
SCE's Charge Ready Transport	$343 million	Infrastructure to support MDHD EVs such as semi-trucks, transit, and school buses, fleet delivery trucks, and port equipment.
Light-Duty Schools and Parks EV Charging Programs (AB 1082, AB 1083)	$54.5 million	PG&E, SCE, SDG&E, and Liberty Utilities to install up to 800 charging ports at parks, beaches, and schools.

Source: CPUC Charging Infrastructure Deployment and Incentives webpage available at https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/infrastructure/transportation-electrification/charging-infrastructure-deployment-and-incentives.

In November 2022, the CPUC approved a new funding strategy to start in 2025. The CPUC is considering a pause on the authorized program and is expected to make a decision on this at the end of 2024. For this report, no charging port estimates were included in the analysis.

This funding, while significant, does not account for the significant level of ratepayer-support that is essential for the buildout of the distribution and transmission infrastructure necessary to support all EV charging.

Low Carbon Fuel Standard Credits Revenue Programs

California's publicly owned utilities (POUs) and IOUs participate in several programs to support EVs that are funded by the LCFS. EV drivers generate LCFS credits by using low carbon fuel (electricity) and the utilities receive credits on behalf of their customers. When the utilities sell

the credits, they are required to use their LCFS credit proceeds to benefit current or future EV customers through rebates on on-bill credits.

In December 2020, the CPUC issued a decision developed in consultation with CARB that outlines how the IOUs can spend LCFS credit revenues that exceed their contributions to the California Clean Fuel Reward program.[20] The decision on these remaining funds, also called holdback funds, focuses funding on transportation electrification programs addressing equity and resiliency. The decision requires the IOUs to spend 75 percent of their holdback funds on equity projects in 2024 and thereafter. ZEV charging related programs include:

- PG&E's Multi-Unit Dwelling and Small Business Direct Install Pilot that installs low-power Level 1 and Level 2 at small multifamily housing and small businesses. The pilot covers charger equipment installation costs, two years of networking and software fees for the site host.
- PG&E's Residential Charging Solutions Pilot provides financial support to help customers install EV charging at single-family or multifamily homes while avoiding or lowering the cost of electric panel upgrades.
- SCE's Zero-Emission Truck, Bus, and Infrastructure Financing Program offers financing options so fleet owners can access capital to help purchase new and used commercial EVs and charging equipment.

Several POUs offer rebates for installation of EV chargers, including, but not limited to:

- Burbank Water and Power's Commercial Electric Vehicle Charging Station Rebate Program offers up to $20,000 per charging port in rebates for all commercial customers and multifamily buildings with 3 or more units.[21]
- City of Pasadena's Commercial Charger Incentive Program offers $3,000 per Level 2 charging port for commercial, workplace, multifamily, and fleet customers. The program also offers a total of $6,000 per charging port for DC fast and charging stations that are accessible to students and patrons of schools, installed at eligible income-qualified housing projects, or located in disadvantaged communities.[22]
- City of Redding's Commercial Electric Vehicle Charging Program offers up to $6,000 towards the installation of qualifying DC fast charging stations. Incentives may be funded through Greenhouse Gas and LCFS Revenues.[23]

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20 CARB adopted amendments to the LCFS Regulation that mandated utilities contribute a certain percentage of their LCFS credit revenue to a statewide program. In February 2021, California utilities, CPUC, and CARB launched a new point-of-purchase statewide EV rebate program funded with utility LCFS credit revenue, known as the California Clean Fuel Reward.

21 Burbank Water and Power. Commercial Electric Vehicle Charging Station Rebate Program Website available at: https://www.burbankwaterandpower.com/leadthecharge.

22 City of Pasadena's Commercial Charger Incentive Program available at: https://pwp.cityofpasadena.net/commercialchargerrebate/.

23 City of Redding's Commercial Electric Vehicle Charging Program available at https://cityofredding.civilspace.io/en/projects/the-city-of-redding-s-commercial-electric-vehicle-charging-program.

CEC Funding

CEC funding consists of funding from the Clean Transportation Program and recent Greenhouse Gas Reduction Funds and California state general funds. As part of the Clean Transportation Program, the CEC prepares and adopts an annual Investment Plan Update that identifies the funding priorities for the coming fiscal years. This report and other assessments will be used to guide future Clean Transportation Program funding for ZEV infrastructure deployment.[24]

Green Building Code Compliance

Code compliance includes estimated Level 2 charging ports resulting from the mandatory 2022 California Green Building Standards Code (CALGreen) that went into effect on January 1, 2023. CALGreen sets minimum standards for new residential and non-residential buildings and additions or alterations of existing parking facilities to have EV ready, EV capable, or electric vehicle supply equipment (EVSE) installed parking spaces.[25] CARB analysis for triennial code adoption cycles and in 2018 and 2019 projects how many EV charging ports would result from residential and non-residential code compliance at the statewide level for the 2016 CALGreen code from 2021 through 2024. CARB updated these estimates based on the 2021 triennial code adoption cycle effective January 1, 2023, and the 2024 triennial code adoption cycle effective January 1, 2026. CEC staff did an initial look at the EV charging resulting from the 2022 updated and 2025 proposed code based on CARB's methodology and included estimates for this analysis. While the code allows for any combination of Level 2 and DC fast chargers to be installed to meet code requirements, CEC staff assumed only Level 2 charging ports will be deployed for this analysis.

The 2022 CALGreen code also added new construction requirements for warehouses, grocery stores, retail stores, office buildings, and manufacturing facilities with planned off-street loading spaces to accommodate future charging ports serving MDHD vehicles. For these building types, the new construction project must provide adequate electrical capacity and allocate space to install raceways and busways. Because it is too early to estimate how many potential charging ports serving MDHD could result from this code change, staff did not include an estimate of potential charging ports as part of the MDHD analysis.

Additional Needs

Additional needs include charging ports funded by the private sector and other future funding programs. As previously mentioned, the private sector has historically funded about half the state's charging ports and is expected to continue to contribute significantly to the buildout of the state's infrastructure. Staff continues to follow public announcements for private sector

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24 Tuggy, Benjamin. 2024. *2024-2025 Investment Plan Update for the Clean Transportation Program*. California Energy Commission. Publication Number: CEC-600-2024-047. Available at https://www.energy.ca.gov/publications/2024/2024-2025-investment-plan-update-clean-transportation-program.

25 The 2022 CALGreen code definitions are:
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.

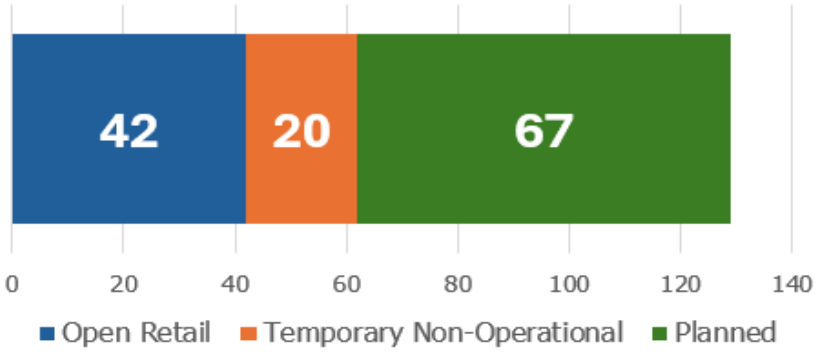
investments in ZEV infrastructure, however it is difficult to quantify the exact private sector contribution.

State of Current Hydrogen Fueling Infrastructure Deployments

In December 2023, CEC and CARB released the *Joint Agency Staff Report on Assembly Bill 8: 2023 Annual Assessment of the Hydrogen Refueling Network in California.*[26] With the expended funds and committed allocation of funds toward hydrogen fueling stations, California is meeting the former 100-station goal under AB 8.

Between public and private investments, CEC staff anticipates that California will have 89 stations. At least seven stations are expected to be capable of fueling medium- or heavy-duty vehicles in addition to light-duty vehicles. CEC staff will continue exploring ways to expand the network capacity of stations to provide sufficient, convenient, and reliable refueling options in line with FCEV uptake by drivers.

Figure 8: Number and Status of Light-Duty Hydrogen Fueling Station Deployments



Source: CEC Staff Analysis

The CEC's inaugural 2023 Final Staff Report on Senate Bill 643 provides an initial statewide assessment of the MDHD hydrogen FCEV infrastructure and clean hydrogen fuel production needed to support the adoption of trucks, buses, and off-road applications to meet state clean-air goals. The analyses conducted by the CEC include a baseline of existing and planned infrastructure, commercially available medium- and heavy-duty FCEVs, and four possible scenarios of MDHD FCEV refueling station requirements through 2035. The scenarios produced a wide range of results, estimating anywhere from 1 to 601 stations needed by 2030. By 2035, the range varied from 11 to more than 2,000 stations. The variance indicates the current level of uncertainty for what will be needed in the future based on vehicle availability, hydrogen fuel costs, and other factors.

Table 3 below shows the estimated MDHD FCEV Infrastructure need based on a balanced scenario.

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26 Crowell, Miki and Andrew Martinez. 2023. *Joint Agency Staff Report on Assembly Bill 8: 2023 Annual Assessment of the Hydrogen Refueling Network in California*. California Energy Commission and California Air Resources Board. Publication Number: CEC-600-2023-069. Available at https://www.energy.ca.gov/sites/default/files/2023-12/CEC-600-2023-069.pdf.

Table 3: Senate Bill 671 Balanced Scenario for MDHD FCEV Infrastructure

Station Access	2025	2030	2035
Private	7	150	539
Public	21	451	1,618
Total Stations	**28**	**601**	**2,157**

Source: California Transportation Commission Staff

As of July 2024, there are four open MDHD retail stations (11 nozzles) and 5 private depots (12 nozzles) in California.

The following transit agencies have hydrogen refueling infrastructure in the planning stages:

- North County Transit
- Santa Cruz Transit
- San Joaquin Regional Transit District
- City of Santa Clarita Transit

Transit agencies that have secured funding and are in the preliminary stages of development:

- Humboldt Transit
- Lake Transit
- Livermore/Amador Valley Transit
- Redding Area/Shasta Regional
- Victor Valley Transit
- Sacramento Regional Transit
- Omnitrans
- City of Pasadena

CHAPTER 4:
Business Case for Light-Duty Charging

EV Charging and Public Funding

The need to invest public funding for EV charging infrastructure depends upon how the markets for public EV charging mature. It is essential that CEC monitors maturation of the market as it makes funding decisions for ZEV infrastructure deployment. In a mature market, EV charging will be sustainable with limited to no public financial support. However, market maturation depends on widespread adoption of ZEVs. California is still in the early stages of the ZEV transition, with ZEVs accounting for 26.4 percent of all new cars sold in the third quarter of 2024 and ZEVs accounting for 5.17 percent of on-road vehicles at the end of 2023.[27, 28] The state continues to have a role in supporting the deployment EV charging infrastructure to ensure drivers are comfortable adopting a ZEV and access to charging is no longer an impediment. Importantly, a mature market is one in which there is equitable access to charging infrastructure.

The maturation of markets depends on the business case for charging. If the business case for charging is stronger, private investments towards additional stations are more likely to occur. Private capital generally seeks a return on investment that is financially tangible, such as high utilization or ancillary sales revenue from increased customer traffic, whereas public investment will be needed to complement private sector investment. Many chargers are expected to be built in California regardless of public funding (analysis from the 2022 ZIP showed the private sector has historically funded about half of the state's charging ports); the role of public funding is to create a baseline network, incentivize additional deployment of chargers with greater public benefit, ensure equity, and accelerate ZEV adoption to address climate change and public health.

Exploring a Business Case for EV Charging

Market trends suggest strong private interest in DC fast charger installations, with some entities installing DC fast chargers without public support. For example, Tesla has privately funded nearly all of its charging infrastructure. To understand this trend, staff examined the business case of Level 2 and DC fast charging. This helps staff understand to what degree the private market will independently install DC fast and Level 2 charging ports and under which conditions chargers will need public support to create a positive business case.

To explore the business case for charging, staff is developing a methodology to assess the levelized cost-of-service in dollars per kilowatt-hour (kWh) – affecting how a light-duty station operator would have to price energy to cover its capital and operating costs and make a profit.

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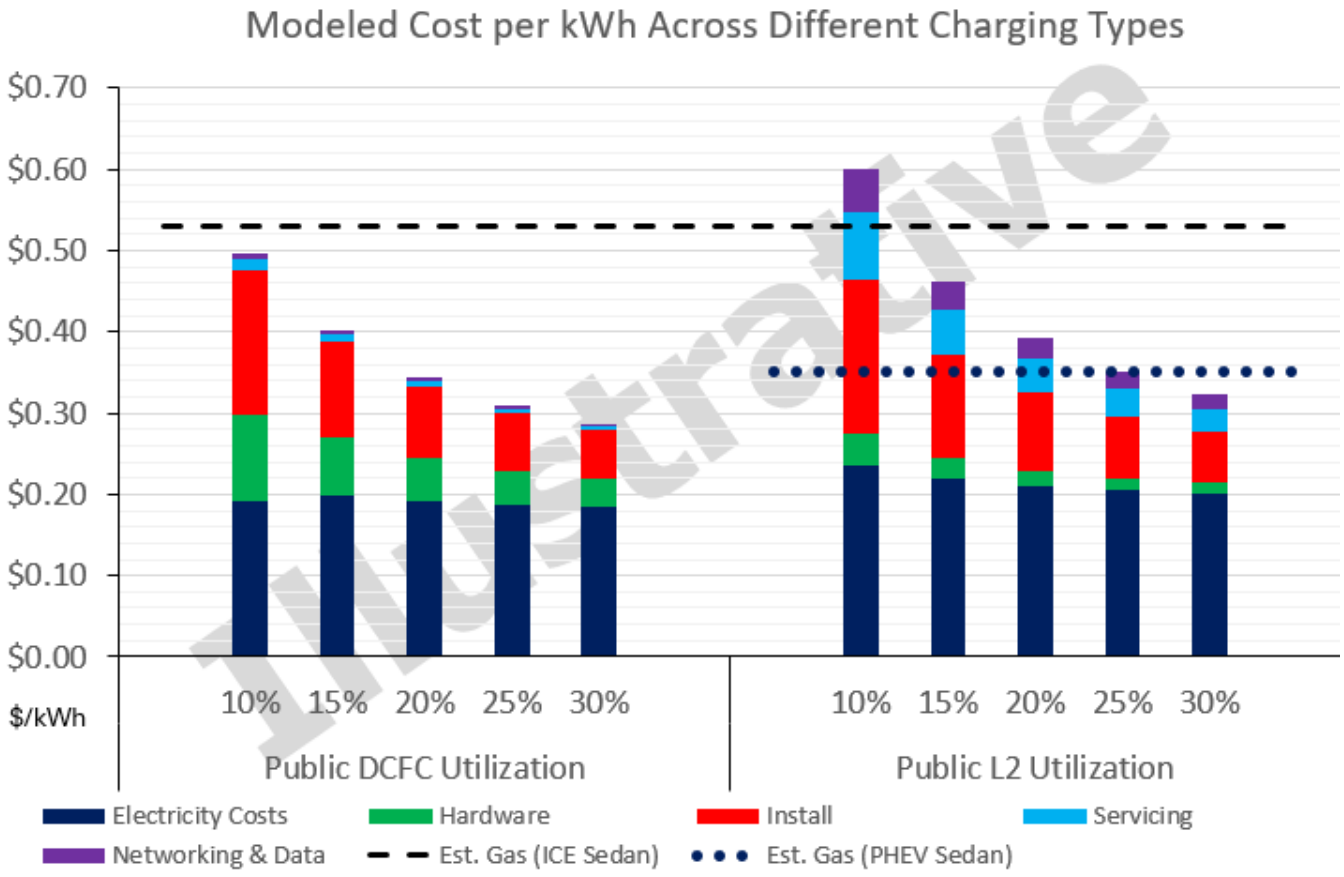
27 California Energy Commission (2024). New ZEV Sales in California. Data last updated June 30, 2024. Retrieved August 30, 2024. from https://www.energy.ca.gov/zevstats.

28 California Energy Commission (2024). Light-Duty Vehicle Population in California. Data last updated May 1, 2024. Retrieved September 9, 2024 from https://www.energy.ca.gov/zevstats.

Figure 9 below demonstrates how this methodology can be used to compare how per kWh costs per port changes with increasing utilization. It features a line for a rough equivalent energy cost of gas for an internal combustion engine sedan, at about $0.53/kWh and a plug-in hybrid electric vehicle (PHEV) at $0.34/kWh. Below that, the modeled station could offer charging at a price comparable to gas prices while still recovering costs of service.

Figure 9: A Visual Representation of Cost-of-Service



Source: CEC Staff Analysis

Figure 9 shows the levelized cost comparing DCFC to Level 2. Notably, servicing (through a service level agreement), network and data services make up a larger portion of per kWh costs in the case of Level 2. Table 4 shows the assumptions used in the graph.

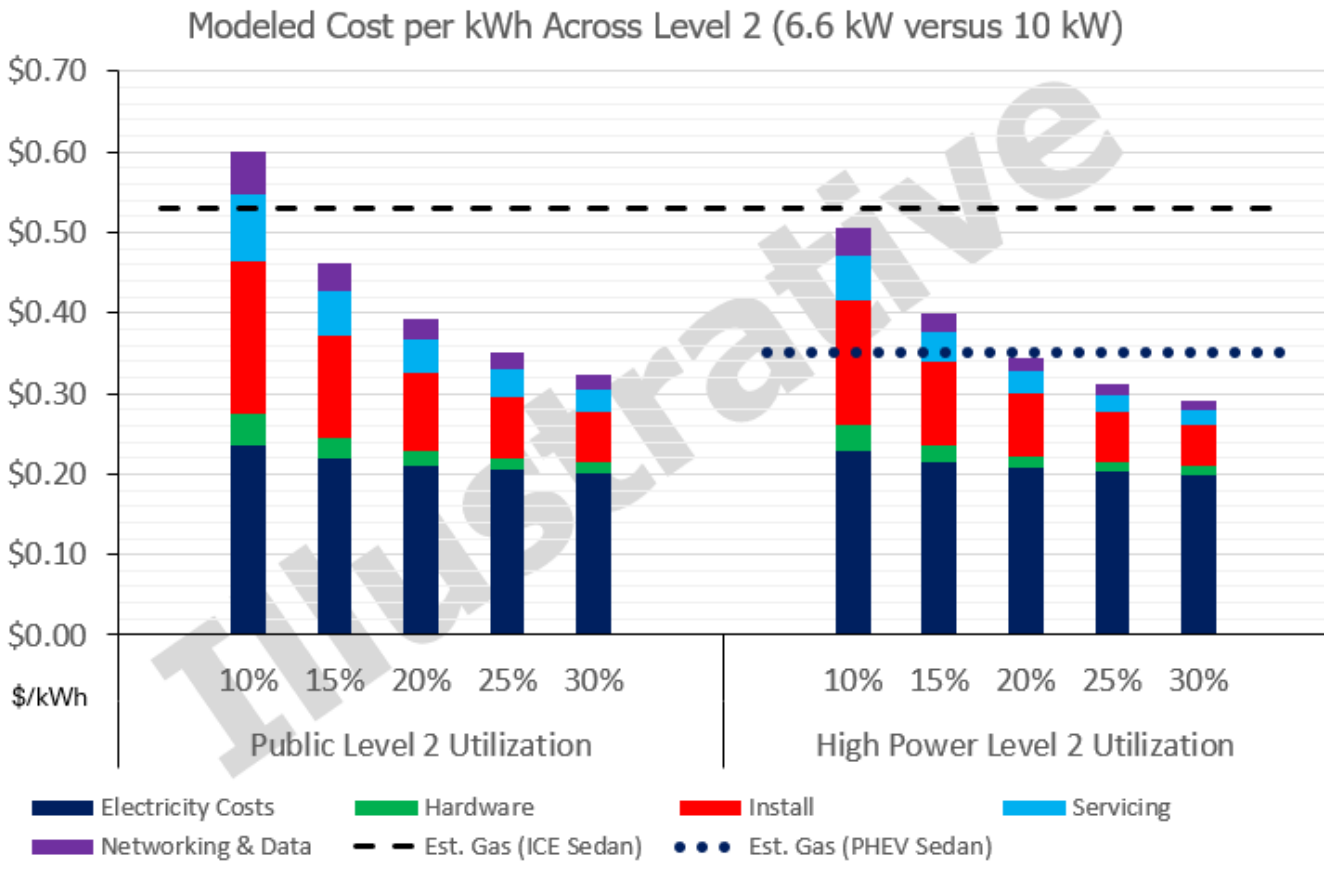
Table 4: Primary Inputs for Cost-of-Service

Variable	Units	Public DCFC	Public L2
Station Size	Ports	12	12
Port Power Level	kW	150	6.6
End Use Life	Years	7	10
Acceptance	Average % of nameplate power	75%	100%
Hardware	$ per port	$60,000	$1,800
Installation	$ per port	$100,000	$9,000
Energy (Utility)	$ per kWh	$0.21	$0.23
Demand (Utility)	$ per kW	$3.36	$3.36
Fixed (Utility)	$ per month	$305.05	$115.09
Servicing	$ per port per month	$110	$40
Networking & Data	$ per port per month	$65	$25

Source: CEC Staff Analysis

Figure 10 below compares the modeled cost between a 6.6 kW public Level 2 and a high power 10 kW public Level 2. The hardware and install costs for higher power Level 2 increased by $2,400.

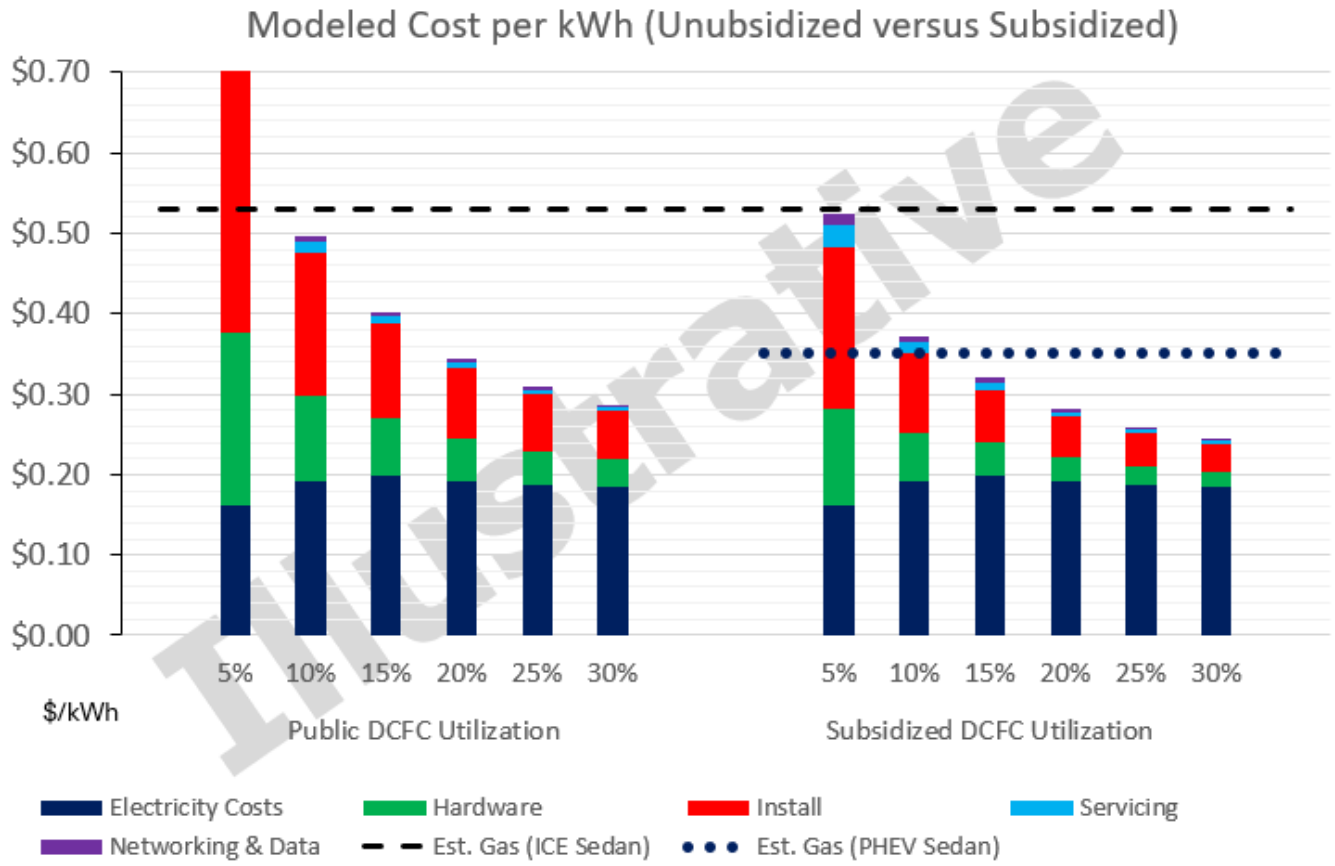
Figure 10: Increasing Level 2 Charging Speed Improves the Business Case



Source: CEC Staff Analysis

Figure 11 below compares a public DC fast charger funded by private investments (left) to a subsidized public DC fast charger that received public incentives (right).

Figure 11: Public Funding Deploying Stations with Low Utilization



Source: CEC Staff Analysis

The sections below explain the different cost elements which explain the sensitivities affecting the ultimate cost of service.

Capital Costs

Capital costs include the cost of purchasing equipment, preparing the site, and installing chargers. It is likely equipment costs will fall over time as more manufacturers enter the industry and participants find efficiencies from "learning by doing." It is unclear if installation costs will fall. Delays in permitting and energization remain deployment challenges, although stakeholders continue working to streamline processes.[29] Historically, CEC grants have been capital subsidies to reduce upfront expenditure for the charger and preparing the site (make-ready).

29 California Public Utilities Commission. Decision 24-09-020. *Decision Establishing Target Energization Time Periods and Procedure for Customers To Report Energization Delays*. September 12, 2024. Available at https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M540/K806/540806654.PDF.

Operating Costs

A site's utility bill represents its "cost of goods sold." Commercial utility bills are composed of fixed, demand, and energy charges.[30] Fixed charges are monthly flat fees. Demand charges are based upon the maximum power requested or reserved by a site in kW within a set period (up to 12 months prior). Energy charges are per-kWh rates that in California can be based on the time-of-use (TOU) of the kWh; rates are lower during mid-day and late-night hours when the grid is less constrained. California EV charging stations are eligible to receive LCFS credits for kWh dispensed, effectively an operational subsidy for California's charging sites. LCFS credits in this example are either on a capacity basis below a certain utilization threshold or on a per kWh basis above that threshold. On an ongoing basis, station operators may be responsible for servicing,[31] networking, data, and payment processing fees, as well as real property rental costs.[32]

Ancillary Revenues

Stations may also earn money from products and services complementary to charging. For DC fast stations, examples include prepared food and drinks (modeled after gas station convenience stores) and commercial advertising to drivers waiting for a full charge. Level 2 stations, for which dwell time is much longer, could be compensated by utilities during times of peak demand for slowing their rate of charging. In the future, vehicle batteries as well as solar panels or microgrids installed at charging stations could provide electricity back to the grid through bidirectional chargers or provide other types of support to grid operators with utility compensation returning to the station or drivers of contributing vehicles. The examples above are merely illustrative – ancillary revenues could come from any product or service, if it fits within the confines of the charging station's specific business model.

Findings

Initial outcomes of the draft methodology show that DC fast charger levelized cost per kWh could be similar or even lower than Level 2 cost per kWh for passenger vehicles. There are two factors that lower the cost per kWh somewhat independent of charger technology: utilization and charger speed. Highly utilized Level 2 has a greater likelihood to be lower cost than DCFC on a levelized cost per kWh. Increasing DCFC speed while keeping utilization constant can similarly lower costs. The appropriate charger technology will vary based on site conditions that affect costs and utilization.

While Level 2 projects tend to be cheaper to build than DC fast charging stations, DC fast charging may offer greater *potential* to reach a lower per kWh cost of service. The volume of kWh sold from a DC fast port can be an order of magnitude greater than from a Level 2 port

30 There may also be miscellaneous charges resulting from individual site needs.

31 Possibly via service-level agreements.

32 Perhaps through a lease agreement with the property owner.

with a similar utilization percentage.[33] While demand charges and operational costs may be nominally lower for Level 2 ports than for DC fast ports, these costs are not an order of magnitude lower.[34] Furthermore, although capital costs for a small DC fast charging site can be substantial, larger sites can realize economies of scale. Installation costs tend to rise at a slower rate as more chargers are added to a site, implying per port installation costs trend lower for larger sites. Furthermore, per port hardware costs may fall when placing a larger equipment order. Level 2 sites also have economies of scale in capital costs, but if the goal is reducing per kWh cost of service, faster Level 2 charging will help (likely in combination with automatic load management), but they are ultimately limited by their lower maximum kWh output.

Driver experience is critical to facilitating the EV transition, and Level 2 charging may have an advantage in terms of convenience. Level 2 charging at existing destinations like homes and workplaces may be more convenient than DC fast charging, which can require drivers to make an additional stop or wait for charging to complete.

Conclusion

Levelized cost (dollars per kWh) provides a framework to help understand the market and the role of public funding. However, more research and input is needed to determine how best to integrate it into public funding decisions and the ultimate deployment strategy the State should pursue in the future.

At this time, neither DC fast nor Level 2 charging has a clearly superior business case. DC fast charging installation costs are substantial, but the results show that the increased throughput in kWh of DC fast diminishes the per kWh difference in these fixed costs as utilization increases. This highlights the role of charging speed to lower per kWh costs. A similar relationship between speed and lower per kWh costs can be seen in Level 2 where increasing speed results in lower per kWh costs and more investigation is needed to evaluate this relationship. Consistent with the findings in this section, Chapter 5 explores a second funding scenario which has a stronger focus on DC fast charging deployments.

33 Early data indicates lower-power charging has higher utilization than DC charging. Bloomberg NEF data indicates that average utilization in Europe in 2022 for AC charging was about 13.5%, while DC charging was about 9.5% on average. It is unclear how much these respective rates will grow as EV adoption continues.

34 This assertion is based upon CEC staff's assumptions of utility demand charges, servicing, and networking costs in 2024.

CHAPTER 5:
ZEV Infrastructure Deployment Strategy

The CEC is the lead agency on ZEV infrastructure investment and analysis. To help address - climate change and air pollution, the California Legislature passed Assembly Bill 118. This legislation created the Clean Transportation Program, which the CEC administers. With funds collected from vehicle registration, vehicle identification plates, and smog abatement fees, the Clean Transportation Program funds projects that will "transform California's fuel and vehicle types to help attain the state's climate change policies."

In addition to Clean Transportation Program base funding, the Budget Acts of 2021, 2022, and 2023 added funding in state general funds and Greenhouse Gas Reduction Fund (GGRF) funds for zero-emission transportation and related activities. These Budget Acts were amended in 2024 and changed many of these funds, including reassigning most allocations from the general fund to the GGRF. Details of this funding can be found in Appendix A. The CEC has flexibility to make adjustments in base Clean Transportation Program funding. However, funding categories in the Budget Act of 2024 are more prescriptive and set in law. This chapter will explore a primary funding scenario and an increased DC fast charger funding deployment scenario for light duty EV charging, funding strategies for MDHD charging, and strategy for light-duty and MDHD hydrogen fueling deployment.

Light Duty EV Deployment Strategy

Each year, the CEC prepares an investment plan for the program to determine funding priorities and opportunities. The investment plan guides the allocation of program funding for transportation solicitations for the upcoming fiscal year. The following section discusses which sectors to allocate base Clean Transportation Program funding to, totaling roughly $92.2 million per fiscal year. It is important to note that the following articulates strategies of how to utilize CEC funds to complement efforts by other public, ratepayer, and private funding. The following strategies are not a reflection on the value of how non-CEC funds should be used to accelerate the market. For example, workplaces should provide workplace charging for their employees, even if CEC funding might be more appropriate for harder to reach segments like multi-family charging.

More specifics on the breakouts and assumptions used can be found in Appendix A. This strategy takes into consideration other efforts to deploy ZEV infrastructure by other entities described in Chapter 3.

Primary AB 2127 Funding Scenario

The Primary AB 2127 Funding Scenario uses the primary modeling scenario under AB 2127 that estimates 1.01 million chargers needed in 2030. To support routine intraregional travel by 7.1 million battery electric vehicles and plug-in hybrid electric vehicles in 2030, California will need to install 313,000 shared private Level 1 and Level 2 chargers at multifamily housing sites, 656,000 public and shared private Level 2 chargers at commute destinations and other activity locations, and 32,800 DC fast chargers.

Strategy to Deploy Chargers Serving Light-Duty Electric Vehicles Under the Primary Funding Scenario

The Clean Transportation Program has limited annual funding and strives to target investments to ensure equitable deployments and accelerate ZEV adoption. Light-duty EV adoption will likely be slower in low-income communities because of the high cost of new and newer used electric vehicles, but the state has an important role in ensuring that the availability of charging is not a barrier for anyone looking to transition to EVs. For light-duty EVs, there is an estimated $37 million per fiscal year in funding for projects through the base Clean Transportation Program funding. This is subject to change as the Clean Transportation Program Investment Plan Update goes through an annual process to update funding allocations. For this report, staff used the $37 million per fiscal year to conduct this analysis. Based on analysis of current and anticipated infrastructure deployments and stakeholder interviews, a potential funding strategy is to focus on a broad range of use cases. Under the primary funding scenario, the CEC would prioritize the following:

- Level 2 deployments serving multifamily households
- DC fast charging in rural areas of the state
- Increasing the presence of DC fast charging in low-income and disadvantaged areas of the state
- Harder-to-reach workplaces and commute destinations

This deployment strategy proposes that the CEC directs half of its annual base funding towards DC fast charging ports, a quarter of its annual base funding towards workplaces, and a quarter of its annual base funding towards multifamily housing.

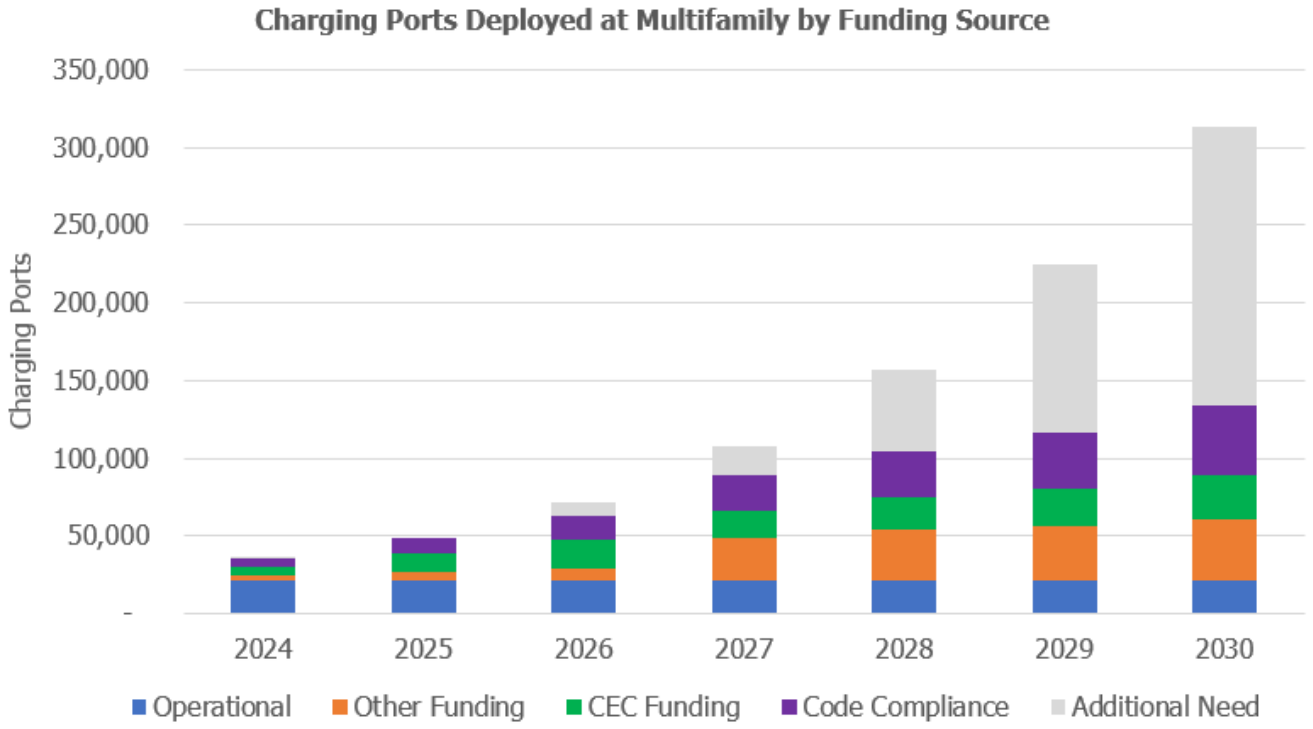
Staff explored several scenarios in which base funding was allocated exclusively to one sector (i.e., multi-family housing) and explored other potential funding pathways. However, due to the limited base funding available, focusing on one sector increased the additional need in the sectors from which funds were diverted. The scenarios can be found in Appendix B.

Prioritize Level 2 Deployments Serving Multifamily Households

The 2022 ZIP highlighted maximizing access to home charging as a priority for the state, specifically prioritizing at-home and routine charging for households that cannot currently charge at home. The state needs to prioritize charging solutions especially for multifamily residents and low-income drivers that cannot install charging solutions where they park.

While many programs target funding for multifamily housing, this sector is likely to continue to need long-term funding assistance from the state, especially in low-income areas. Charging at multifamily housing accounts for roughly 32 percent of the light-duty Level 2 charging need by 2030 in the AB 2127 second assessment. Based on analysis of funding estimates, this sector is likely to need roughly 180,000 charging ports from additional funding/programs and private sector investments in 2030. The additional need is the AB 2127 baseline estimate subtracted by the operational and projected future charging ports. See Figure 12 below.

Figure 12: State Will Have Long-Term Role in Deploying Charging Ports at Multifamily Housing



Source: CEC Staff Analysis

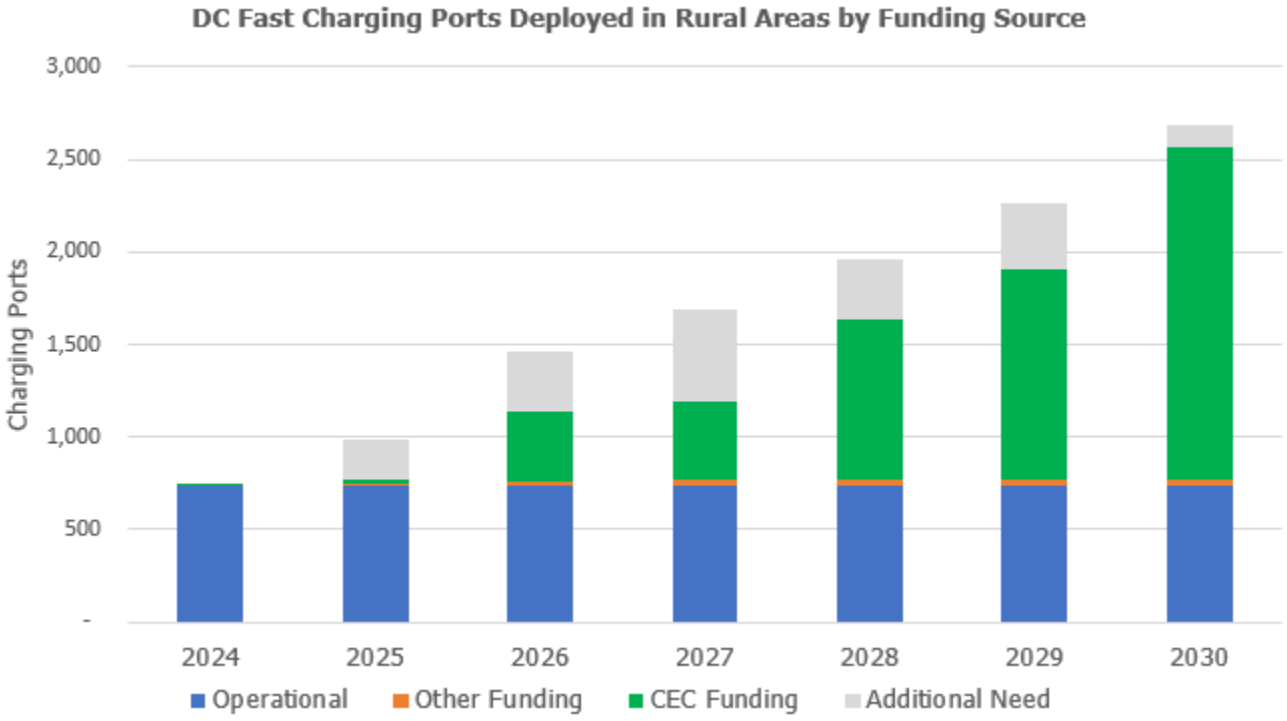
Code compliance is anticipated to play a large role in deploying infrastructure at new and certain retrofits for multifamily housing. The 2022 CALGreen update (effective January 1, 2023) requires new multifamily parking facilities to have low power Level 2 EV charging receptacles in 40 percent of the total number of parking spaces (assigned parking spaces) and the 10 percent of total number of parking spaces must be equipped with Level 2 EV charging ports (located in common use parking or unassigned parking). Future code cycle updates can potentially increase the number of low power Level 2 EV charging receptacles and Level 2 EV charging ports required.[35] The CEC will continue to monitor updated code changes to assess the impacts of code compliance for EV charger deployment.

Prioritize DC Fast Charging for Rural Communities

The second Senate Bill 1000 assessment found rural communities had less public fast charging station coverage than urban communities. About 88 percent of urban communities are within 10 minutes of a public DC fast charger; in contrast, about 40 percent of rural communities are within 10 minutes of one. Low-income rural communities have the least access to public fast charging – only 30 percent are under 10 minutes of a public DC fast charger.

35 Low power Level 2 EV charging receptacle - A 208/240-volt 20-ampere minimum branch circuit and a receptacle for use by an EV driver to charge their electric vehicle or hybrid electric vehicle

Figure 13: State Will Focus DC Fast Charging Deployments in Rural Areas



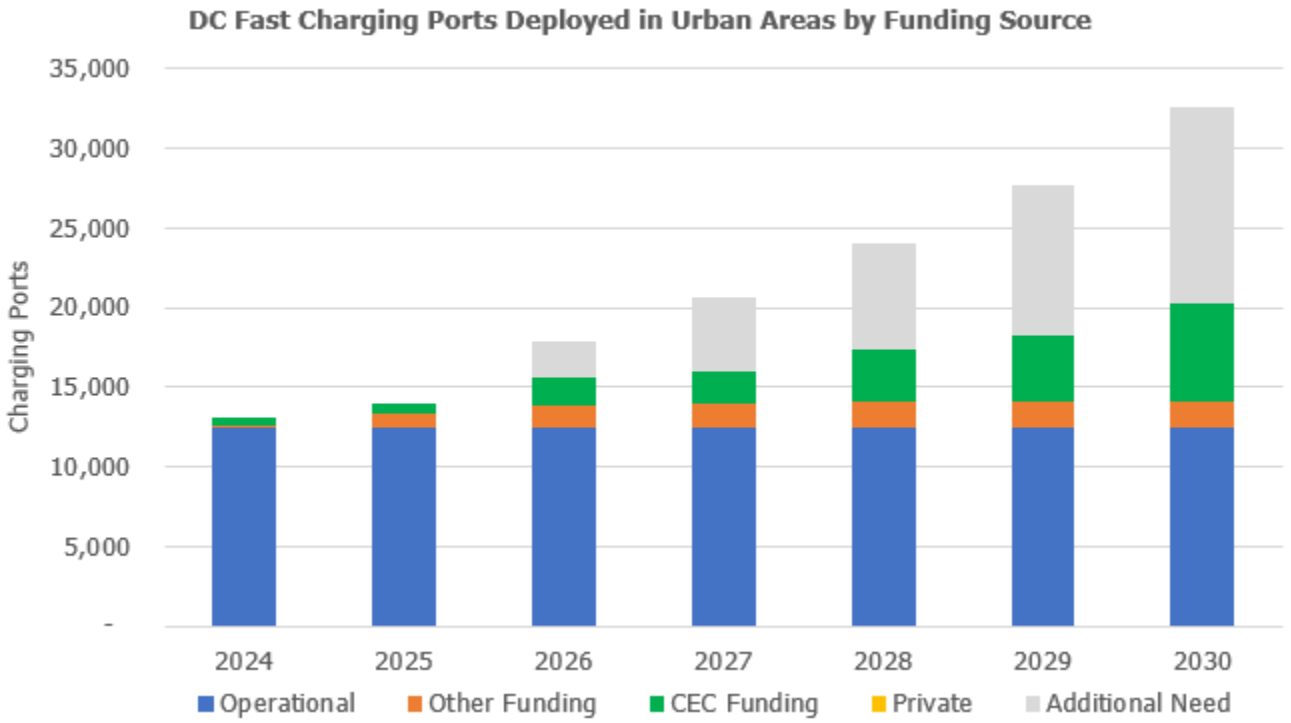
Source: CEC Staff Analysis

CEC funding will be crucial for deploying DC fast charging ports in rural areas of the state. Community-based DC fast chargers can expand access to residents who need a fast charge for their daily operations, those who lack home charging options, or other use cases. Rural areas have been harder to reach and chargers in these regions may not have sufficiently high utilization rates in the short term to justify private investments. Rural areas also may not have sufficient circuit capacity to support installation of DC fast charging ports, which could present additional hurdles, costs, and project delays. In this strategy, the CEC is likely to provide most of the funding support to deploy these charging ports. Modeling estimates nearly 2,700 DC fast chargers needed for urban areas. Staff estimates roughly 2,570 operational and future planned DC fast charging ports. Resulting in an additional need of roughly 109 DC fast chargers may be filled by private sector investments or other future funding programs such as the CFI federal programs (Figure 13).

Prioritize Increasing the Presence of DC Fast Charging to Meet Equity Needs

California reached its goal of 10,000 fast chargers by 2025 set under Executive Order (EO) B-48-18 two years early. EV drivers appear to prefer fast charging more than originally assumed in CEC models, especially on long travel days. An increasing number of drivers are using it if they do not have charging at home. While the market has installed these chargers at a higher rate than Level 2 when considering the state's goals under EO B-48-18, the state still has a role ensuring equity and access for DC fast charging deployments. Building a network of reliable, convenient, and cost-effective community-based public charging options is vital for those that cannot charge at home to ensure all Californians can join the transition to ZEVs.

Figure 14: Focus Urban DC Fast Charging Deployments to Serve Equity Needs



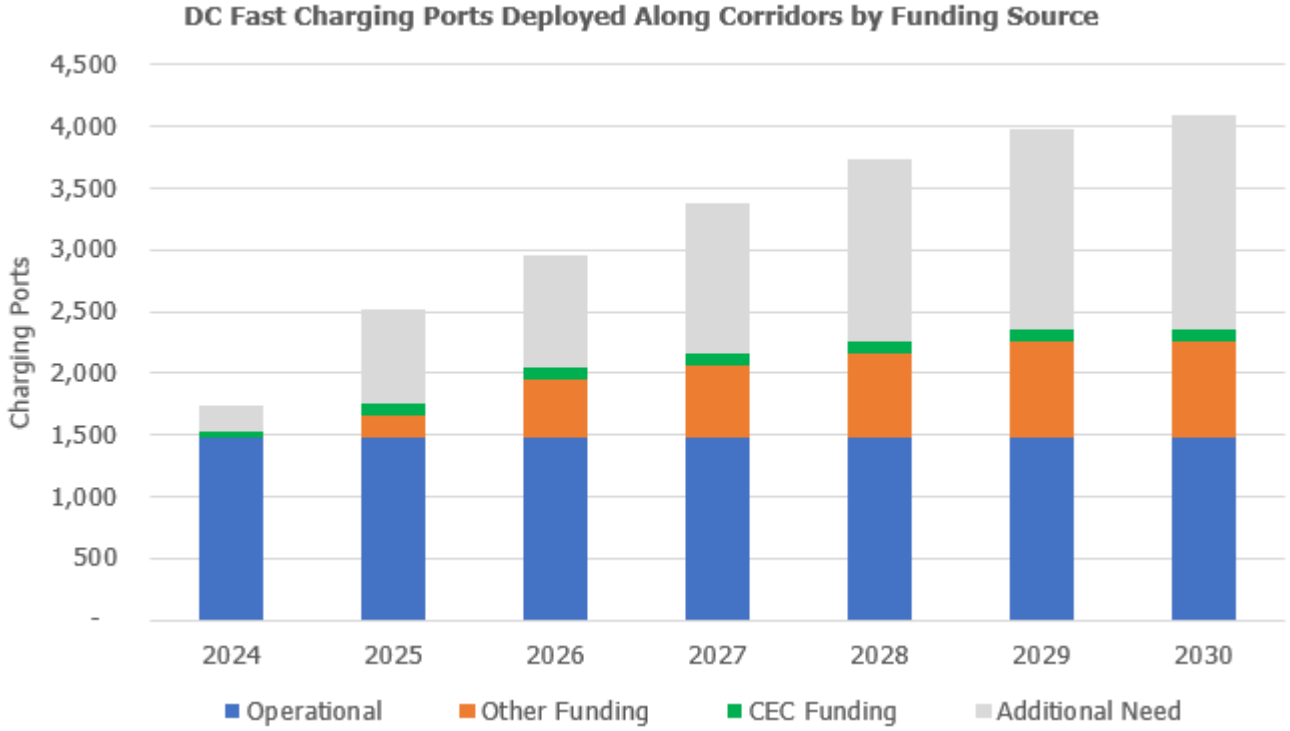
Source: CEC Staff Analysis

The first SB 1000 assessment assessed the geographic distribution and density of public Level 2 and DC fast chargers by income level and population density and found that low-income communities, on average, have fewer public chargers per capita than middle- or high-income communities. Public chargers are unevenly distributed across state air districts and counties but correlated with county populations and plug-in electric vehicles.

The state has a role in deploying DC fast charging ports in low-income and disadvantaged communities in the urban areas of the state. These deployments would also serve transportation network company (TNC) drivers who may not have charging at home. Modeling estimates roughly 32,500 DC fast charging ports needed in 2030 for the urban areas. Staff estimates roughly 20,200 operational and future planned DC fast charging ports deployed by 2030. The remaining additional need shown in Figure 14 (roughly 12,000 DC fast chargers) is likely to be supported by the private sector as DC fast charging is closer to being a functional self-sustaining market than Level 2.

Increasing the presence of DC fast charging includes building out a statewide network of charging ports along long-distance travel corridors, which is expected to be supported by NEVI.

Figure 15: Focus NEVI Funding for DC Fast Charging Corridor Deployments



Source: CEC Staff Analysis

The CEC intends to leverage federal NEVI Formula funding for the buildout of DC fast charging along the state's travel corridors. As part of the NEVI program, the state will need to assess completion of corridor buildouts based on requirements set under NEVI. In 2030, there is an additional need for roughly 1,700 DC fast chargers. As the state continues the buildout of the statewide DC fast charging network, the private sector is anticipated to provide much of the additional need. The CEC will monitor progress and explore if future Clean Transportation Program funds will be needed to complete travel corridors ineligible for NEVI Formula Program funding.

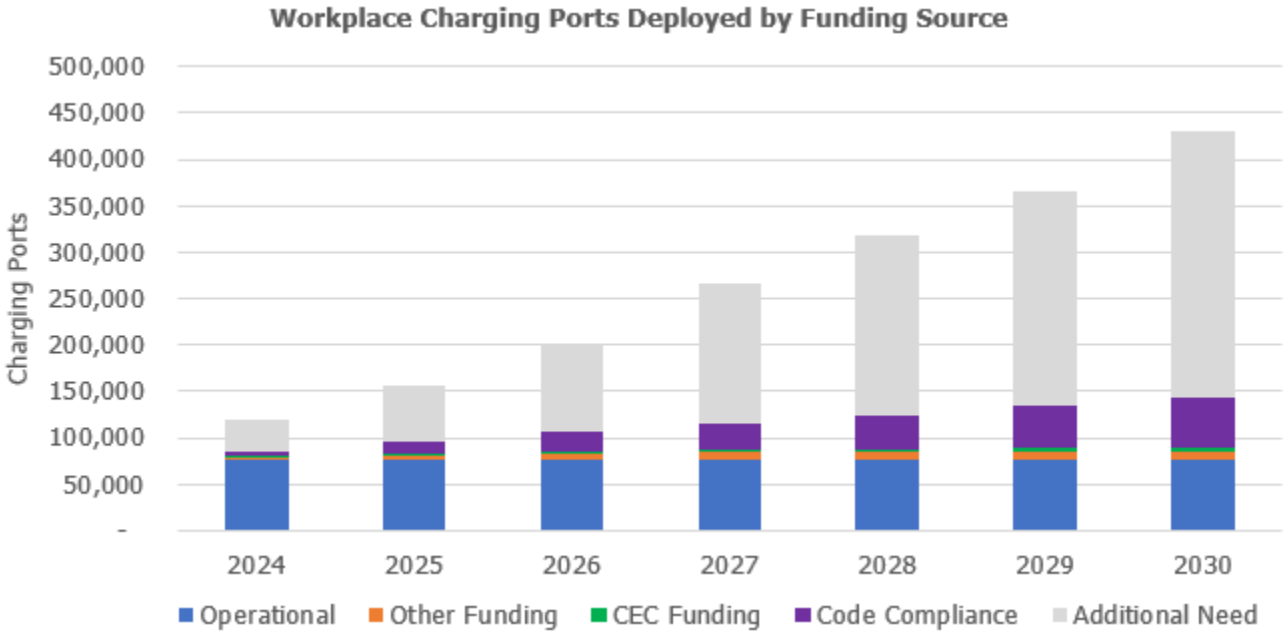
Prioritize Harder -to-Reach Workplaces and Commute Destinations

The state can play a role in deploying EV charging in harder-to-reach workplaces and improving access for those without home charging. Workplace charging includes both public and shared private charging. Shared private workplace charging is in parking lots where access is limited to employees of a specific business entity or who work at a specific location. Public work charging takes place in parking lots where access is not limited; this includes parking lots in downtowns, at shopping malls, on-street charging in multi-use areas, and park-and-ride transit locations.

Charging while at work will be particularly important for EV drivers without access to charging at home and to shift charging load to the daytime when the electrical system often has excess capacity and is powered by renewable solar generation. The state will need to analyze various job types, hours, and potential for charging access of EV drivers who work at each location to identify potential commute destinations where workplace charging can serve these drivers. Charging at commute destinations is the largest category of charging need in the AB 2127

assessment. Another approach is to identify and prioritize charging port deployments at workplace locations with low-wage occupations.[36]

Figure 16: Private Sector Expected to Continue to Deploy Workplace Charging



Source: CEC Staff Analysis

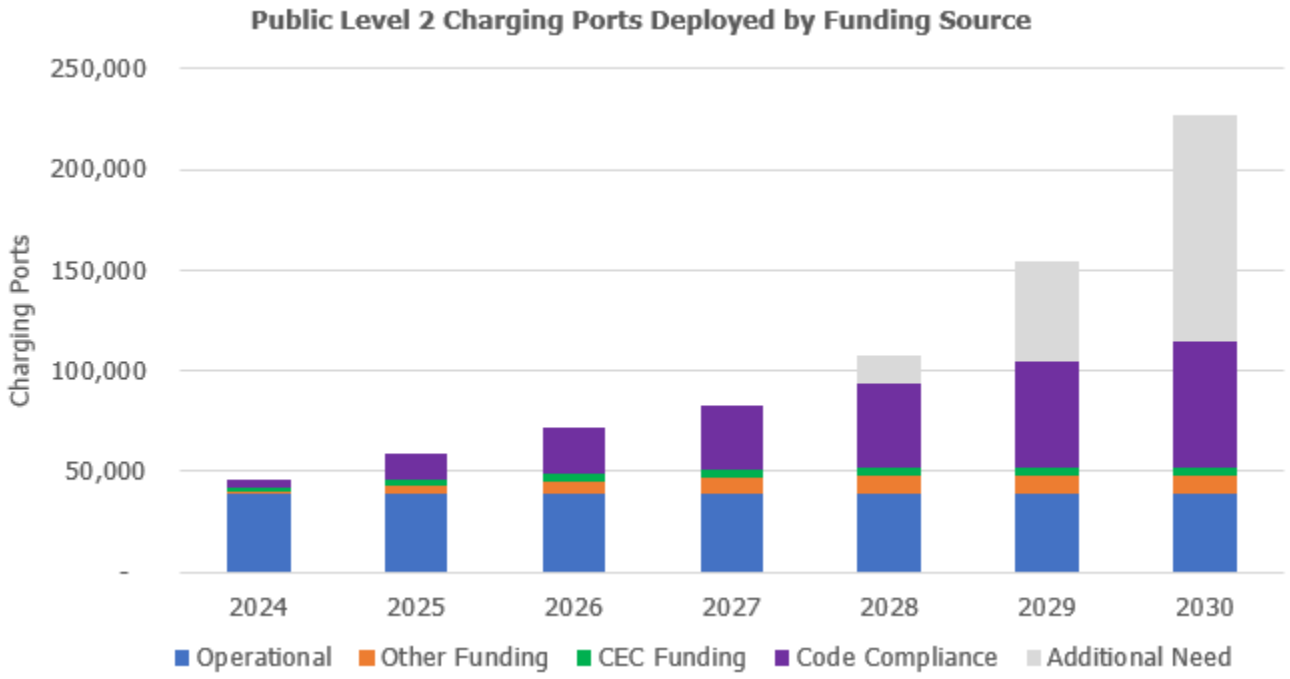
While the additional need is high for the workplace sector, much of the shared private workplace charging that has already been installed in California was installed at workplaces with limited financial support from the CEC. Private sector willingness to install workplace charging indicates there may be limited need for state funds. Modeling estimates workplace charging will need over 429,000 charging ports. Staff estimates nearly 143,000 operational and future planned charging ports will be deployed by 2030. The private sector is likely to continue to contribute to the remaining additional needs.

Code compliance is also expected to have a large impact on workplace charging as new workplaces and retrofits of workplaces happen. Staff will continue to monitor code updates to determine impact of charging port deployments at workplaces.

[36] Low-wage occupations are occupations with a median hourly wage no greater than $17.50 per hour. Many of the largest low-wage occupations involve the provision of services in close physical proximity to customers such as home health and personal care aides, fast food cooks and counter works, and cashiers/retail salespersons.

Legislative Analysists Office. March 2024. *Who Are California's Low-Wage Workers?* Accessed August 28, 2024. Available at https://lao.ca.gov/Publications/Report/4878/1.

Figure 17: Code Compliance May Have Significant Impact on Public Level 2



Source: CEC Staff Analysis

The CEC sees a smaller role in public funding of public Level 2 chargers. Shopping, dining, and errands are typically much shorter and less consistently scheduled than time spent at work or home, so EV drivers are less likely to rely on public Level 2 charging at these locations. Modeling estimates this sector will need nearly 227,000 charging ports and staff estimates roughly 117,000 operational and future planned charging ports deployed by 2030. While the remaining additional need seems high (roughly 110,000 Level 2), businesses such as retail, dining, hospitality, and entertainment businesses are likely to install charging ports as an amenity to attract customers and are less likely to need state funding.

CEC staff also estimate code compliance may potentially play a larger role in deploying Level 2 at new commercial and retrofits/additions of public locations. There is still a need for public Level 2 chargers at specific location types such as parks and remote destinations, hospitals, courthouses, and routine-disrupting destinations. However, this deployment strategy will focus on deployments at multifamily, workplace, and DC fast charging.

Increased DC Fast Charger Funding Scenario

The AB 2127 report also modeled an alternative future scenario that assumes EV drivers use DC fast charging as their primary means of charging away from home, referred to in the report as the "gas station model" alternative future.[37] To meet the state's charging needs under this alternative scenario, California would need 63,000 additional DC fast chargers by 2030 and about 400,000 fewer Level 2 chargers at work and public locations compared to the

[37] In the baseline AB 2127 modeling scenario, drivers will use public and shared private workplace and public locations as their primary means of charging away from home. DC fast charging is used when traveling along highway corridors or the driver couldn't get sufficient charge from home, workplace, or public charging.

primary scenario. Level 2 charging accounts for the vast majority of charging ports in both scenarios, though DC fast charging plays a larger role in the alternative scenario.

Importantly, due to a greater reliance on DC fast charging under the alternative scenario, fewer sites would need to be developed to meet California's charging needs. Fewer sites mean fewer permits, utility energization, site design, and other site-specific steps would need to be taken. Assuming that each DC site has 10 chargers and each L2 site has 10 chargers, 33,700 fewer sites would have to be developed. Assuming 10 ports per DC site and 20 ports per L2 site, there would still be 13,700 fewer sites that must be developed under the alternative scenario. CEC publishes a new edition of the AB 2127 Assessment every two years, with new estimates of charging port needs for the baseline scenario and a range of alternative future scenarios. For each edition of the AB 2127 Assessment, staff updates modeling assumptions and develops new scenarios in consideration of state policy, trends in both the vehicle and charger markets, and changing grid conditions. The next AB 2127 report will further refine scenarios where DC fast charging plays a more prominent role in providing broad access to EV drivers. It is anticipated that the number of chargers needed will continue to be adjusted based on ongoing analysis.

At a minimum, DC fast charging will support long-distance EV travel and TNC drivers who use most of their vehicle range each day. Improvements to battery technology and the availability of higher-powered chargers may make DC fast charging a realistic routine charging option for many drivers. As charging speeds continue to increase, charging at a DC fast charging station may come to resemble fueling at a gas station. High charging speeds will also make DC fast charging the easiest option for drivers without an established Level 2 charging location or charging at home. For these and other reasons, the market has organically favored the deployment of DC fast charging compared to Level 2 charging, when comparing actual deployments of charging ports to expected deployments.

Table 5 below estimates the total charging ports deployed through public funding and code compliance by 2030 for the two funding scenarios. Note that this does not include estimates of what the private sector will contribute to each sector. In the Increased DC Fast Charger \Funding Scenario, all base Clean Transportation Program funds totaling $148 million would be allocated toward DC fast charging deployments. For multifamily, there is $280 million from Budget Acts of 2021, 2022, and 2023 dedicated to this sector. Therefore, the CEC would continue to invest in Level 2 chargers at multi-unit dwellings, even in the Increased DC Fast Charger Funding Scenario. While the additional need for the multifamily sector doesn't change in either scenario, in the Fast Charger Focused Funding Scenario there is potential of DC fast charging to become the primary charging option for drivers who do not have charging at home.

Table 5: Total Charging Ports Deployed by Funding Scenario in 2030

Sector	Primary AB 2127 Funding Scenario	Increased DC Fast Charger Funding Scenario
Multifamily	106,882	104,681
Workplace	143,644	141,443
Public Level 2	117,113	114,850
DC Fast	25,212	25,947

Note: Does not include charging ports deployed by private sector without public funding

Source: CEC Staff Analysis

If the CEC adopted the Increased DC Fast Charger Funding Scenario, the CEC would focus funding on DC fast chargers and Level 2 at multifamily housing starting in 2025. This would be the deployment strategy for a number of years but not throughout the entire Clean Transportation Program. DC fast chargers would be equitably deployed in communities and could be targeted to urban city center, rural communities, and low-income and disadvantaged communities that would benefit from charging hubs.

In addition to the Level 2 chargers funded by the CEC at existing multi-unit dwellings, Level 2 would be deployed at new and redeveloped multifamily housing through building codes. Utility programs and investments would also help fund additional chargers at existing multifamily housing. However, the CEC would not make significant investments in workplace charging or public Level 2 charging. This is not a reflection of the value and benefits of those use cases but rather a decision based on limited state funds and how best to accelerate EV adoption. Workplace and public Level 2 charging continue to have value and can provide meaningful access to drivers.

DC fast charging has a stronger business case in its ability to be self-sustaining in the near term. Further, driver utilization of the fast charging network has been higher than anticipated and requires a stronger buildout to keep up with demand. It is likely that fast chargers will be utilized in near and long term throughout a range of communities in California. Level 2 is an important part of the charging ecosystem but may take longer to deploy. Those Level 2 chargers should still be deployed, especially in MUDs and workplaces. However, from a market acceleration and broad access perspective, a community based fast charging network can support near and long-term growth.

Shifting to a funding strategy that prioritizes DC fast charging and Level 2 in MUDs can help unlock the next wave of EV drivers. The first wave of EV drivers were largely supported by access to home charging at single family homes. The next wave can be unlocked by creating a strong, reliable, and visible fast charging network so that everyone has access to a fast charger, giving them confidence that they can charge regardless of their living situation, and by expanding home charging access at MUDs. There will still be a strong focus on equity through making investments in urban city centers, community charging, and rural charging.

MDHD EV Deployment Strategy

The AB 2127 Second Electric Vehicle Charging Infrastructure Assessment evaluates infrastructure needed to support MDHD vehicles using an updated analysis model in collaboration with Lawrence Berkeley National Laboratory. This model determines the number, locations, and types of charger deployments needed at depots and public locations for charging en route. Depot chargers are chargers located at trip destinations and locations where vehicles are stored overnight, including depots owned by the vehicle operator and charging locations owned by a third party, and locations operated by charging-as-a-service provider. Because vehicles spend longer periods at these locations, depot chargers can provide lower-powered charging. Some vehicles make trips beyond the range of the batteries and rely on en route chargers to replenish range quickly. To support rapid charging, en route chargers must provide higher-powered charging than those at depots.

As the baseline scenario in the second AB 2127 assessment, the Medium- and Heavy-Duty Electric Vehicle Infrastructure Load, Operations, and Deployment (HEVI-LOAD) model estimated to support 155,000 MDHD EVs in 2030, California will need about 109,000 lower-speed depot chargers (20 kW to 150 kW) and 5,500 higher-speed en route chargers (350 kW to 1,500 kW). This estimate assumes that depot charging is an option for all vehicles, which may not be the case. Lower-speed depot charging may not be an option for certain types of vehicles such as drayage trucks used for multiple shifts, leased vehicles that do not return to depots overnight, and owner-operator vehicles without dedicated depots.

For MDHD charging, staff used the high-speed depot alternative future scenario where 20 percent of depot charging is shifted from slower (20 kW – 150 kW) to faster (350 kW to 1,500 kW) charging to analyze charging port needs out to 2030. In the high-speed depot alternative California will need 87,598 lower-speed depot charging ports, 4,910 high speed local charging ports, and 5,527 en route charging ports. Table 6 below compares the charging needs between the two scenarios.

Table 6: Charging Port Needs by Type and Modeling Scenario

Charging Type	Primary MDHD Modeling Scenario	High Speed Depot Alternative Future
Depot (20 - 150 kW)	109,497	87,598
High Speed Local (350 kW - 1,500 kW)	0	4,910
En Route (350 kW - 1,500 kW)	5,527	5,527
Total	115,024	98,035

Source: CEC Staff Analysis

For MDHD EV, there is estimated $33.12 million per fiscal year in funding for projects from Clean Transportation Program base funding. This is subject to change as the Clean Transportation Program Investment Plan Update goes through an annual process to update funding allocations. For this report, staff used the $40.2 million per fiscal year to conduct this analysis. Based on analysis of current and anticipated infrastructure deployments and theory

of change interviews, staff proposes the following strategy for MDHD charging port deployment:

- Prioritize both depot and public (en route) charging.
- Prioritize infrastructure investments serving vehicle classes and fleets with more urgent targets under ACF/ACT.

This deployment strategy proposes the CEC directs half of its annual base funding towards depot and half for en route charging ports.

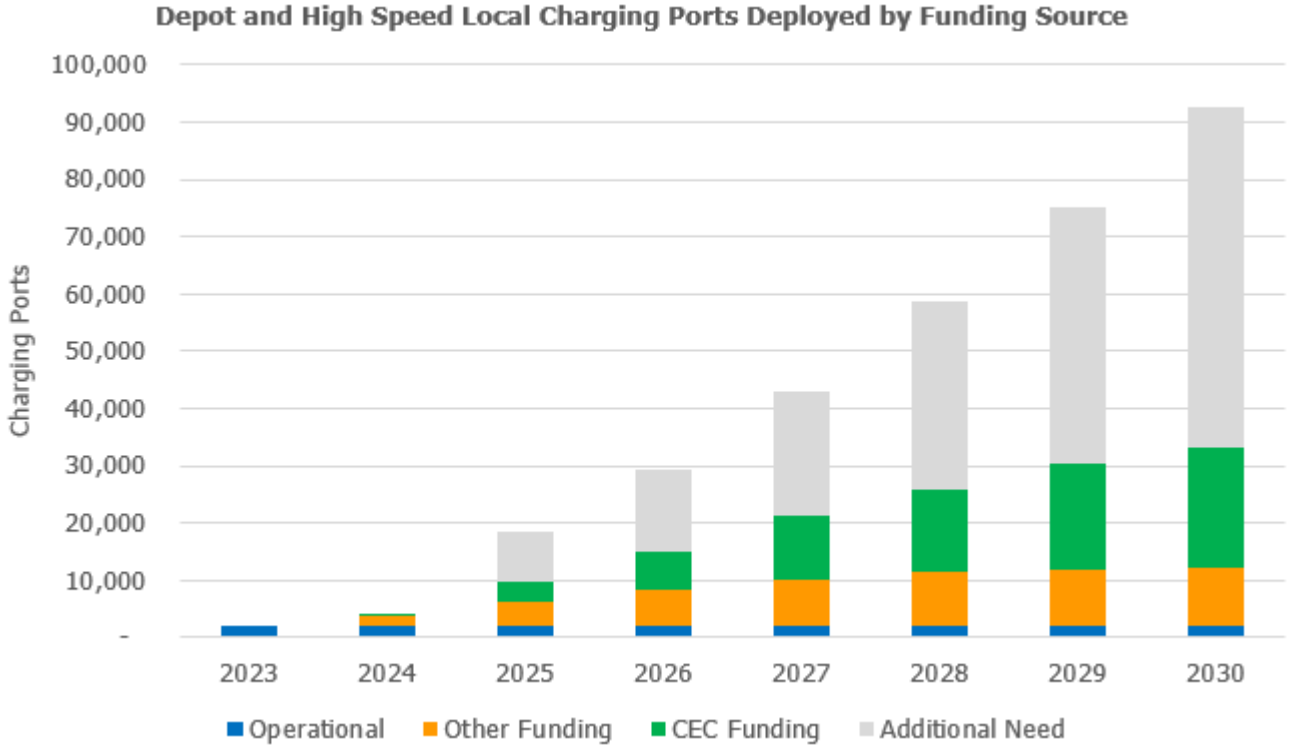
As part of the Clean Transportation Program, GGRF funds are allocated for specific sectors including drayage truck; school bus; clean truck, bus, and off-road; emerging opportunities (rail, marine, aviation); and transit.

These MDHD vehicle types will need both depot and en route charging to serve their needs. For this report, the analysis does not include charging needs and estimates for off-road charging and emerging opportunities. For drayage truck, school bus, and transit, it is assumed infrastructure is deployed in the depot setting. For clean truck, bus, and port ZEV infrastructure, 50 percent is deployed at depot and 50 percent is en route. CEC staff continues to monitor deployments through the Energy Infrastructure Incentives for Zero-Emission Commercial Vehicles (EnergIIZE) program to understand the different charging needs of different MDHD vehicle types. As these chargers become operational, evaluating utilization could also help validate assumptions on where fleets are charging and help inform future MDHD charger funding.

Prioritize Both Depot and Public (En Route) Charging

There are many uncertainties about what a mature MDHD charging system will look like, so it is difficult to prioritize one charging type over another. Lower speed charging ports at existing depot locations are expected to provide the majority of charging for most MDHD EVs. However, low-speed depot charging may not be an option for all MDHD vehicles, including many vehicles in the classes with the earlier adoption targets under ACF. Other vehicles do not have dedicated depots and it may be impossible or impractical to install charging ports at some depots, due to depot size, grid capacity, or cost constraints. To support the needs of these vehicles, high speed local charging ports will need to be installed near their existing vehicle destinations. This type of charging can serve zero-emission drayage trucks, truck and bus, and ports and can be installed by fleet operators, third-party depot operators, or charging-as-a-service provider. High speed local charging ports may be publicly accessible or shared private. The state has a role to help ensure fleets, especially those with more urgent targets under ACF/ACT transition successfully to ZEVs including drayage, high priority and federal fleets, and state and local agency fleets.

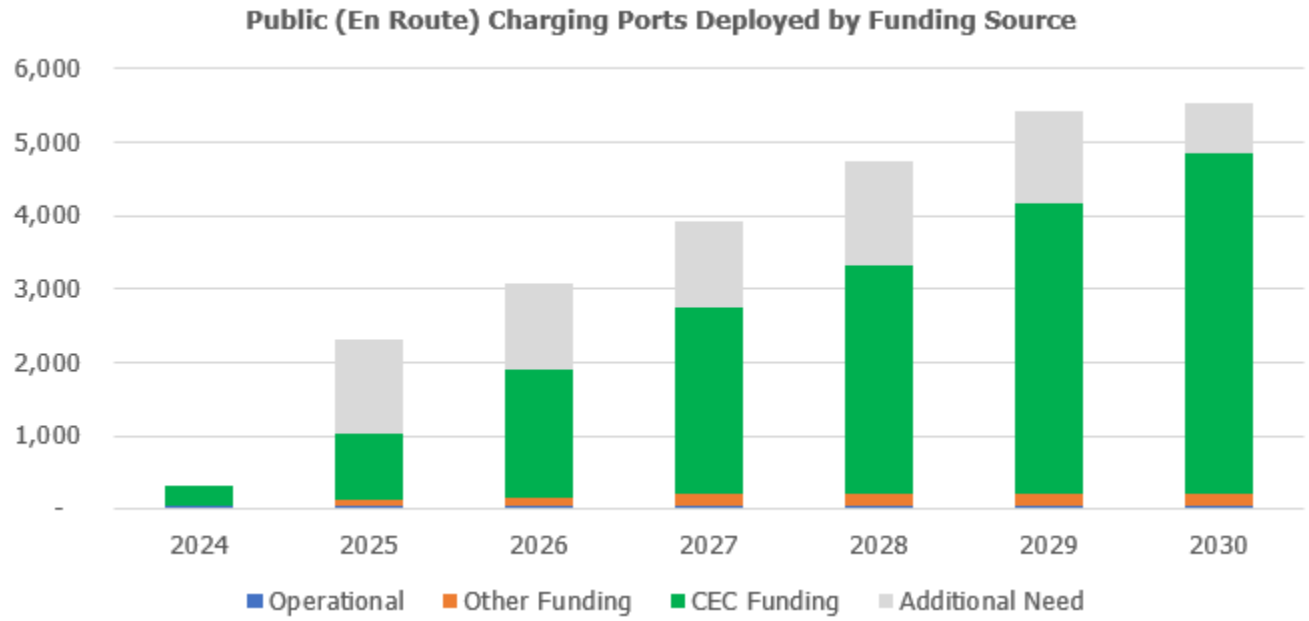
Figure 18: Depot and High-Speed Local Charging for MDHD



Source: CEC Staff Analysis

While high speed charging ports along major freight corridors account for a smaller share of overall MDHD charging load, these charging ports are vital to ensuring that long-distance freight transportation is possible for MDHD EVs. The state acknowledges this is an early priority for CEC investment, similar to the light-duty sector, building a baseline network of chargers along major corridors by 2030. Once this network exists, funding will likely move towards depot charging. This strategy is also supported in the SB 671 Clean Freight Corridors Assessment, which identified priority freight corridors necessary to support the efficient movement of goods across the state. Fleet owners are likely to install charging on their property to charge their fleet vehicles and not likely to build a publicly available charging station because their primary concern is the financial stability of their fleet.

Figure 19: Public (En Route) Charging for MDHD



Source: CEC Staff Analysis

For future analysis, staff will explore breaking out charging needs by vehicle types such as drayage, transit/school bus, port, etc. The existing data didn't support such a breakout. Costs to deploy MDHD charging ports also widely vary. Staff continues to gather cost data to refine this analysis in the future.

EV Charging Reliability

Ensuring a reliable charging experience is critical to encouraging wider adoption of electric vehicles. AB 2061 (Ting, Chapter 345, Statues of 2022) and AB 126 require the CEC to take certain steps to improve charger reliability. The CEC released a draft staff report, *Tracking California's Electric Vehicle Chargers: Regulations for Improved Inventory, Utilization, and Reliability Reporting*, in September 2023 and held a workshop on the related rulemaking in October 2023. Staff released a second draft of the staff report and held a workshop in April 2024 to receive further public feedback.[38] The CEC has taken other steps including reliability requirements in all funding opportunities since late 2021 and contracting a large field study to test publicly available chargers operating in California.

As mentioned in Chapter 3, the CEC is collaborating with Caltrans on charging infrastructure deployment and will be the administrator of California's EVC RAA program to fund repair and replace an estimated 1,302 charging ports across the state.

38 Schell, Dustin, Ralph Lee, and Michael Dioha. 2024. *Tracking and Improving Reliability of California's Electric Vehicle Chargers*. California Energy Commission. Publication Number: CEC-600-2024-055-D2. Available at https://www.energy.ca.gov/publications/2023/tracking-and-improving-reliability-californias-electric-vehicle-chargers.

LD and MDHD Hydrogen Fueling Station Deployment Strategy

The hydrogen strategy section discusses LD station deployment as well as MDHD station deployment. Mixed use hydrogen stations can be used across multiple vehicle segments. Further, there is potential for one segment to help support other segments if scale can be achieved. Staff proposes the following strategy for hydrogen fueling station deployment:

- Continue to monitor the light-duty hydrogen FCEV market and make infrastructure investments accordingly
- Focus on improving the driver experience and fueling supply in California so that the existing network is maintained and reduce the number of temporary non-operational hydrogen stations
- Encourage development of depot and publicly accessible MDHD hydrogen fueling network

Continue to Monitor the Light-Duty Hydrogen FCEV market and Make Infrastructure Investments Accordingly

AB 126 directed the CEC to allocate no less than 15 percent of the amount of funds appropriated by the Legislature to fund hydrogen refueling stations until there is a sufficient network of stations, which includes all types available, in operation in California to support existing and expected hydrogen vehicles until July 1, 2030. AB 126 removed the 100-station requirement that was in AB 8. To date, the state has 62 open retail (including 20 TNO) and 67 planned LD hydrogen fueling stations. The CEC will continue to assess the hydrogen refueling network in California in collaboration with state agencies and stakeholders and plan for future station deployment, as appropriate.

Focus on Improving the Driver Experience and Fueling Supply in California – Ensure the Existing Network is Maintained and Reduce the Number of TNO Hydrogen Stations

The 62 available stations can support about 54,000 FCEVs when operating at full capacity, which is more than the 14,185 FCEVs that staff estimates to be on the road in California as of the end of the first quarter of 2024. However, the reliability of the light-duty hydrogen refueling network continues to suffer from maintenance downtime, equipment failures, supply chain constraints, and fuel supply disruptions, which considerably reduce the refueling capacity of the network. In fact, CARB's *2023 Annual Evaluation of Fuel Cell Electric Vehicle Deployment and Hydrogen Fuel Station Network*[1] found that the network of open retail stations was operating at 60 percent of capacity on average from the third quarter of 2022 to the second quarter of 2023, not including TNO stations. This reduces the capacity of the network from being able to support nearly 53,000 FCEVs at nameplate capacity to about 32,000 FCEVs. The reliability issues of the network affect FCEV drivers' ability to refuel their vehicles and contribute to a lack of confidence for FCEV drivers.

There are numerous challenges that face the operation and maintenance (O&M) of the stations, from maintenance downtime, fuel supply disruptions and shortages, equipment failures, supply chain disruptions for new equipment, and price spikes. This is leading to an

overall dissatisfaction and frustration of FCEV drivers. The goal of the CEC is therefore to help the existing LD station network become more reliable.

To combat O&M issues at the existing stations, the CEC has released the "Improvements in Maintenance Processes for Reliable Operations that are Verifiable and Effective for Hydrogen Refueling Stations (IMPROVE for H2)" funding opportunity, which awarded a total of nearly $9.4 million to FirstElement Fuel, Inc. and Iwatani Corporation of America to make improvements to 45 existing stations so that these stations can be reliable and available to drivers.

To combat the issue of equipment failures, the CEC released the "Zero-Emission Transportation Manufacturing" funding opportunity, which awarded $7.7 million in awards to expand manufacturing of hydrogen refueling station modules and cryogenic hydrogen infrastructure, as well as expand testing capabilities of fueling equipment in California. This project will create a new manufacturing line for LD vehicle fueling equipment with an annual production capacity of 100 modules, and HD vehicle fueling equipment with an annual production capacity of 10 modules.

To achieve a successful hydrogen transportation sector, satisfaction of current customers is of paramount importance. Further solicitations for O&M will help increase the performance of the hydrogen network. Furthermore, more funding into in-state equipment production and testing can be considered. Another factor that contributes to customer dissatisfaction is the price of hydrogen. The current in-state hydrogen production projects are long-term solutions that may not have an effect on hydrogen price in the near term. More price transparency and data sharing by station operators is needed.

Hydrogen production is dominated by steam methane reforming (SMR) of natural gas, which is then transported to the stations in pressurized gaseous or cryogenic liquid tank tubes. The hydrogen refueling network has experienced frequent hydrogen supply constraints, demonstrating the need for more supplier options and dedicated in-state hydrogen production. As a result, station developers are forced to secure expensive temporary emergency hydrogen supply for their stations, and have frequent downtime due to lack of fuel, which adds to the dissatisfaction of FCEV drivers. Additionally, FCEV drivers have experienced unprecedented spikes in hydrogen fuel prices, leading to an increase from $14 per kilogram to nearly $36 per kilogram at the pump. A resilient, diverse, and reliable hydrogen supply chain is therefore vital for the stability and expansion of the hydrogen market in the transportation sector. The Clean Transportation Program has funded three renewable hydrogen production plants and two upgrade projects to existing plants to expand options for renewable hydrogen supply in California. Another renewable production plant has been proposed for award. The Alliance for Renewable Clean Hydrogen Energy Systems (ARCHES), a private-public partnership, was awarded $1.2 billion by the U.S. Department of Energy to establish a clean hydrogen hub in California. The goal is to reach a total in-state clean hydrogen production capacity of 45,000 tons per day by 2045.[39]

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39 U.S. Department of Energy. October 13, 2023. "Biden-Harris Administration Announces $7 Billion For America's First Clean Hydrogen Hubs, Driving Clean Manufacturing and Delivering New Economic Opportunities

The deployment strategy for LD hydrogen vehicle stations is to support the build out of stations which were previously funded in the CEC's multi-batch hydrogen station solicitation. The construction of many of those stations has been paused until market conditions stabilize. The CEC will monitor if those projects come to fruition or station developers pivot to other segments. The CEC will continue to take actions to support current stations and current drivers including working with industry to increase the reliability and fuel supply stability of existing and planned stations.

Encourage Development of Depot and Publicly Accessible MDHD Hydrogen Stations

More emphasis has been given to MDHD FCEVs in recent years, with the idea that a strong MDHD hydrogen market with its larger fuel demand would have a positive impact on hydrogen prices as well as fuel supply for the LD market. However, there remains uncertainty regarding the type of zero-emission technology fleet owners will choose for their MDHD operations.

Estimating the future demand for MDHD hydrogen refueling stations is challenging. Estimations made by the 2022 Scoping Plan, ARCHES, SB 671, and Additional Achievable Transportation Electrification (AATE) 3 scenario range from 1 station to 601 stations by 2030, and from 11 stations to 2,157 stations by 2035. With the strong variation in the number of stations needed, the hydrogen demand estimations also vary greatly. [40]

Depot and Public Fueling Stations

CARB's Innovative Clean Transit (ICT) regulation requires 25 percent of new bus purchases by large transit agencies to be zero emission beginning on January 1, 2023. This requirement will increase over the course of the decade and will apply to small transit agencies beginning in 2026.[41] This regulation was an important first step in transitioning California's heavy-duty vehicles to zero emission. The CEC has provided funding support to encourage large scale conversion of transit bus fleets to fuel cell electric buses. Transit agencies often require financing that may be outside many of the agencies' budgets to support the transition to zero emission.

MDHD FCEVs similar to MDHD EVs will need depot and public refueling to serve their needs. FCEV fleet owners will decide what will work best for their operations, including cost considerations. For example, a fleet owner could choose to have a "home base" depot station for long-haul trucking that is optimally located within the range where it could refuel at a public refueling station, and possibly another public station if there is a buildout of stations along major trucking corridors.

Nationwide." Available at https://www.energy.gov/articles/biden-harris-administration-announces-7-billion-americas-first-clean-hydrogenhubs-driving.

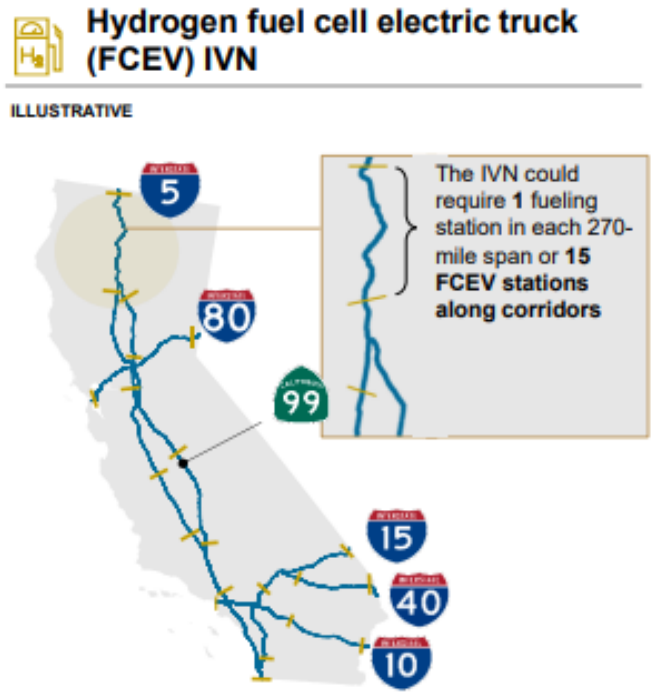
40 CARB. "About AB 32 Climate Change Scoping Plan." Available at: https://ww2.arb.ca.gov/our-work/programs/ab-32-climate-change-scoping-plan/about.

41 CARB. Innovative Clean Transit: Review on 2023 Program Readiness. Accessed on September 10, 2024. Available at https://ww2.arb.ca.gov/our-work/programs/innovative-clean-transit/program-update.

Public Corridor Fueling Stations

The SB 671 assessment identified corridors that are priority to support the efficient movement of goods across the state. It identified the "Top 6" corridors needed to support an initial viable network, which represented over 50 percent of average daily truck vehicle miles traveled by MDHD trucks across California.

Figure 20: Initial Viable Hydrogen Fueling Truck Network Along Top 6 Priority Corridors



Source: SB 671 Clean Freight Corridors Assessment

The SB 671 assessment acknowledges uncertainty surrounding which type of technologies are likely to be adopted by fleets in the future. The assessment recommends policy makers focus first on the initial viable network of publicly available zero-emission stations needed along the "Top 6" corridors. Since the return on investment for a publicly available station is uncertain, the state has a greater role in the development of this initial network.

The National Zero-Emission Freight Corridor Strategy highlights that providing ubiquitous and convenient access to both electric vehicle charging and hydrogen refueling along freight corridors and at truck depots within freight hubs is key to successfully deploying zero-emission MDHD vehicles.[42] The strategy outlined in this document has four progressive phases to promote zero-emission truck adoption between 2024 through 2040. Phase 1 establishes priority hubs based on freight volumes between 2024 and 2027, and Phase 2 connects hubs

[42] Chu, Kang-Ching (Jean), Kevin George Miller, Alex Schroeder, Alycia Gilde, Michael Laughlin. Joint Office of Energy and Transportation and the U.S. Department of Energy. *National Zero-Emission Freight Corridor Strategy*. March 2024. Available at: https://driveelectric.gov/files/zef-corridor-strategy.pdf.

along critical freight corridors between 2027 and 2030. Phase 1 would primarily support local and regional return-to-base operations, first-/last-mile delivery, and drayage fleets. Phase 2 would support increased regional freight movement enabling long-haul trucking.

Similar to the MDHD charging system, it is unclear what a mature MDHD hydrogen fueling network will look like, so it is difficult to determine funding ratios between depot and publicly accessible fueling. The CEC will focus hydrogen station infrastructure investments in new MDHD hydrogen stations to support both depot refueling and public retail refueling.

Conclusion

ZEV infrastructure plays a critical role in transitioning California to clean transportation, reducing greenhouse gas emissions, improving air quality, reducing pollution, and creating high-quality instate jobs. Sales of light-duty ZEVs have surpassed two million vehicles to date and the state is increasing its focus on converting MDHD fleets to ZEVs. Extensive analysis has been conducted to determine ZEV charging and hydrogen fueling infrastructure needs and where more work needs to be done to ensure all Californians have access to ZEV infrastructure.

California is committed to a zero-carbon transportation future. The CEC will continue to have a strong focus on ZEV infrastructure deployment. The light-duty EV segment will benefit from a strong focus on building out the DC fast charging network in communities, complementing NEVI corridor efforts, and expanding Level 2 charging at MUDs. Building codes and private sector investments will complement CEC funding.

Electric MDHD vehicles will benefit from CEC investments in depot charging and en route charging. Depot and high-speed local charging will help fleets with vehicles in classes with the earliest adoption targets under ACF/ACT. Buildout of an initial public en route network will be essential especially for major freight corridors to ensure long-distance freight transportation is possible for MDHD EVs.

Hydrogen infrastructure investments will support maintenance of the light-duty FCEV market to ensure drivers have a stable network. The CEC will focus hydrogen station infrastructure investments in new MDHD hydrogen stations to support both depot refueling and public retail refueling.

GLOSSARY

AIR DISTRICT -- A political body responsible for managing air quality on a regional or county basis. California is currently divided into 35 air districts. They can be an Air Pollution Control District (APCD) or an Air Quality Management District (AQMD).

ALTERNATING CURRENT (AC) -- Flow of electricity that constantly changes direction between positive and negative sides. Almost all power produced by electric utilities in the United States moves in current that shifts direction at a rate of 60 times per second.

AUTHORITY HAVING JURISDICTION (AHJ) -- An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.

BATTERY ELECTRIC VEHICLE (BEV) -- Also known as an "All-electric" vehicle (AEV), BEVs utilize energy that is stored in rechargeable battery packs. BEVs sustain their power through the batteries and therefore must be plugged into an external electricity source in order to recharge.

CALIFORNIA AIR RESOURCES BOARD (CARB) -- The "clean air agency" in the government of California, whose main goals include attaining and maintaining healthy air quality; protecting the public from exposure to toxic air contaminants; and providing innovative approaches for complying with air pollution rules and regulations.

CALIFORNIA DEPARTMENT OF TRANSPORTATION (Caltrans) -- Responsible for the design, construction, maintenance, and operation of the California State Highway System, as well as that portion of the Interstate Highway System within the state's boundaries.

CALIFORNIA ENERGY COMMISSION (CEC) -- The state agency established by the Warren-Alquist State Energy Resources Conservation and Development Act in 1974 (Public Resources Code, Sections 25000 et seq.) responsible for energy policy. The Energy Commission's five major areas of responsibilities are:

1. Forecasting future statewide energy needs
2. Licensing power plants sufficient to meet those needs
3. Promoting energy conservation and efficiency measures
4. Developing renewable and alternative energy resources, including providing assistance to develop clean transportation fuels
5. Planning for and directing state response to energy emergencies.

CALIFORNIA PUBLIC UTILITIES COMMISSION (CPUC) -- A state agency created by constitutional amendment in 1911 to regulate the rates and services of more than 1,500 privately owned utilities and 20,000 transportation companies. The CPUC is an administrative agency that exercises both legislative and judicial powers; its decisions and orders may be appealed only to the California Supreme Court. The major duties of the CPUC are to regulate privately owned utilities, securing adequate service to the public at rates that are just and reasonable both to customers and shareholders of the utilities, including rates, electricity

transmission lines and natural gas pipelines. The CPUC also provides electricity and natural gas forecasting, and analysis and planning of energy supply and resources. Its main headquarters are in San Francisco.

DEMAND CHARGE -- The sum to be paid by a large electricity consumer for its peak usage level.

DIRECT CURRENT (DC) -- A charge of electricity that flows in one direction and is the type of power that comes from a battery.

ELECTRIC UTILITY -- Any person or state agency with a monopoly franchise (including any municipality), which sells electric energy to end-use customers; this term includes the Tennessee valley Authority but does not include other Federal power marketing agency (from EPAct).

ELECTRIC VEHICLE CHARGING STATION (EVCS) -- Infrastructure designed to supply power to EVs. EVSE can charge a wide variety of EVs including BEVs and PHEVs.

ELECTRIC VEHICLES (EV) -- A broad category that includes all vehicles that are fully powered by Electricity or an Electric Motor.

ENERGIZATION (Electric utility) ---– "energization" and "energize" means connecting customers to the electrical distribution grid and establishing adequate electrical distribution capacity or upgrading electrical distribution or transmission capacity to provide electrical service for a new customer, or to provide upgraded electrical service to an existing customer. The determination of adequate electrical distribution capacity includes consideration of future load. "Energization" and "energize" do not include activities related to connecting electrical supply resources.

FEDERAL HIGHWAY ADMINISTRATION (FHWA) -- is a division of the U.S. department of transportation. The FHWA is a cabinet-level organization of the Executive Branch of the U.S. Government. The FHWA specializes in highway transportation. The FHWA ensures that the U.S. highways and public roads are in good shape and technologically up to date for traveling.

FUEL CELL ELECTRIC VEHICLE (FCEV) -- A zero-emission vehicle that runs on compressed hydrogen fed into a fuel cell "stack" that produces electricity to power the vehicle.

GOODS MOVEMENT -- The processes and activities involved in the pickup, movement and delivery of goods (agricultural, consumer, industrial products and raw materials) from producers/points of origin to consumers/point of use or delivery. 'Goods movement' relies on a series of transportation, financial and information systems for this to occur, that involves an international, national, state, regional and local networks of producers and suppliers, carriers and representative agents from the private sector, the public sector (federal, state, regional and local governmental agencies) and the general public.

GOVERNOR'S OFFICE OF BUSINESS AND ECONOMIC DEVELOPMENT (GO-Biz) -- The Governor's Office of Business and Economic Development (GO-Biz) serves as the State of California's leader for job growth and economic development efforts. They offer a range of services to business owners including attraction, retention and expansion services, site selection, permit assistance, regulatory guidance, small business assistance, international trade development, and assistance with state government.

GROSS VEHICLE WEIGHT (GVW) -- The maximum operating weight/mass of a vehicle as specified by the manufacturer including the vehicle's chassis, body, engine, engine fluids, fuel, accessories, driver, passengers and cargo but excluding that of any trailers.

INFRASTRUCTURE -- generally refers to the recharging and refueling network necessary to successful development, production, commercialization and operation of alternative fuel vehicles, including fuel supply, public and private recharging and refueling facilities, standard specifications for refueling outlets, customer service, education and training, and building code regulations.

INVESTOR-OWNED UTILITIES -- A private company that provides a utility, such as water, natural gas or electricity, to a specific service area. The electric investor-owned utilities are regulated by the California Public Utilities Commission. In California the investor-owned utilities supplying energy are:

- Bear Valley Electric Service, Inc.
- Liberty Utilities (CalPeco Electric) LLC
- Pacific Gas and Electric Company
- San Diego Gas & Electric
- Southern California Edison Company

KILOWATT (kW) -- One thousand (1,000) watts. A unit of measure of the amount of power. On a hot summer afternoon a typical home, with central air conditioning and other equipment in use, might have a demand of four kW each hour.

KILOWATT-HOUR (kWh) -- The most commonly-used unit of measure of energy, used to indicate the amount of electricity consumed over time. It means one kilowatt of electricity supplied for one hour.

LIGHT-DUTY VEHICLE (LDV) -- Any motor vehicle with a gross vehicle weight of 6,000 pounds or less.

LOW CARBON FUEL STANDARD (LCFS) -- A set of standards designed to encourage the use of cleaner low-carbon fuels in California, encourage the production of those fuels, and therefore, reduce greenhouse gas (GHG) emissions. The LCFS standards are expressed in terms of the "carbon intensity" (CI) of gasoline and diesel fuel and their respective substitutes. The LCFS is a key part of a comprehensive set of regulations in California to cut greenhouse gas emission and other smog-forming and toxic air pollutants by improving vehicle technology, reducing fuel consumption, and increasing transportation mobility options.

MEGAWATT (MW) -- One-thousand kilowatts (1,000 kW) or one million (1,000,000) watts. One megawatt is enough electrical capacity to power 1,000 average California homes. (Assuming a loading factor of 0.5 and an average California home having a 2-kilowatt peak capacity.)

MEGAWATT HOUR (MWh) -- One-thousand kilowatt-hours, or an amount of electrical energy that would supply 1,370 typical homes in the Western U.S. for one month. (This is a rounding up to 8,760 kWh/year per home based on an average of 8,549 kWh used per household per year [U.S. DOE EIA, 1997 annual per capita electricity consumption figures]).

NATIONAL RENEWABLE ENERGY LABORATORY (NREL) -- The National Renewable Energy Laboratory in Golden, Colorado is the United States' primary laboratory for renewable energy and energy efficiency research and development. NREL is the only Federal laboratory dedicated to the research, development, commercialization, and deployment of renewable energy and energy efficiency technologies.

OFF-ROAD -- Any non-stationary device, powered by an internal combustion engine or motor, used primarily off the highways to propel, move, or draw persons or property, and used in any of the following applications: marine vessels, construction/farm equipment, locomotives, utility and lawn and garden equipment, off-road motorcycles, and off-highway vehicles.

ON-ROAD, ON-ROAD VEHICLE -- Vehicles that are intended by their manufacturer for use on public highways. On-road vehicles must be certified by their manufacturer with the U.S. Department of Transportation (DOT), National Highway Traffic Administration (NHTSA), as compliant with on-highway safety standards as well as certified to all applicable ARB and U.S. EPA on-road emission standards. Compliance with these standards is indicated by separate safety and emissions labels on the vehicle.

PLUG-IN ELECTRIC VEHICLE (PEV) -- is a general term for any car that runs at least partially on battery power and is recharged from the electricity grid. There are two different types of PEVs to choose from -- pure battery electric and plug-in hybrid vehicles.

PLUG-IN HYBRID ELECTRIC VEHICLE (PHEV) -- PHEVs are powered by an internal combustion engine and an electric motor that uses energy stored in a battery. The vehicle can be plugged in to an electric power source to charge the battery. Some can travel nearly 100 miles on electricity alone, and all can operate solely on gasoline (similar to a conventional hybrid).

PUBLIC OWNED UTILITIES (POUs) -- Non-profit utility providers owned by a community and operated by municipalities, counties, states, public power districts, or other public organizations. Within POUs, residents have a say in decisions and policies about rates, services, generating fuels and the environment.

TIME-OF-USE RATES -- Electricity prices that vary depending on the time periods in which the energy is consumed. In a time-of-use rate structure, higher prices are charged during utility peak-load times. Such rates can provide an incentive for consumers to curb power use during peak times.

TRANSPORTATION NETWORK COMPANY (TNC) -- A ride sourcing company that provides prearranged transportation services for compensation using an online-enabled application or platform (such as smart phone apps) to connect drivers using their personal vehicles with passengers.

UNITED STATES DEPARTMENT OF ENERGY (U.S. DOE) -- The federal department established by the Department of Energy Organization Act to consolidate the major federal energy functions into one cabinet-level department that would formulate a comprehensive, balanced national energy policy. DOE's main headquarters are in Washington, D.C.

ZERO-EMISSION VEHICLE (ZEV) -- Vehicles which produce no emissions from the on-board source of power (e.g., an electric vehicle).

APPENDIX A:
Program Funding Assumptions and Estimates

Table 7: Estimated Light-Duty EV Charger Deployments from Funding Programs or Code Compliance by 2030

Funding Program	Level 2	DC Fast	Total
CEC Funding: Primary AB 2127 Funding Scenario	39,342	7,943	47,285
CEC Funding: DC Fast Charger Funding Scenario	34,940	8,766	43,706
Settlement Agreements	267	530	797
Federal/State/Local Government	5,808	1,655	7,463
Utilities	21,009	288	21,297
Code Compliance	161,302	0	161,302

Source: CEC Staff Analysis

Table 8: Estimated MDHD EV Charger Deployments from Funding Programs by 2030

Funding Program	Depot	En Route	Total
CEC Funding: base, general fund, GGRF	20,798	4,622	25,420
Federal/State/Local Government	6	120	126
Settlement Agreements	68	0	68
Utilities	10,174	0	10,174

Source: CEC Staff Analysis

Clean Transportation Program Funding Assumptions

Funding allocations in the Clean Transportation Program Investment Plan reflect state policy goals and support the transition away from fossil fuels. Since the latest Clean Transportation Program Investment Plan did not include proposed base Clean Transportation Program fund allocations for future fiscal year, staff used the funding allocations in Table 9 to estimate future ZEV infrastructure anticipated from Clean Transportation Program base program

funding. For the ZIP analysis, staff used cost estimates from program projects and estimates anticipated chargers and hydrogen fueling deployments for light-, medium-, and heavy-duty sectors based on the funding allocations below. Since the Investment Plan must be adopted every fiscal year, future fiscal year funding allocations may change.

Table 9: Clean Transportation Program Base Allocations

Category	FY 24/25	FY 25/26	FY 26/27	FY 27/28	Total
LD EV	$37.0	$37.0	$37.0	$37.0	$148.0
MDHD EV	$40.2	$40.2	$40.2	$40.2	$160.8
Hydrogen	$15.0	$15.0	$15.0	$15.0	$60.0
Total	**$92.2**	**$92.2**	**$92.2**	**$92.2**	**$368.8**

Source: CEC Staff analysis

Table 10: One-Time ZEV Package Proposed Out-Year GGRF and General Fund

Category	2024-2025	2025-2026*	2026-2027*	2027-2028*
Light-Duty Charging Infrastructure (GGRF)	-	$140	$80	$219
Equitable At-Home Charging Infrastructure (GGRF)	-	$60	$40	$80
Drayage Truck Infrastructure (GGRF)	-	$50	$49	$50
School Bus Infrastructure (General Fund)	-	$125	-	-
Clean Trucks, Buses, and Off-Road Equipment Infrastructure (GGRF)	-	$89	-	$137
Port ZEV Infrastructure (GGRF)	-	-	$130	-
Emerging Opportunities (GGRF)	-	$46	-	-
	$0	**$510**	**$299**	**$486**

*Subject to future budget act appropriations. The anticipated GGRF amounts in these fiscal years has not been reduced to reflect administrative costs. Those fiscal year allocations will be reduced following direction in the associated budget act.

Source: California Energy Commission

For light-duty electric:

- Assume 55 percent of annual fiscal year funding is dispersed through block grant funding mechanism and remaining 45 percent through targeted solicitations
- Assume 50 percent of annual fiscal year funding goes towards DC fast chargers; remaining 50 percent towards Level 2 in the Primary AB 2127 Funding Scenario; Assume 100 percent of annual fiscal year funding goes towards DC fast chargers in DC Fast Charger Funding Scenario
- Costs Assumptions (based on cost averages of recent solicitations and block grants)
    - Assume $16,182.50 per Level 2
    - Assume $89,875.00 per DC fast charger
    - This does not represent equipment costs per charger. This cost represents the total cost to CEC to deploy the charger and includes items such as administrative costs to manage the grant agreement, reporting, charger design, equipment procurement, construction, and energization.
- Assumes three years from fiscal year funding available to charger deployments. For example, funding from fiscal year 2024/25 will see charging port deployments in 2027. This accounts for the Clean Transportation Program Investment Plan public process, block grant project design/set-up, solicitation planning and development, grant agreement execution, and time for funding recipients to deploy charging ports.

For MDHD electric:

- All Clean Transportation Program Base funding must be disbursed through solicitations
- For GGRF/general fund, assume 62 percent of annual funding is dispersed through block grant funding mechanism and remaining 38 percent through targeted solicitations
- For drayage truck, school bus, and transit infrastructure: Assume all infrastructure is deployed in depot setting
- For clean truck, bus, and port infrastructure: Assume all infrastructure is 50 percent deployed at depot, and 50 percent deployed en route.
- Does not include charging needs and estimates for off-road charging.
- Does not include charging needs and estimates for emerging opportunities (rail, marine, aviation).
- Assumes three years from fiscal year funding available to charger deployments. For example, funding from fiscal year 2024/25 will see charging port deployments in 2027. This accounts for the Clean Transportation Program Investment Plan public process, block grant project design/set-up, solicitation planning and development, grant agreement execution, and time for funding recipients to deploy charging ports.

Modeling Assumptions:

- For operational chargers, assume:
    - 5 percent of DC fast chargers are in rural areas
    - 10 percent of DC fast chargers are on travel corridors
    - 25 percent of public Level 2 chargers serve workplace charging
    - 25 percent of shared private Level 2 are at multifamily housing
- For light-duty EV charging needs, staff used the AB 2127 baseline modeling scenario and the gas station model alternative future scenario
    - 92 percent of DC fast chargers for routine travel are in urban areas
    - 25 percent of DC fast chargers for long distance travel are in urban areas
    - 95 percent of DC fast chargers for TNC vehicles are in urban areas
- For MDHD charging, staff used the high-speed depot alternative future scenario where 20 percent of depot charging is shifted from slower (20kW – 150 kW) to faster (350 kW to 1,500 kW) charging.

For operational chargers:

- For Level 2:
    - Assume 25 percent of publicly available Level 2s are in workplaces
    - Assume 25 percent of shared private Level 2s are in multifamily housing
- For DC fast charging:
    - Assume 10 percent of operational DC fast charging are on travel corridors
    - Assume 5 percent of operational DC fast charging are in rural areas

APPENDIX B:
Funding Scenarios

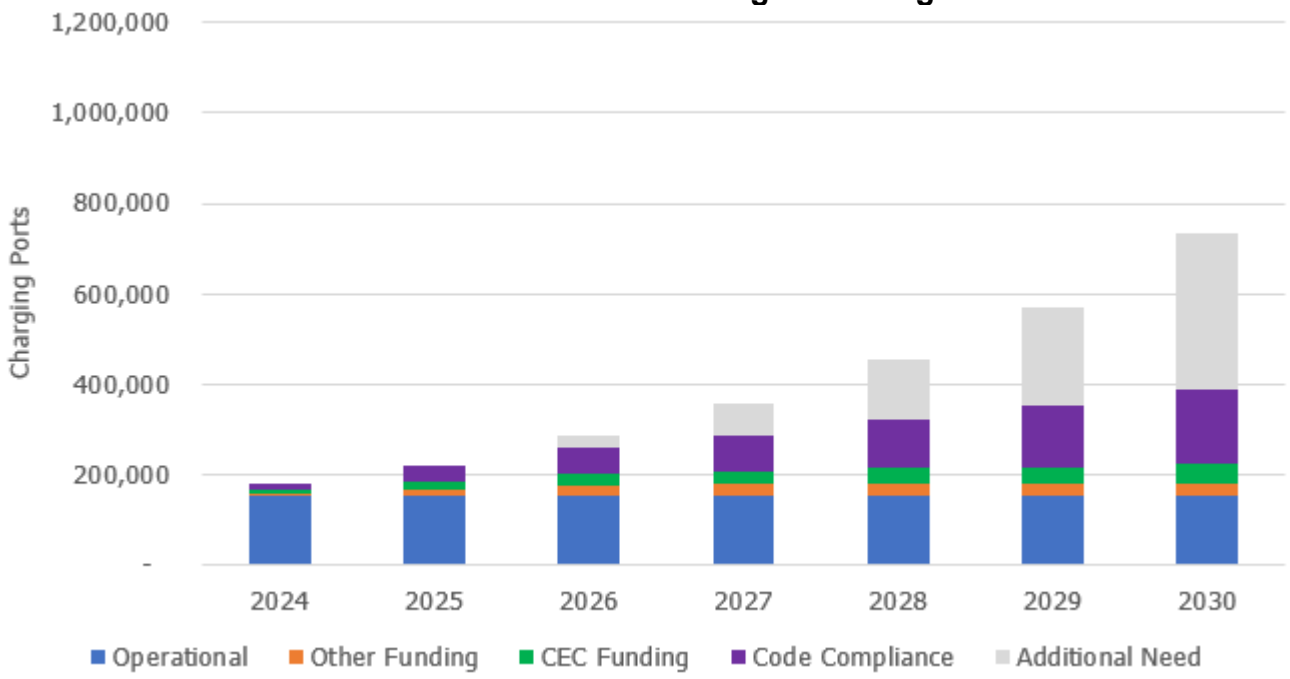
Increased DC Fast Charger Funding Scenario

In the Increased DC Fast Charger Funding Scenario, the charging port needs are based on the counts for the "gas station model" alternative future scenario. In this scenario, all base Clean Transportation Program funds would be allocated toward DC fast charging deployments.

The following figures depicts the year-by-year anticipated deployments by the different funding sources/code compliance.

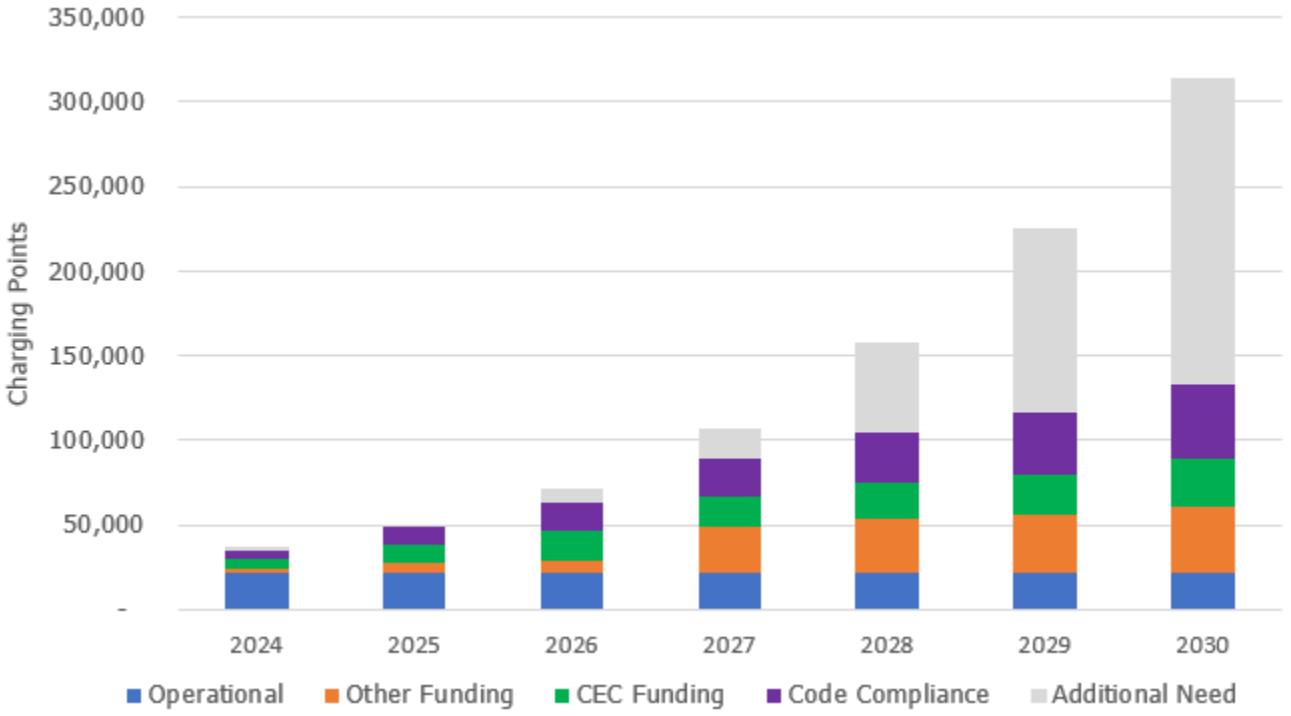
In this scenario, the additional need for public Level 2 and workplace decreases significantly.

Figure 21: Estimated Total Number of Charging Ports Deployed by 2030 under the Increased DC Fast Charger Funding Scenario



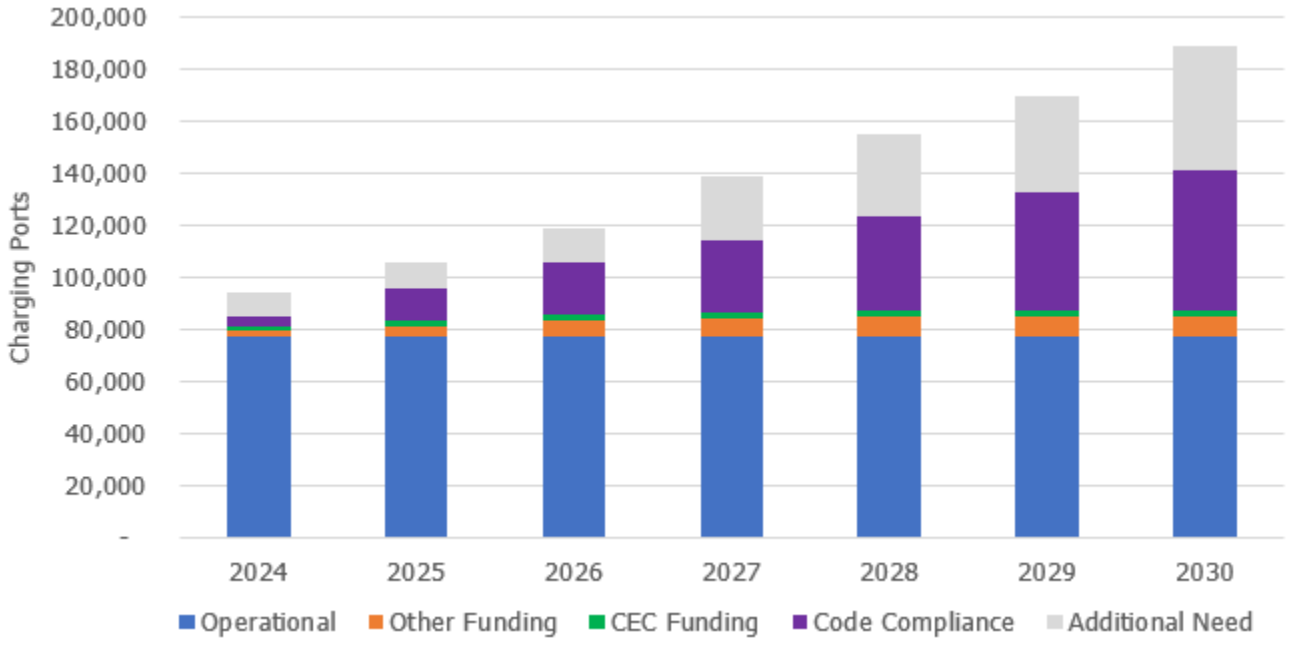
Source: CEC Staff Analysis

Figure 22: Estimated Multifamily Charging Ports Deployed by 2030 under the Increased DC Fast Charger Funding Scenario



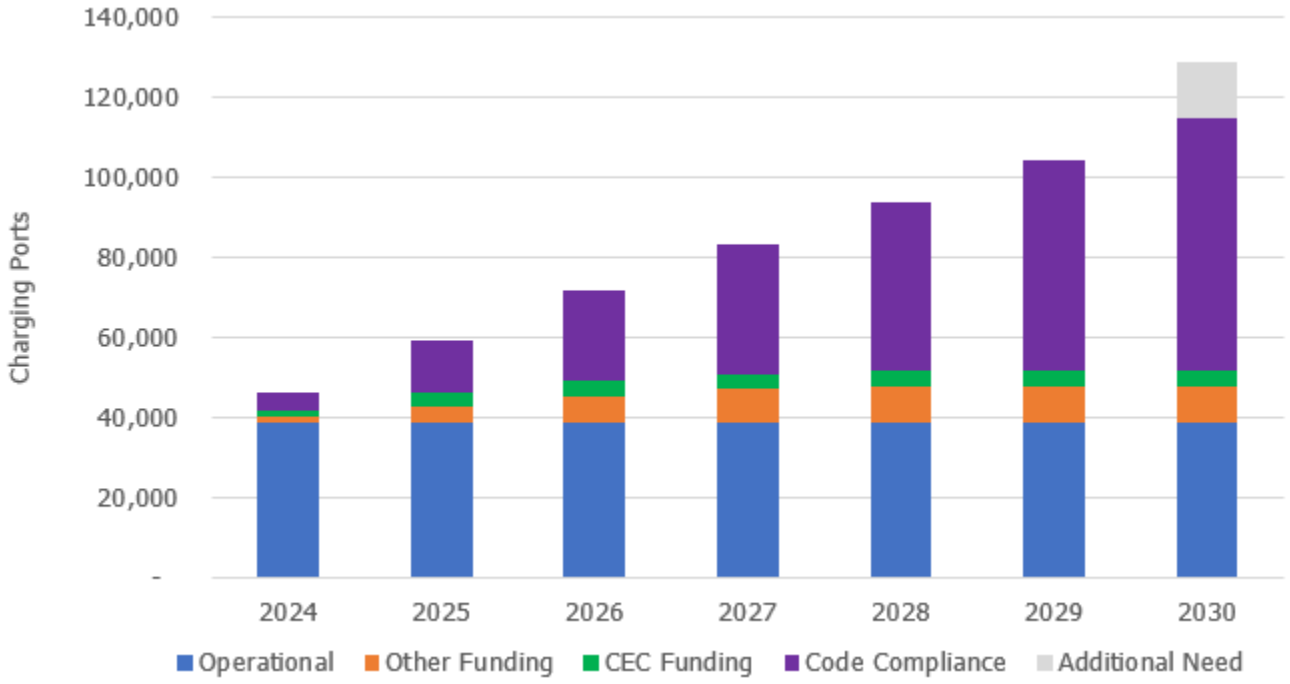
Source: CEC Staff Analysis

Figure 23: Estimated Workplace Charging Ports Deployed by 2030 under the Increased DC Fast Charger Funding Scenario



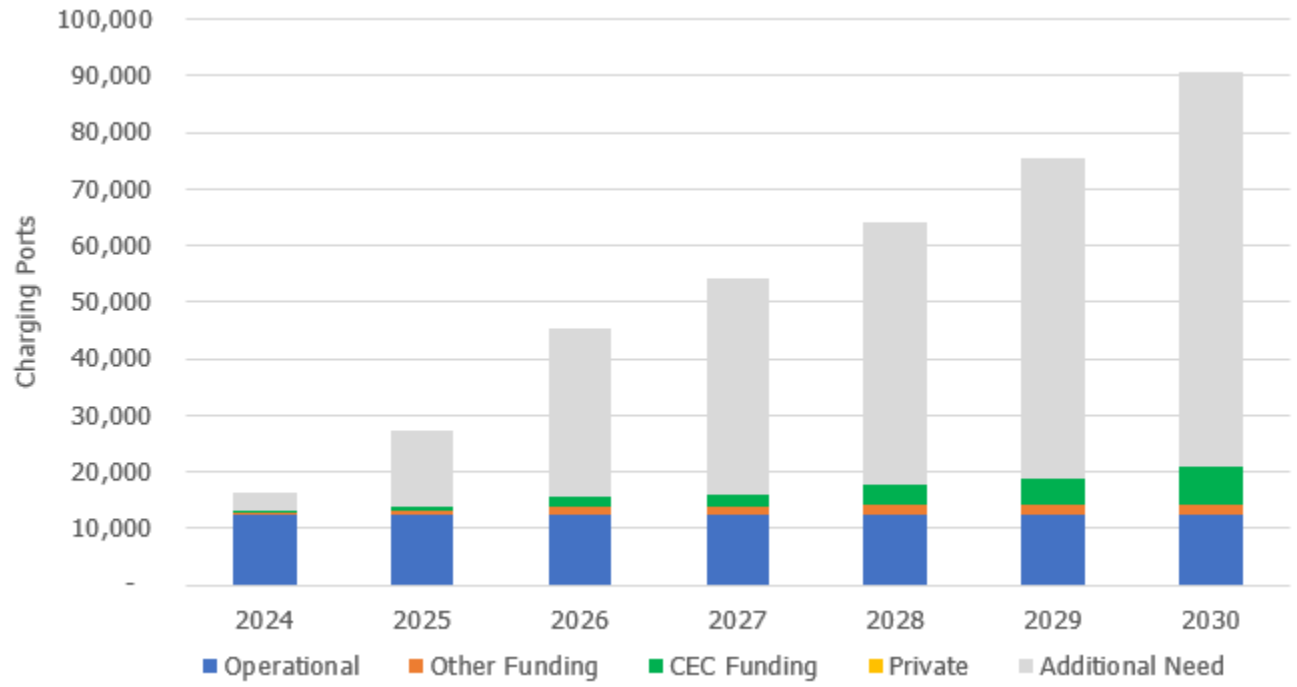
Source: CEC Staff Analysis

Figure 24: Estimated Public Level 2 Charging Ports Deployed by 2030 under the Increased DC Fast Charger Funding Scenario



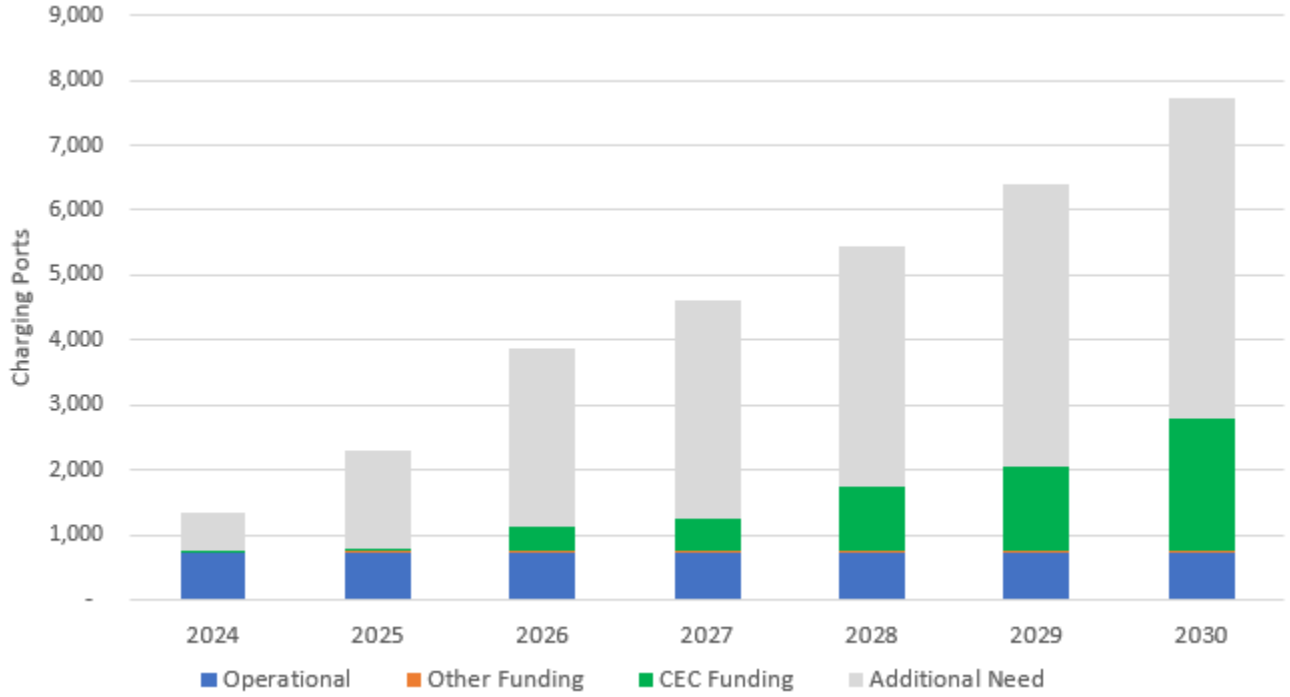
Source: CEC Staff Analysis

Figure 25: Estimated Urban DC Fast Charging Ports Deployed by 2030 under the Increased DC Fast Charger Funding Scenario



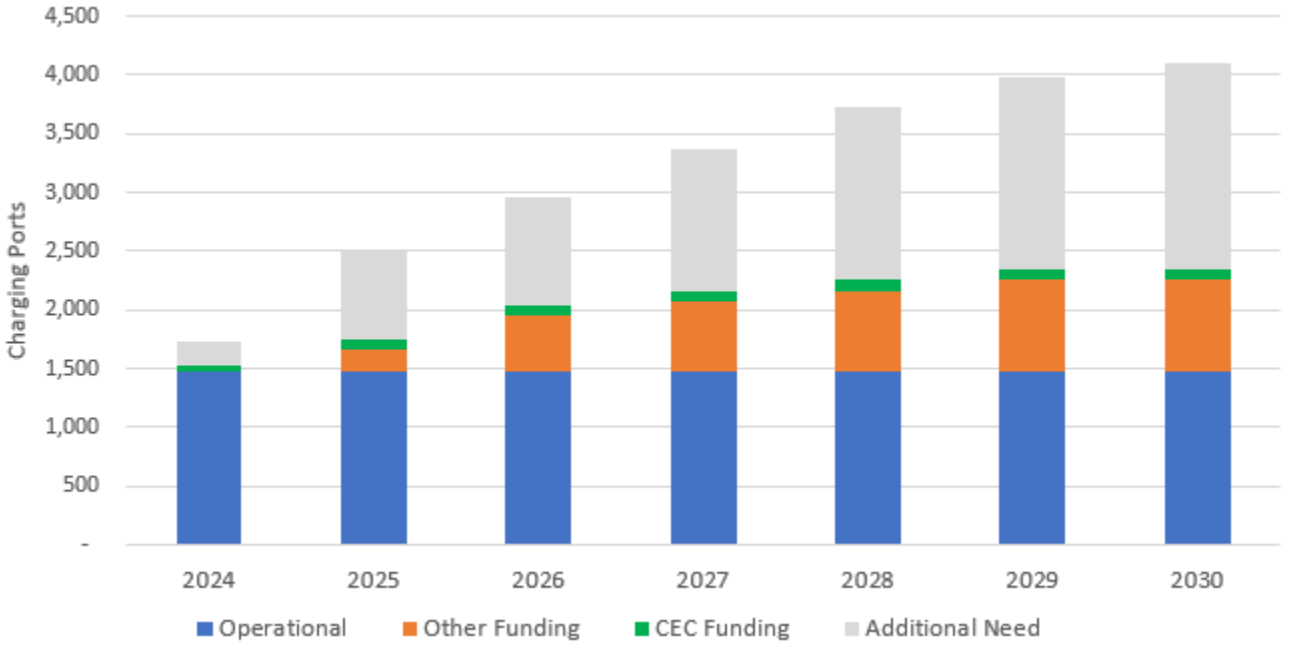
Source: CEC Staff Analysis

Figure 26: Estimated Rural DC Fast Charging Ports Deployed by 2030 under the Increased DC Fast Charger Funding Scenario



Source: CEC Staff Analysis

Figure 27: Estimated Corridor DC Fast Charging Port Deployments by 2030 under the Increased DC Fast Charger Funding Scenario



Source: CEC Staff Analysis

As part of this scenario, staff looked at the potential of decreasing the cost of DC fast charger incentives provided by the CEC. In the Primary AB 2127 Funding Scenario, staff assumed a $90,000 per DC fast charger deployed by the CEC.[43] This cost is based on recent grant funding opportunities and block grant projects administered by the CEC. In the Updated Scenario in Table 11 below, the cost of DC fast charger is reduced by half, with an assumed $45,000 per DC fast charger deployed. This scenario had the potential off adding an additional 5,500 DC fast chargers.

Table 11: Estimated Charging Port Deployments by 2030 with Reduced CEC per DC Fast Charger Costs

Sector	Primary AB 2127 Funding Scenario	Reducing DCFC Cost in Primary AB 2127 Funding Scenario
Multifamily	106,882	106,882
Workplace	143,644	143,644
Public Level 2	117,113	117,113
DC Fast	25,212	30,714

Source: CEC Staff Analysis

Multifamily Funding Scenario

In the multifamily funding scenario, CEC staff explored what the anticipated deployments for this sector would look like if all base Clean Transportation Program funding were allocated for multifamily Level 2 deployments only, increase in code requirements under CALGreen for multifamily housing parking requirements, and funding from the CPUC's Funding Cycle 1 Program.

Directing all Clean Transportation Program funding potentially results in 6,600 additional Level 2 charging ports deployed for multifamily by 2030 depicted by the lighter green bar in Figure 28 below.

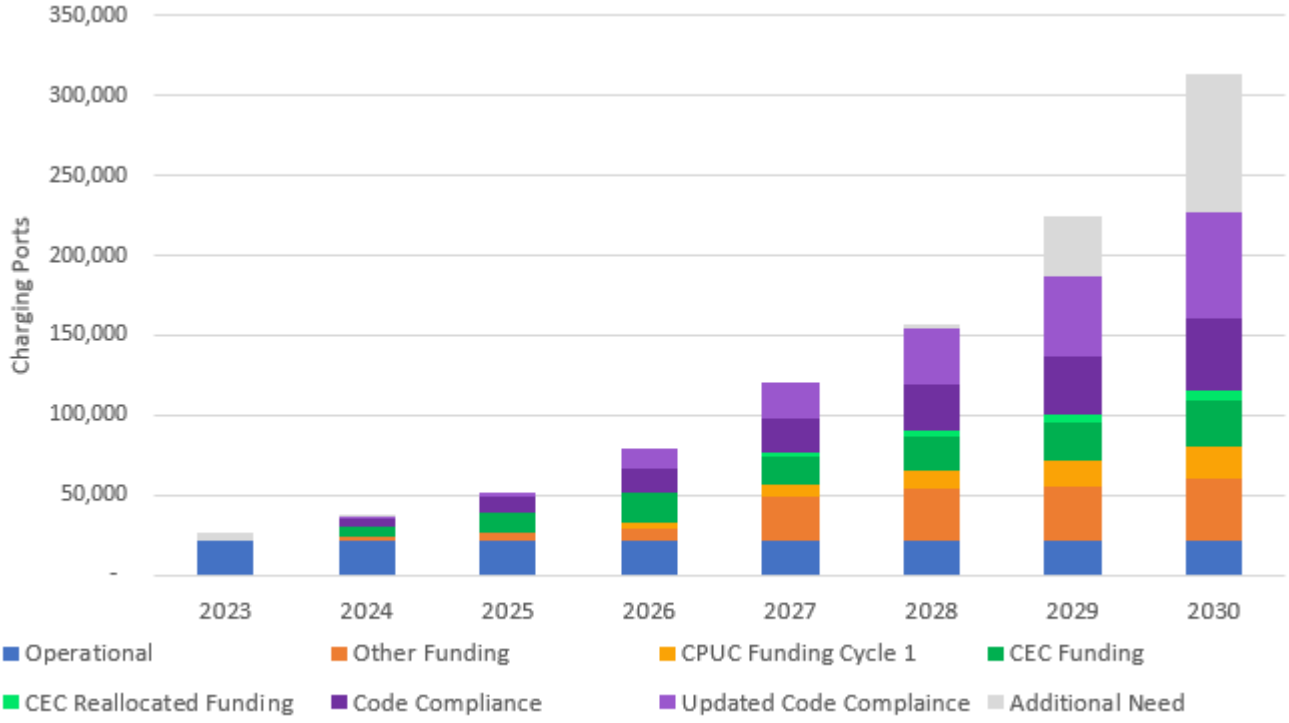
For CALGreen code, the existing code requires 40 percent of multifamily to have Level 2 receptacles and equip 10 percent of parking stalls with full Level 2 chargers. The current 2024 CALGreen Triennial Code Adoption Cycle has started, and agencies have provided input and feedback for future EV regulations in CALGreen. If updated, the code goes into effect January 1, 2026. Staff incorporated higher levels of Level 2 receptacles required in this scenario depicted by the lighter purple bar in Figure 28 below. This highlights a greater role code compliance may have for future charging port deployments.

In November 2022, the CPUC approved a new funding strategy to start in 2025 (although it is on hold). This strategy includes $600 million (potentially up to $1 billion) in transportation

43 This does not represent equipment costs per charger. This cost represents the total cost to CEC to deploy the charger and includes items such as administrative costs to manage the grant agreement, reporting, charger design, equipment procurement, construction, and energization.

electrification rebates administered by third parties instead of the IOUs.[44] Thirty percent of the funding was set to go towards light-duty charging at or near multifamily housing. Staff estimated roughly 20,000 Level 2 charging ports resulting from the program and is reflected by the lighter orange bar in Figure 28 below.

Figure 28: Estimated Total Charging Ports Deployed by 2030 under a Multifamily Funding Scenario



Source: CEC Staff Analysis

In this funding scenario, there is potential to reduce the additional need from nearly 180,000 Level 2 charging ports to 86,000 charging ports in 2030. This scenario would also see roughly 823 fewer DC fast chargers and 2,200 fewer Level 2 chargers for workplace.

Similar scenarios were explored where all base Clean Transportation Program funded was directed towards a specific sector. Due to the limited amount of flexible base funding, results were similar where chargers helped to decrease additional need in one sector, but increased need in the sector where funding was diverted from. Significant changes were seen in the Increased DC Fast Charger Funding Scenario and the Multifamily Funding Scenarios shown above.

44 California Public Utilities Commission. "Transportation Electrification." Accessed August 28, 2024. Available at https://www.cpuc.ca.gov/zev/.