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**DRAFT STAFF REPORT**

# **2022–2023 Investment Plan Update for the Clean Transportation Program**

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# California Energy Commission

Patrick Brecht  
**Primary Author**

Patrick Brecht  
**Project Manager**

Michael Comiter  
**Assistant Project Manager**

Charles Smith  
**Office Manager**  
**TRANSPORTATION INTEGRATION AND PRODUCTION OFFICE**

Hannon Rasool  
**Deputy Director**  
**FUELS AND TRANSPORTATION DIVISION**

Drew Bohan  
**Executive Director**

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## **ACKNOWLEDGEMENTS**

The following California Energy Commission staff members contributed to the development of this Investment Plan Update:

Matt Alexander

Jennifer Allen

Jane Berner

Jonathan Bobadilla

Michael Comiter

Miki Crowell

Susan Ejlalmaneshan

Brian Fauble

Tami Haas

Tiffany Hoang

Madison Jarvis

Elizabeth John

Thanh Lopez

Jeffrey Lu

Pilar Magaña

Jim McKinney

Tomas Ortiz

Larry Rillera

Michelle Vater

Mark Wenzel

Taiying Zhang, Ph.D.



## ABSTRACT

The *2022–2023 Investment Plan Update for the Clean Transportation Program* guides the allocation of program funding for Fiscal Year 2022–2023 and the first six months of Fiscal Year 2023-2024. The program is set to expire at the end of the calendar year 2023. The California Energy Commission (CEC) reviews the proposed allocations annually and makes adjustments as needed.

This 2022–2023 investment plan covers the fourteenth year of the program and reflects laws, executive orders, regulations, and other funding programs to reduce greenhouse gas emissions, petroleum dependence, and criteria pollution emissions for all Californians. Program priorities are determined with input from stakeholders, the Disadvantaged Communities Advisory Group, the Clean Transportation Program Advisory Committee, and by CEC analyses such as the *Senate Bill 1000 Electric Vehicle Charging Infrastructure Deployment Assessment* and the *Assembly Bill 2127 Electric Vehicle Charging Infrastructure Assessment-Analyzing Charging Needs to Support Zero-Emission Vehicles in 2030*. These priorities are consistent with the overall program goal “to develop and deploy innovative technologies that transform California’s fuel and vehicle types to help attain the state’s climate change policies.”

This *2022–2023 Investment Plan Update* establishes funding allocations based on identified needs and opportunities, including a focus on zero-emission vehicle infrastructure. The investment plan also prioritizes jobs, economic stimulus, and equity.

This draft staff report represents the first step in developing the *2022–2023 Investment Plan Update*. Before the adoption of the report at a CEC business meeting, the Energy Commission expects to release a Lead Commissioner report later in the year, as well as convene at least two advisory committee workshops and conduct other stakeholder outreach and engagement.

**Keywords:** California Energy Commission, Clean Transportation Program, AB 118, AB 8, funding program, alternative transportation fuels, investment plan, equity, electric vehicles, hydrogen, biofuels, biomethane, biodiesel, renewable diesel, diesel substitutes, gasoline substitutes, disadvantaged communities, workforce, training, sustainability, fueling stations, fuel production, alternative fuel infrastructure, manufacturing, COVID-19

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## EXECUTIVE SUMMARY

California has led the nation in addressing the climate crisis through aggressive greenhouse gas (GHG) emission reduction goals and innovative funding programs. The California Energy Commission's (CEC) Clean Transportation Program is one of the first transportation-focused grant programs created by the California Legislature to help achieve the state's climate policies. The program has made significant progress through steady investments designed to transform California's fuel and vehicle types. Now in the fourteenth year, the Clean Transportation Program has provided more than \$1 billion to projects covering a broad spectrum of alternative fuels and technologies and in communities that can immediately accrue health, environmental, and economic benefits from these investments. Investments have aligned with state policy with a greater portion towards zero-emission vehicle infrastructure.

In this time, California has experienced rapid growth in the sales of plug-in electric vehicles, the introduction of hydrogen fuel cell electric vehicles, and a notable increase of in-state production and use of low-carbon alternative fuels. According to the CEC's Zero-Emission Vehicles and Infrastructure Statistics online dashboard, in 2021, the share of new light-duty ZEV sales reached the highest level ever at 12.4%, with 247,000 plug-in vehicles and 3,200 fuel cell vehicles sold in the year. In the fourth quarter of 2021, the state reached the milestone of having 1,000,000 passenger ZEVs sold. According to Bloomberg New Energy Finance, there were 50 models of plug-in passenger vehicles available in North America as of the first quarter of 2020 and by 2024, there will be 130 models. There are also two fuel cell passenger vehicle models available. While behind the passenger ZEV market, the medium- and heavy-duty ZEV market is beginning to accelerate, with transit, school and delivery vehicles at the forefront. The Clean Transportation Program has supported this emerging revolution in the transportation sector with significant investments in zero-emission vehicle infrastructure and supporting projects and will continue to do so with this *2022–2023 Investment Plan Update*.

The invasion of Ukraine by Russia has spurred gasoline and diesel prices to new heights and exacerbated supply chain issues originating from the COVID-19 pandemic. The supply of new and used ZEVs as well as ZEV refueling infrastructure have also been impacted by supply chain constraints, especially as consumers seek to buy more ZEVs to avoid high prices at the gasoline pump. The CEC is leveraging funding from the Clean Transportation Program and other sources to expand ZEV manufacturing and to build the ZEV supply chain in-state, including seeking opportunities to capitalize on California sources of lithium.

The CEC recognizes the importance of prioritizing investments to promote public health, provide equitable access, stimulate the economy, and create jobs for Californians, especially the most vulnerable. The CEC will prioritize funding opportunities that put Californians to work in good jobs building out the infrastructure needed for a clean transportation future, while promoting equitable access to the benefits of a cleaner transportation system. Further, CEC investments will focus on filling the gaps that may not otherwise be addressed by the private market.

## Purpose of the Clean Transportation Program

Since 2006, California has set several pivotal goals to reduce GHG emissions, address the threat posed by global climate change, and improve the public health of its residents. These goals require incremental progress that will ultimately lead to major emission reductions, including:

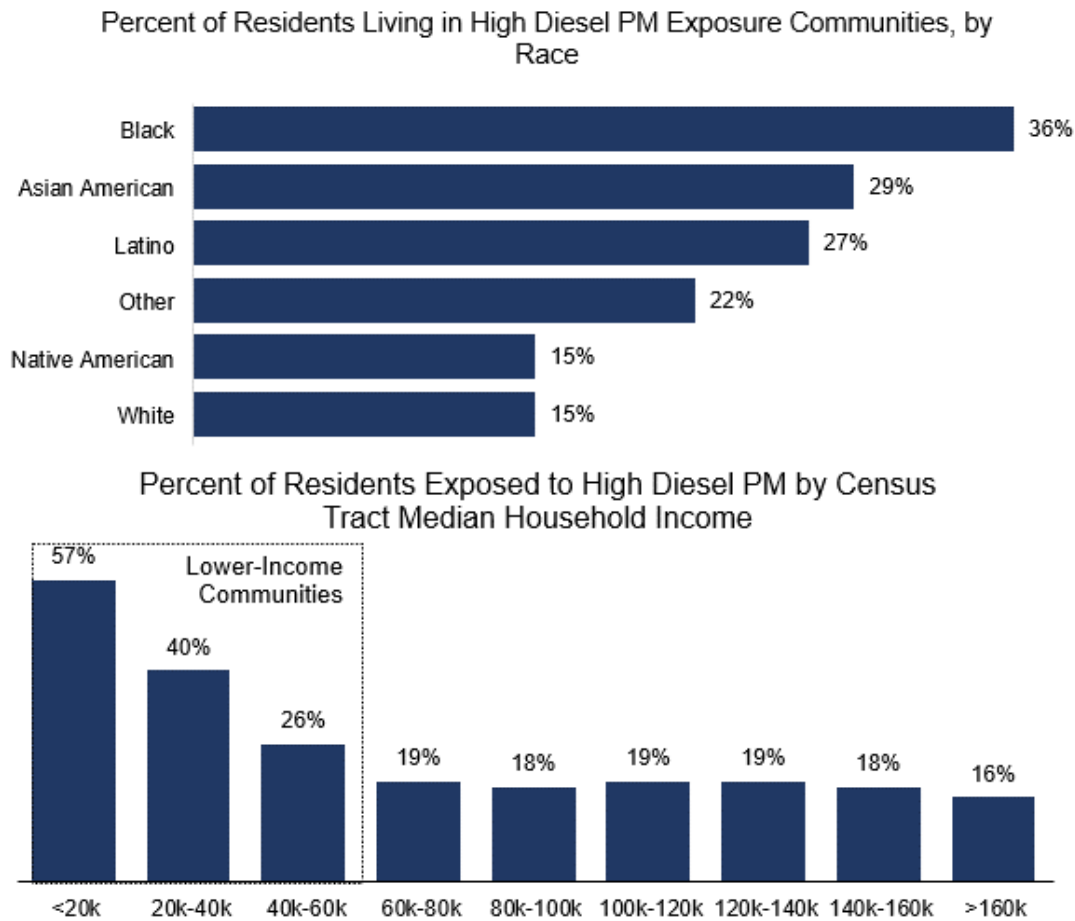
- Reducing GHG emissions to 40 percent below 1990 levels by 2030. (Senate Bill 32 in 2016).
- Reducing short-lived climate pollutant emissions, such as methane, to 40 to 50 percent below 2013 levels by 2030. (Senate Bill 1383 in 2016).
- Achieving a carbon-neutral economy by 2045. (Executive Order B-55-18).
- Meeting goals to boost the supply of zero-emission vehicles (ZEVs) as well as charging and fueling stations, including:
  - By 2025,
    - Having at least 1.5 million ZEVs on the road (Executive Order B-16-12).
    - Installing 200 hydrogen-fueling stations and 250,000 battery-electric vehicle chargers, including 10,000 direct-current fast chargers (Executive Order B-48-18).
  - By 2030,
    - Having 5 million ZEVs on the road (Executive Order B-48-18).
  - By 2035,
    - Transitioning 100 percent of new sales of passenger vehicles and trucks to ZEVs (Executive Order N-79-20).
    - Transitioning 100 percent of operating drayage trucks to zero emission (Executive Order N-79-20).
    - Transitioning 100 percent of operating off-road vehicles and equipment to zero emission everywhere feasible (Executive Order N-79-20).
  - By 2045,
    - Transitioning 100 percent of operating medium- and heavy-duty trucks and buses to zero emission by 2045 everywhere feasible (Executive Order N-79-20).
- Ensuring Clean Transportation Program investments benefit communities of color, disadvantaged communities, low-income communities, rural communities, tribal communities, and those living in multifamily housing.

Achieving these goals will require significant state and federal investments to support and accelerate the market transformation that is underway within the transportation sector, which accounts for roughly 50 percent of state greenhouse gas emissions when considering “upstream emissions” from fuel production.

In addition to these GHG emission reduction goals, the state must reduce emissions of criteria pollutants to attain federal and state ambient air quality standards. Reducing air pollution is

important to improve equitable outcomes, given that air quality burdens fall disproportionately on low-income residents and people of color (Figure ES-1).

**Figure ES-1: Disparities in Transportation-Related Pollution Exposure by Race and Income**



Source: CEC analysis of census and CalEnviroScreen 2021 data (Note: "High Diesel PM Exposure" communities are census tracts that score in the highest seventy-fifth percentile of census tracts for diesel particulate matter. The vast majority [90 percent] of diesel PM emissions come from vehicles.)

To help the state achieve its climate change policies, the California Legislature passed Assembly Bill 118 (Núñez, Chapter 750, Statutes of 2007). This legislation created the Clean Transportation Program, to be administered by the CEC. With funds collected from vehicle and vessel 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." Assembly Bill 8 (Perea, Chapter 401, Statutes of 2013) subsequently extended the collection of fees that support the Clean Transportation Program to January 1, 2024.

The State Budget Act of 2021 provided additional funding for clean transportation projects to be administered by the CEC using monies from the state's General Fund. Across three fiscal years, this will amount to over \$1.1 billion in additional funds targeted at expanding the state's

ZEV refueling network for passenger vehicles, building new ZEV infrastructure for medium- and heavy-duty buses and trucks, and expanding the state's ZEV manufacturing supply chain.

## **Description of the Investment Plan**

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 year. Assembly Bill 1314 (Wieckowski, Chapter 487, Statutes of 2011) focused the scope of the annual Clean Transportation Program investment plan to an update. The update builds on the work of previous investment plans while highlighting differences from previous years. The resulting funding allocations are intended to reflect the unique technological and market conditions for each of these fuels and technologies, as well as state goals, policies, and directives.

The CEC has completed two multiyear Investment Plan Updates to provide a more consistent signal about the state's planned clean transportation investments. The updates covered investments through the Clean Transportation Program expiration at the end of 2023. For the third year in a row, the CEC proposes a multiyear funding plan to provide the public and stakeholders improved funding certainty and convey short-term and long-term transformative goals of the Clean Transportation Program. A public stakeholder process will be utilized to evaluate whether adjustments should be made to the allocations.

The funding recommendations in this report are guided by, and complementary to, the state's energy policies, executive orders, regulations, and actions by other state agencies. The CEC is committed to ensuring that the Clean Transportation Program funding is complementary to policies and grant programs administered by other agencies, including the California Air Resources Board (CARB) and the California Public Utilities Commission (CPUC).

## **Highlights of Investments**

The Clean Transportation Program has been an essential part in making California a leader in near- and zero-emission transportation. The program has provided grants to ZEV manufacturers, like electric vehicle bus manufacturer Proterra, to help it scale up in-state operations and support economic development. California is home to more than 360 companies with 70,000 employees that work directly on zero-emission transportation, including vehicles, components, infrastructure, and research (CALSTART's California ZEV Jobs Study, January 2021). California has 43 ZEV-related manufacturers and leads the nation in ZEV manufacturing jobs. In addition to jobs, these companies are stimulating the state economy; in 2020, ZEVs were California's number one export.

The program has funded the buildout of ZEV infrastructure, helping California create the largest electric vehicle charger and hydrogen refueling networks in the nation. These investments in ZEV infrastructure are critical to supporting California's growing market for ZEVs. California comprises about half of U.S. ZEV sales, and the state reached 1 million light-duty ZEVs sold in 2021. If California were a country, it would be the sixth-largest market for ZEVs in the world, after China, Germany, the United States as a whole, France, and the United Kingdom (World Economic Forum, February 2021).

Since the first Clean Transportation Program investment plan was released in 2009, the CEC has invested more than \$1 billion in projects supporting the advancement and use of alternative fuels and advanced vehicle technologies. Key highlights through December 2021 from the Clean Transportation Program include the following:

- Installed or planned 15,213 chargers for plug-in electric vehicles, including 4,277 at multi- and single-family homes, 155 for fleets, and 419 at workplaces; 8,403 public and shared private Level 2 and Level 1 chargers; and 1,713 public direct-current (DC) fast-chargers and 246 Level 2 chargers along highway corridors and urban metropolitan areas. Level 1 chargers provide charging through a 120-volt alternating-current (AC) plug, whereas Level 2 chargers provide charging through a 240-volt (typical in residential applications) or 208-volt (typical in commercial applications) AC plug. DC fast chargers provide charging through a DC plug, typically at a rate of 50 kilowatts or higher.
- Created the California Electric Vehicle Infrastructure Project (CALeVIP) to provide streamlined Clean Transportation Program incentives for light-duty electric vehicle charging infrastructure.
- Funded 55 regional readiness planning grants, regional readiness implementation grants, and medium- and heavy-duty ZEV blueprint grants for communities and fleets that are ramping up for the adoption of ZEV technologies.
- Released new solicitations targeting high priority or underserved EV charging needs, including multi-family housing charging installations; charging infrastructure in rural communities; and charging infrastructure for high mileage on-demand transportation services.
- Released new solicitations to expand innovative and interoperable charging opportunities, including a vehicle-grid innovation laboratory; a future symposium on electric vehicle charging interoperability; and the demonstration of innovative charging solutions to accelerate their commercialization.
- Funded 80 publicly available hydrogen-fueling stations and approved funding for an additional 74 stations based on deployment progress, funding availability, and Clean Transportation Program Investment Plan funding allocations. Of these stations, 13 will accommodate medium- and heavy-duty vehicles as well as passenger vehicles. In addition, there are 23 privately funded stations under development. CEC staff expects that California will exceed the 100 station goal set by AB 8 by 2023. As of February 2022, 55 hydrogen fueling stations were open retail in California.
- Developed retail fueling standards to enable hydrogen sales on a per-kilogram basis.
- Prepared to launch the nation's first commercial vehicle fleet incentive project titled "EnergIIZE" to accelerate the deployment of electric and hydrogen infrastructure needed to fuel zero-emission trucks, buses, and equipment. The project will use a concierge-like model working directly with eligible applicants to plan and fund the purchase of charging and hydrogen fueling infrastructure. The \$50 million multiyear project will help communities most impacted by transportation-related pollution by meeting essential infrastructure needs and has a requirement that 60 percent of funds

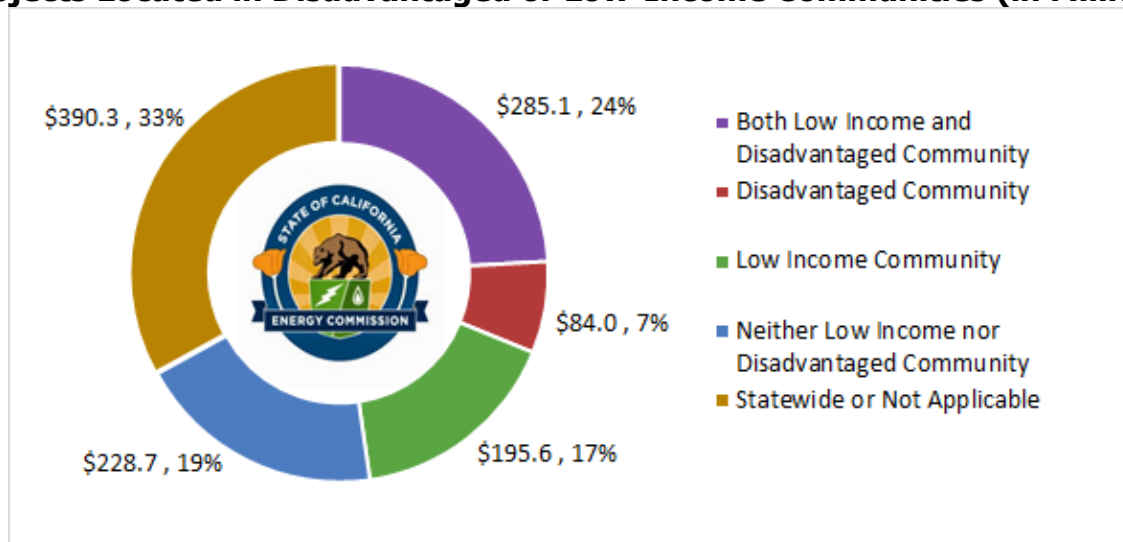
support low-income and disadvantaged communities. The project officially launched in March 2022.

- Released targeted grant funding solicitations to provide zero-emission charging and refueling infrastructure for transit buses and drayage trucks, the latter in direct partnership with CARB to provide vehicle funding incentives.
- Funded 27 manufacturing projects supporting in-state economic growth while reducing the supply-side barriers for alternative fuels and advanced technology vehicles, primarily in electric drive-related components and vehicles.
- Provided workforce training for more than 20,000 trainees and 277 businesses, helping prepare workers for the clean transportation economy and the opportunity to earn sustainable wages and expand employment opportunities.
- Launched 71 projects to promote the production of sustainable, low-carbon alternative fuels within California, with a cumulative annual production capacity equivalent to more than 158 million gallons of diesel fuel. Most of the projects use waste-based feedstocks such as dairy manure and municipal solid waste, which have some of the lowest carbon intensity pathways recognized under the Low Carbon Fuel Standard, a CARB regulation that requires the carbon intensity of transportation fuels to be cut by 20 percent by 2030.
- Funded five projects to produce 100 percent renewable hydrogen from in-state renewable resources. The hydrogen will be used for on-road fuel cell electric vehicles, both light-duty and medium-/heavy-duty.

## **Commitment to Inclusion, Diversity, Equity, and Access**

The CEC is committed to inclusion, diversity, equity, and access, ensuring that all Californians have an opportunity to participate in and benefit from programs and services, and supporting in-state employment, in-state manufacturing, and economic development. In 2015, the CEC adopted a resolution committing the CEC to improving fair and equal opportunities to participate in and benefit from CEC programs. Furthermore, the CEC will seek to provide more than 50 percent of Clean Transportation Program funds from this investment plan toward projects that benefit low-income and disadvantaged communities. The CEC will seek to quantify these benefits in ways that go beyond measuring funding within a given location and will continue to investigate new metrics to ensure these investments enhance equity within the state. As depicted in Figure ES-2, 48 percent of Clean Transportation Program project funds have been awarded to projects within disadvantaged or low-income communities or both.

**Figure ES-2: Proportion of Clean Transportation Program Funding Awarded to Projects Located in Disadvantaged or Low-Income Communities (in Millions)**



Source: California Energy Commission. Totals may not match due to rounding. As of November 17, 2021. "Disadvantaged communities" are defined as communities within the top 25 percent scoring areas under CalEnviroScreen, as well as areas of high pollution and low population (such as ports). "Low-income communities" are defined as communities that are at or below 80 percent of the statewide median income.

The Disadvantaged Communities Advisory Group (DACAG), established under Senate Bill 350 (De León, Chapter 547, Statutes of 2015), consults with and advises the CEC and the CPUC in determining how programs can be more effective and beneficial in disadvantaged and other communities. The DACAG and other stakeholders have encouraged the CEC to prioritize investments that directly benefit low-income, disadvantaged, rural and tribal communities, and to conduct outreach and engagement in partnership with local community-based organizations. Expanding outreach is particularly important for smaller, tribal, or rural communities that may not have the resources to compete for funding opportunities, nor the information and awareness of state program offerings.

Strengthening outreach and education efforts can provide more equitable opportunities to participate in the Clean Transportation Program Advisory Committee and allow the identification of funding needs and priorities (such as developing the program investment plan update), the development of more equitable funding solicitation criteria, and the application and award-making process. In addition to other equity-related efforts, the CEC established the Inclusive, Diverse, Equitable, Accessible, and Local (IDEAL) Communities Partnership to put in place technical assistance, conduct a ZEV community survey and outreach forum, and implement a ZEV student ambassador program in partnership with the Foundation for California Community Colleges. The CEC also continues to coordinate with its Office of the Public Advisor, Energy Equity, and Tribal Affairs to better reach underrepresented and underserved communities.

The Advisory Committee for the Clean Transportation Program has 32 members and reflects a broad array of stakeholders representing community-based organizations, social and environmental justice advocates, alternative vehicle technologies, as well as workforce and



labor interests. The perspectives and recommendations of the members and other stakeholders help guide an inclusive approach for Clean Transportation Program investments.

In addition, Senate Bill 1000 (Lara, Chapter 368, Statutes of 2018) requires the CEC to assess whether chargers are disproportionately deployed by population density, geographical area, or population income level, including low-, middle-, and high-income levels. Staff published the first *SB 1000 Electric Vehicle Charging Infrastructure Deployment Assessment* on December 30, 2020. The report found that low-income communities, on average, have fewer public chargers per capita than middle- or high-income communities. The second report, which the CEC expects to publish in May 2022, will assess drive times to the nearest public direct-current fast charging station from census tract population centers. In this assessment, the CEC finds that low-income rural communities have the least access to public charging and that several disadvantaged communities have less fast charging coverage. Staff will continue to analyze charger deployment to help inform Clean Transportation Program investments in charging infrastructure, including project and grant funding design. Further details of this analysis can be found in Chapter 4.

## **Zero-Emission Vehicle Infrastructure Gap**

Executive Order B-48-18 calls for the installation and construction of 250,000 electric vehicle charging ports, including 10,000 DC fast charging ports, and 200 hydrogen-fueling stations by 2025. Based on existing public and private commitments, Clean Transportation Program staff estimates that California should be able to meet the goals of 250,000 chargers and 200 hydrogen stations.

Assembly Bill 2127 requires the CEC to biannually evaluate charger needs in 2030 to meet the state goal of having 5 million ZEVs on the road and reducing greenhouse gas emissions to 40% below 1990 levels by 2030. However, Executive Order N-79-20, signed by Governor Gavin Newsom on September 23, 2020, provides even more ambitious ZEV goals and tasks the CEC with assessing charging infrastructure needs for this higher level of ZEV adoption. In response, the CEC adopted the *Assembly Bill 2127 Electric Vehicle Charging Infrastructure Assessment — Analyzing Charging Needs to Support Zero-Emission Vehicles in 2030*. For passenger vehicle charging in 2030, this report projects that California will need nearly 1.2 million public and shared-private chargers to support the roughly 8 million ZEVs that CARB projects in its Mobile Source Strategy. An additional 157,000 chargers are needed to support 180,000 medium- and heavy-duty vehicles anticipated for 2030. Last year, the legislature required that the CEC monitor charging station

There are 177 hydrogen stations operational or planned through existing or allocated funds, with a gap of 23 from the state goal of having 200 stations (Table ES-1). The gap grew when a developer canceled an agreement for two stations. The CEC plans to release a solicitation using \$27 million from the general fund ZEV Package approved in the Budget Act of 2021 to develop more stations to close the gap. In addition, Chevron and Iwatani Corporation of America recently announced an agreement to fund and develop 30 hydrogen fueling stations in California by 2026, some of which may be in addition to the already planned 177 stations. With these investments, staff anticipates that California will meet the goal of 200 stations, which would have sufficient capacity to refuel 280,000 fuel cell vehicles. Industry expects to

have 61,000 light duty fuel cell vehicles on the road in 2027, so station capacity should not be a near term barrier to light duty fuel cell vehicle deployment once these stations are operational. However, medium- and heavy-duty FCEVs could play an important role in goods movement, particularly for long range buses and trucks with heavy payloads that need fast refueling, and additional infrastructure will be needed to support these fleets

In addition, there are other barriers to fuel cell vehicle deployment, including the high price at the pump for hydrogen, supply disruptions in the nascent industry of producing hydrogen for transportation, hydrogen station downtime due to equipment failures and other factors, and a lack of vehicle models and consumer options.

**Table ES-1: Progress Toward 250,000 Chargers and 200 Hydrogen Stations by 2025**

Category	Level 2 Chargers	DC Fast Chargers	Hydrogen Fueling Stations
Existing Chargers/Open Retail Hydrogen Fueling Stations (Estimated)*	71,236	7,158	55
Number of Chargers/Fueling Stations For Which Funding Has Been Allocated (includes anticipated funding from Clean Transportation Program)**	186,375	4,511	122
<b>Total</b>	257,611	11,669	177
<i>2025 Goal (Executive Order B-48-18)</i>	<i>240,000</i>	<i>10,000</i>	<i>200</i>
<b>Gap From 2025 Goal</b>	0	0	23
AB 2127 Report's 2030 Estimate of Charging Needs	1,126,855	37,461	
<b>Gap from 2030 Estimates</b>	869,244	25,792	

Source: California Energy Commission. Analysis as of March 2022. \*Existing charging ports estimated based on available data from U.S. Department of Energy's Alternative Fuels Data Center and surveys to electric vehicle network service providers, utilities, and public agencies in California. Not included in this table are an estimated 629 statewide public or shared-private Level 1 chargers, which are included in the CEC [ZEV and Infrastructure Statistics page](https://www.energy.ca.gov/data-reports/energy-insights/zero-emission-vehicle-and-charger-statistics) (available at <https://www.energy.ca.gov/data-reports/energy-insights/zero-emission-vehicle-and-charger-statistics>) but are not part of the goal of 250,000 chargers. \*\*Estimate of ports from other state programs derived from public presentations and statements by utilities, CPUC, CARB, other entities, and CEC. Includes PG&E's application for EV Charge 2 under CPUC review. Includes funding from State Budget Act of 2021 intended to close the gaps for both Level 2 and DC Fast Chargers; the estimated number of chargers are subject to change as solicitations are released. Does not include funding for new charging infrastructure under the Governor's proposed budget for Fiscal Year 2022–2023.

## The Zero-Emission Vehicle Infrastructure Plan (ZIP)

CEC staff, in coordination with various state agencies including the California Public Utilities Commission (CPUC), California Air Resources Board (CARB), California State Transportation Agency (CalSTA), California Department of Transportation (Caltrans), California Governor's Office of Business and Economic Development (GO-Biz), and Department of General Services (DGS), has been developing the Zero-Emission Vehicle Infrastructure Plan (ZIP). This document supports decision-making in the public and private sectors by documenting plans

and strategies to deploy ZEV infrastructure for all Californians. The document divides ZEV infrastructure into five market segments to address the specific challenges and opportunities unique to each sector. The market segments include hydrogen fueling for light-duty FCEVs, charging and hydrogen fueling for medium- and heavy-duty ZEVs, Level 1 and Level 2 charging for light-duty EVs, DC fast charging for light-duty BEVs, and emerging technologies. When completed in the summer of 2022, this document will be a resource for public and private entities to better understand the status and short-term and long-term state actions to support ZEV infrastructure.

## **The 2021-2022 State Budget Provides Significant Funding to Transform Transportation in California**

### **California Accelerates Charging Infrastructure Deployment, Hydrogen Refueling Station Deployment, and In-State Zero-Emission Vehicle and Related Manufacturing**

On July 12, 2021, Governor Gavin Newsom strengthened California's commitment to a clean transportation future by approving the State Budget Act of 2021 (Senate Bill 129, Skinner), which includes a three-year, \$3.9 billion budget for ZEV-related investments by CEC, CARB, and GO-Biz. The budget prioritizes diesel emission reduction by earmarking funding for 1,125 zero-emission drayage trucks, 1,000 zero-emission school buses, and 1,000 zero-emission transit buses along with their appropriate charging and refueling infrastructure. Of that package amount, the CEC will administer \$1.165 billion over three years.

The CEC funding is for infrastructure deployment to accelerate charging and hydrogen fueling station deployment and grants to promote in-state ZEV and ZEV-related manufacturing, such as infrastructure equipment and ZEV components including EV batteries. The investments will help the markets for ZEVs and infrastructure grow to scale and, more importantly, serve as a foundation for equitable and sustainable economic growth by drawing private investments to California and creating jobs in manufacturing, construction, and engineering.

### **Governor Gavin Newsom's Proposed 2022-2023 State Budget**

On January 10, 2022, Governor Gavin Newsom announced his proposed 2022–2023 budget, which includes \$6.1 billion for the transportation system and other related zero-emission vehicle efforts, titled *The California Blueprint — Building the Transportation and Infrastructure of the Future*. The proposed funding builds on the already historic clean transportation funding from the Budget Act of 2021. Of the \$6.1 billion, the CEC would administer more than \$2 billion over four fiscal years to continue deploying ZEV infrastructure to support the goals outlined in the Governor's Executive Order N-79-20. If approved, the funding would help increase ZEV charging for light-duty vehicles with a focus on equity and access. The proposed budget includes \$900 million that would go toward light-duty passenger vehicle infrastructure, primarily for a broad network of grid-integrated, high-powered fast chargers, as well as at-home charging for multifamily residents and priority community single-family homes. In March,

the Governor proposed to accelerate the \$900 million for light duty charging to the current fiscal year (2021-2022) to address the crisis of high pump prices facing Californians today.

The four-year budget proposal would also provide \$1.04 billion in infrastructure funding to power heavy-duty vehicles and equipment. This funding would include \$390 million to deploy infrastructure for an additional 1,000 zero-emission drayage trucks and 1,700 zero-emission transit buses. The proposed budget also includes \$500 million to deploy infrastructure for an array of zero-emission commercial vehicles and equipment, including those used in construction and agriculture, and \$150 million to help transition the state's seaports to zero-emission operations.

The CEC will continue to monitor the budget legislative process and will adjust this *2022–2023 Investment Plan Update* as needed.

## **Infrastructure Investment and Jobs Act**

President Joseph R. Biden Jr. signed the \$1.2 trillion Infrastructure Investment and Jobs Act (IIJA) into law in November 2021 (Public Law 117-58). The law authorizes hundreds of billions of dollars in new investments in a wide array of infrastructure categories, including roads and bridges, water infrastructure, passenger rail, energy, and broadband internet. Of particular interest to the CEC are the new investments in clean transportation, clean energy generation, and grid resiliency. Electric vehicle charging infrastructure will see significant new funding, with 5 billion to accelerate EV infrastructure deployment nationally. An additional \$2.5 billion nationally is available on a competitive basis for EV and hydrogen infrastructure. The IIJA also allocates more than \$6 billion for lithium-ion battery materials processing and cell manufacturing and more than \$8 billion for green hydrogen production from renewable energy resources.

The new federal funding will be allocated both as formula funding and competitive grant funding. The CEC is collaborating with Caltrans on charging infrastructure and is also contributing the CEC's technical and grant-funding expertise to support California in competing for battery manufacturing and green hydrogen funding categories. Federal guidance is still forthcoming in many areas, but the CEC will monitor to determine if Clean Transportation Program funding is able to and appropriate as federal match share.

## **Proposed Funding Allocations for 2022–2023**

The allocations for the *2022–2023 Investment Plan Update* are unchanged from last year's *2021-2023 Investment Plan Update*. The purpose of the multi-year plan is to provide certainty to the market and to stakeholders, with the opportunity to adjust funding allocations on an annual basis as needed. The CEC is not proposing any adjustments at this time and welcomes feedback by stakeholders on this.

The Plan Update combines both Clean Transportation Program funding and the general fund ZEV Package investments from the Budget Act of 2021. Table ES-2 shows the funding allocations for FY 2022–2023, funding projections for the remainder of the Clean Transportation Program, as well as the \$1.165 billion over three years made available through the general fund ZEV Package of the Budget Act of 2021. The allocations reflect the state's

goals for ZEVs, as well as near- and long-term carbon reduction, improved air quality, and equity, with a focus on providing benefits for low-income and disadvantaged communities.

Table ES-2 shows an allocation of about \$50 million to support light-duty passenger vehicles (including light-duty vehicle charging and hydrogen refueling) and more than \$160 million to support medium- and heavy-duty vehicles in FY 2022–2023. Investments in medium- and heavy-duty ZEV infrastructure reflect the need to swiftly transition the most polluting vehicles toward zero-emission technologies in the most sensitive regions of the state.

For light-duty charging infrastructure, the CEC allocates \$30.1 million in the current fiscal year and \$13.8 million in the remaining half fiscal year, which, along with prior investments, should be sufficient to meet the state’s goal of having 250,000 chargers by 2025. For light-duty hydrogen infrastructure, the CEC allocates \$20 million for the current fiscal year and an additional \$10 million for the half fiscal year of 2023–2024, which will be sufficient to meet the 100-station goal set by AB 8. An additional \$27 million from the general fund ZEV Package investments from the Budget Act of 2021 is anticipated to help the state reach the 200 – station goal. The CEC projects that these 200 stations will have the capability to support to refuel about 290,000 fuel cell electric vehicles (FCEVs). The current fuel cell vehicle population was approximately 7,129 in 2021. The auto industry estimates that the population could increase to 61,100 by the end of 2027. Station capacity is not expected to be a barrier to near-term deployment.

Assembly Bill 8 (Perea, Chapter 401, Statutes of 2013) directs the CEC to allocate \$20 million annually, not to exceed 20 percent of the funds appropriated by the Legislature, from the Clean Transportation Program to deploy hydrogen fueling stations until there are at least 100 publicly available stations in operation. The CEC allocates \$20 million in Fiscal Year 2022–2023 and \$10 million in the partial fiscal year of 2023–2024 to support light-duty hydrogen infrastructure. The CEC will continue to evaluate hydrogen fuel cell vehicle deployment, hydrogen station deployment, and other factors and will adjust as needed in annual updates to the Investment Plan Update. This evaluation will be informed by CARB’s *Annual Evaluation of Fuel Cell Electric Vehicle Deployment and Hydrogen Fuel Station Network Development* (AB 8 Report) as well as input from the Advisory Committee, Disadvantaged Communities Advisory Group, and other stakeholders.

**Table ES-2: Proposed Investment Plan Allocations for FY 2022–2023 and Subsequent Fiscal Year (in Millions)**

Category	Funded Activity	2022-2023 <sup>1/</sup>	2023-2024 <sup>1/ 2/</sup>
Clean Transportation Program Zero-Emission Vehicles and Infrastructure	Light-Duty Electric Vehicle Charging Infrastructure and eMobility	\$30.1	\$13.8
General Fund Zero-Emission Vehicles and Infrastructure	Light-Duty Electric Vehicle Charging Infrastructure	-	-
Clean Transportation Program Zero-Emission Vehicles and Infrastructure	Medium- and Heavy-Duty Zero- Emission Vehicles and Infrastructure	\$30.1	\$13.8
General Fund Zero-Emission Vehicles and Infrastructure	Medium- and Heavy-Duty Zero- Emission Vehicles and Infrastructure	-	-
General Fund Zero-Emission Vehicles and Infrastructure	Drayage	\$85.0	\$80.0
General Fund Zero-Emission Vehicles and Infrastructure	Drayage and Infrastructure Pilot	-	-
General Fund Zero-Emission Vehicles and Infrastructure	Transit	\$30.0	\$30.0
General Fund Zero-Emission Vehicles and Infrastructure	School Bus	\$15.0	\$15.0
Clean Transportation Program Zero-Emission Vehicles and Infrastructure	Hydrogen Fueling Infrastructure	\$20.0	\$10.0 <sup>3/</sup>
General Fund Zero-Emission Vehicles and Infrastructure	Hydrogen Fueling Infrastructure	-	-
Clean Transportation Program Alternative Fuel Production and Supply	Zero- and Near Zero-Carbon Fuel Production and Supply	\$10.0	\$5.0
General Fund Manufacturing	ZEV Manufacturing	\$125.0	-
Clean Transportation Program Related Needs and Opportunities	Workforce Training and Development	\$5.0	\$5.0
	<b>Total Clean Transportation Program Fund</b>	<b>\$95.2</b>	<b>\$47.6</b>
	<b>Total General Fund</b>	<b>\$255 <sup>4/</sup></b>	<b>\$125 <sup>4/</sup></b>

Source: California Energy Commission.

- 1/ Subject to future Budget Act appropriations.
- 2/ The Clean Transportation Program is authorized through December 31, 2023; therefore, only half of the revenues/appropriations are anticipated in this fiscal year.
- 3/ The final column of proposed funding is a half year due to the program expiring in middle of the fiscal year.
- 4/ The anticipated general fund amounts in FY 2022–2023 and FY 2023–2024 have not been reduced to reflect administrative costs. Those fiscal year allocations will be reduced in accordance with direction in the associated Budget Act.



# CHAPTER 1:

## Introduction

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California has been at the forefront of national efforts to combat climate change since the passage of the Global Warming Solutions Act of 2006, which established a goal of reducing statewide greenhouse gas (GHG) emissions to 1990 levels by 2020.<sup>1</sup> Senate Bill 32 established a goal of 40 percent below 1990 levels by 2030.<sup>2</sup> Executive Order B-55-18 established a goal to achieve carbon neutrality as soon as possible, and no later than 2045, and achieve and maintain net negative emissions thereafter.<sup>3</sup>

The state's efforts to address the climate crisis are showing progress, and in 2016, California achieved its goal of reducing GHG emissions to 1990 levels, four years ahead of schedule. Despite the steady reduction in GHG emissions overall, emissions from the transportation sector decreased only modestly over the last several years, as Californians purchased more light trucks (sport utility vehicles, pickups, and vans) instead of cars and drove more miles. When including upstream emissions, the transportation sector is the largest source of GHG emissions in California, with vehicles, oil extraction, and oil refining accounting for roughly 50 percent of in-state emissions.<sup>4</sup>

In addition to greenhouse gases, the transportation sector is also a major emitter of criteria pollutants, with mobile sources responsible for nearly 80 percent of nitrogen oxide emissions and 96 percent of diesel particulate matter emissions statewide.<sup>5</sup> Protecting and improving public health in the state will require substantial reductions in criteria pollutant emissions. The California Air Resources Board (CARB) estimates that attaining federal air quality standards in 2023, 2024, 2031, and 2037 will require significant reductions of nitrogen oxide emissions in parts of the state.<sup>6</sup>

To help address state climate change and air quality objectives, the California Legislature passed Assembly Bill 118 (Núñez, Chapter 750, Statutes of 2007). This legislation created the Clean Transportation Program. With funds collected from vehicle and vessel registration, vehicle identification plates, and smog abatement fees, the Clean Transportation Program

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1 [Assembly Bill 32 \(Núñez, Chapter 488, Statutes of 2006\)](https://leginfo.ca.gov/faces/billNavClient.xhtml?bill_id=200520060AB32),  
[https://leginfo.ca.gov/faces/billNavClient.xhtml?bill\\_id=200520060AB32](https://leginfo.ca.gov/faces/billNavClient.xhtml?bill_id=200520060AB32).

2 [Senate Bill 32 \(Pavley, Chapter 249, Statutes of 2016\)](https://leginfo.ca.gov/faces/billNavClient.xhtml?bill_id=201520160SB32),  
[https://leginfo.ca.gov/faces/billNavClient.xhtml?bill\\_id=201520160SB32](https://leginfo.ca.gov/faces/billNavClient.xhtml?bill_id=201520160SB32).

3 [Executive Order B-55-18](https://www.ca.gov/archive/gov39/wp-content/uploads/2018/09/9.10.18-Executive-Order.pdf). September 10, 2018. Available at <https://www.ca.gov/archive/gov39/wp-content/uploads/2018/09/9.10.18-Executive-Order.pdf>.

4 California Air Resources Board. July 18, 2021. [California Greenhouse Gas Emissions for 2000 to 2019 – Trends of Emissions and Other Indicators](https://ww3.arb.ca.gov/cc/inventory/pubs/reports/2000_2019/ghg_inventory_trends_00-19.pdf). Available at [https://ww3.arb.ca.gov/cc/inventory/pubs/reports/2000\\_2019/ghg\\_inventory\\_trends\\_00-19.pdf](https://ww3.arb.ca.gov/cc/inventory/pubs/reports/2000_2019/ghg_inventory_trends_00-19.pdf).

5 California Air Resources Board. October 2021. [Mobile Source Strategy](https://ww2.arb.ca.gov/sites/default/files/2021-12/2020_Mobile_Source_Strategy.pdf). Available at [https://ww2.arb.ca.gov/sites/default/files/2021-12/2020\\_Mobile\\_Source\\_Strategy.pdf](https://ww2.arb.ca.gov/sites/default/files/2021-12/2020_Mobile_Source_Strategy.pdf).

6 Ibid.



funds projects that will "transform California's fuel and vehicle types to help attain the state's climate change policies." Assembly Bill 8 (Perea, Chapter 401, Statutes of 2013) extended the collection of fees that support the Clean Transportation Program to January 1, 2024.

As part of the Clean Transportation Program, the California Energy Commission (CEC) prepares and adopts an annual Investment Plan Update that identifies the funding priorities for the coming fiscal year. The funding allocations reflect state policy goals, the potential for each alternative fuel and vehicle technology to contribute to the goals of the program, the anticipated barriers and opportunities associated with each fuel or technology, and the effect of other investments, policies, programs, and statutes. The Investment Plan Update also describes how the allocations will complement existing public and private efforts, including related state programs.

## **Moving Forward**

This *2022-2023 Investment Plan Update* is the fourteenth investment plan in the history of the Clean Transportation Program and builds on the analyses and recommendations contained in prior documents. The draft staff report is the first version of the *2022-2023 Investment Plan Update*. As part of the development process for the *2022-2023 Investment Plan Update*, the CEC will hold two public meetings with the Clean Transportation Program Advisory Committee. The advisory committee is a broad representation of interests that reflect California communities and provide representation of program beneficiaries, environmental justice communities, rural communities, tribes, and others. Representatives from the advisory committee, other stakeholders, and the public are encouraged to discuss and comment on drafts of this document during these meetings and through the CEC's docket system.<sup>7</sup>

The unexpected conditions brought on by the COVID-19 pandemic will continue to impact CEC's near-term implementation of the Clean Transportation Program and related investment plan. In addition, the invasion of Ukraine by Russia has spurred gasoline and diesel prices to new heights and exacerbated supply chain issues already constrained by the COVID-19 pandemic. The supply of new and used ZEVs as well as ZEV refueling infrastructure have been impacted by supply chain constraints, especially as consumers seek to buy more ZEVs to avoid high prices at the gasoline pump. The CEC is leveraging funding from the Clean Transportation Program and other sources to expand ZEV manufacturing and to build the ZEV supply chain in-state, including using California sources of precious minerals like lithium.

In addition to meeting state clean air and clean transportation goals set by Executive Orders and statute, the Clean Transportation Program can also play an immediate role in helping consumers who are being hammered with high gasoline prices to transition to ZEVs. The Clean Transportation Program can also help create jobs and stimulate the economy to support the state's recovery from the impacts of COVID-19. Prioritizing investments in ZEV infrastructure can spur near-term employment and economic development.

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<sup>7</sup> The Energy Commission's [docket](https://efiling.energy.ca.gov/Lists/DocketLog.aspx?docketnumber=19-ALT-01) for the *2020-2021 Investment Plan Update for the Clean Transportation Program* (Docket #19-ALT-01) can be found at <https://efiling.energy.ca.gov/Lists/DocketLog.aspx?docketnumber=19-ALT-01>.

Chapter 2 of this document provides the context for the current investment plan, including an update on the CEC's implementation of the Clean Transportation Program to date and a review of related policies and programs. Chapter 3 summarizes the funding allocations for FY 2022–2023. The subsequent chapters are organized by specific investment areas. Chapter 4 focuses on zero-emission infrastructure. Chapter 5 addresses the types of opportunities for zero- and near-zero-emission fuel production and supply within California. Chapter 6 describes related opportunities to support the development and deployment of zero-emission vehicle infrastructure and fuel production such as manufacturing and workforce development.

# **CHAPTER 2:**

## **Context of the 2022–2023 Investment Plan**

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### **Implementation of the Clean Transportation Program**

Since the inception of the program, the CEC has followed a consistent approach toward implementing the Clean Transportation Program. Each annual Investment Plan Update allows the program to be responsive and can shift funds in response to gaps in investments by utilities, the private sector, and settlement agreements. As summarized in Figure 1, the process begins with an investment plan that determines the coming fiscal-year funding allocation for categories of projects.

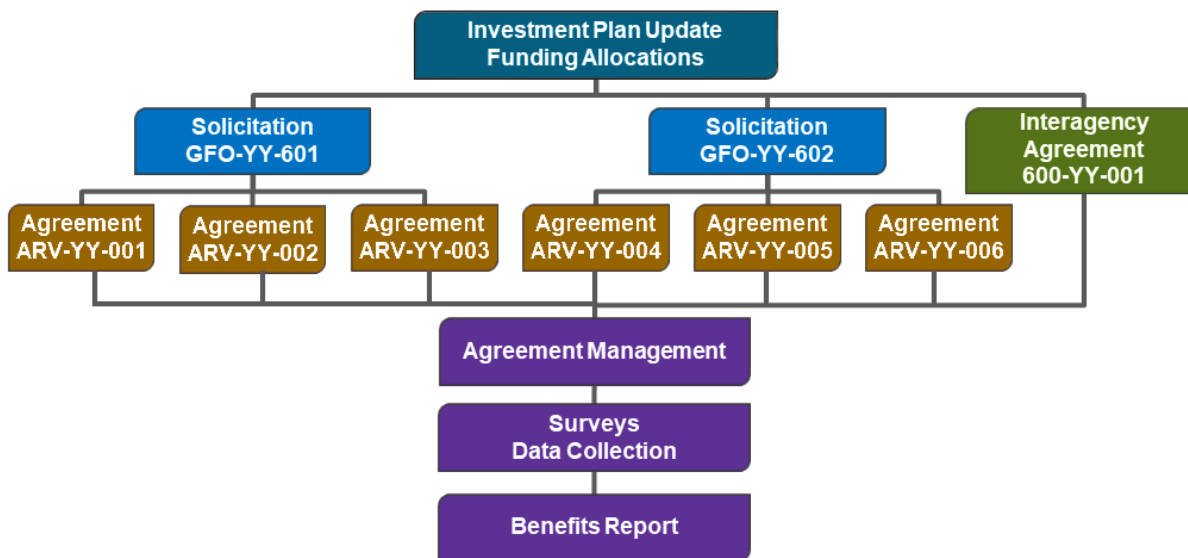
The funding allocations typically do not determine the specific funding solicitations and grant programs that will be issued. Rather, based on these funding allocations, the CEC subsequently issues a series of competitive solicitations, known as “grant funding opportunities” (GFOs).

CEC staff reviews, scores, and ranks the proposals for each solicitation using the evaluation criteria developed for the solicitation. Based on the total scores of each application, the CEC releases a notice of proposed awards (NOPA) for each solicitation. For specialized agreements with certain partner agencies, the CEC may develop interagency agreements without using the solicitation process.

Each funded application becomes a funding agreement once it has been approved and signed by the CEC and the applicant. CEC staff oversees completion of these agreements according to the respective schedules, budgets, scopes of work, and terms and conditions.

Data collection and project review are key aspects of the Clean Transportation Program implementation. The CEC surveys funding recipients on the anticipated results of their projects, with questions relating to alternative fuel use, petroleum displacement, GHG emission reductions, air quality benefits, and in-state economic benefits.

**Figure 1: Schematic of the Clean Transportation Program Implementation**



Source: California Energy Commission

## Description of Funding Mechanisms

To date, the CEC has predominantly used grants to distribute funding, with awardees selected through competitive solicitations. The suite of potential funding and financing mechanisms have respective strengths and weaknesses, and the CEC weighs these options when developing the funding implementation strategy for each allocation. The most prominent funding mechanisms used for the Clean Transportation Program by the CEC are described below.

- **Competitive Solicitation for Grants** — This type of solicitation represents the most common funding mechanism for the Clean Transportation Program to date. It is flexible, as project requirements and scoring criteria can be adapted for a broad variety of commercial and technological maturity levels. Competitive scoring allows increased scrutiny on key issues for each project type. However, it also requires significant time and attention to review each application and oversee each subsequent funding agreement.
- **Block Grants** — The CEC has used this funding mechanism to distribute Clean Transportation Program funding through third-party implementers. The block grant implementer is selected through a competitive process. Block grants allow the CEC to select another organization to administer Clean Transportation Program funding while following set procedures for project and applicant eligibility.
- **First-Come, First-Served** — This type of funding mechanism has been used by the Clean Transportation Program for vehicle and infrastructure incentives. Once eligibility requirements are established, the funding can be administered relatively quickly and can provide greater market certainty for a project type.

- **Production or Operation Incentives** — The CEC has used these types of incentives for in-state ethanol production and hydrogen fueling station operation and maintenance. The primary aim of these incentives is to provide greater market certainty, which encourages further investment from nongovernment sources.
- **Direct Agreements** — The CEC may make a sole source award for applied research. The CEC may also enter into interagency agreements or contracts with public entities to obtain technical, scientific, or administrative services to support the Clean Transportation Program.
- **Federal Cost Sharing** — This mechanism will provide match funding support to applicants of federal funding opportunities.
- **Revolving Loans** — CEC is embarking on an in-depth examination of one or more revolving loan programs to be administered by the California Infrastructure and Economic Development Bank (IBank) on CEC's behalf. Similar to block grants, IBank will handle the operational aspects of the revolving loan program(s), while CEC provides the technical and market expertise to ensure the programs are successful.

Several factors and considerations can inform which funding mechanism is appropriate for a given solicitation. These factors and considerations include using public funds to address infrastructure gaps, targeting use cases where the private market is not investing, meeting equity goals, and accelerating infrastructure deployment to move California away from a reliance on fossil fuels.

## **Program Outreach and Engagement**

The CEC seeks to increase the participation of disadvantaged and underrepresented communities from a diverse range of geographical regions. The CEC also seeks to effectively engage communities disproportionately burdened by pollution and improve economic resiliency, including rural and tribal communities. This effort includes:

- Diversifying the Clean Transportation Program Advisory Committee, as accomplished in 2020, to better reflect California communities and provide increased representation of program beneficiaries, environmental justice communities, rural communities, tribes, and others.
- Consulting with the Disadvantaged Communities Advisory Group<sup>8</sup> for guidance and recommendations on program effectiveness as it relates to disadvantaged communities and other vulnerable and underrepresented groups.
- Consulting with the CEC's Tribal Program and the Tribal Lead Commissioner for assistance with outreach and promotion of transportation-related funding opportunities to tribes.

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<sup>8</sup> More information available on the [Disadvantaged Communities Advisory Group Page](https://www.energy.ca.gov/about/campaigns/equity-and-diversity/disadvantaged-communities-advisory-group). Available at <https://www.energy.ca.gov/about/campaigns/equity-and-diversity/disadvantaged-communities-advisory-group>.

- Hosting a presolicitation workshop and receiving docketed comments on funding opportunities to provide light-duty charging infrastructure that can serve rural communities and multifamily housing residents.
- Assessing whether electric vehicle charging station infrastructure is disproportionately deployed, as examined in the SB 1000 analysis. The first iteration of the *SB 1000 Electric Vehicle Charging Infrastructure Deployment Assessment* was published December 30, 2020. The second iteration assesses drive times from census tract population centers to the nearest public direct-current fast charger.
- Through an agreement with the Foundation for California Community Colleges (FCCC), the CEC launched the IDEAL Communities Partnership Project. Since the start of the project in early 2021, FCCC has completed an equity-focused assessment of the Clean Transportation Program, drafted an outreach and engagement plan, created outreach materials, and launched the ZEV IDEAL Student Ambassadors Program (a cohort of eight community college students across five geographic focus areas). The student ambassadors conduct research, outreach, and engagement activities within their own communities. In the final year of the project, the IDEAL Communities Partnership is conducting focused outreach and engagement with communities, as well as evaluating resources for clean transportation-related technical assistance. The project will also organize and host the IDEAL Community Forum, a space for community partners to share their clean transportation needs and provide essential feedback to the CEC and Clean Transportation Program.

In addition to the above actions, the CEC has provided a scoring preference for projects in the California Communities Environmental Health Screening Tool (CalEnviroScreen3.0).<sup>9</sup> These preferences have been used in recent Clean Transportation Program solicitations, where appropriate, and nearly half of site-specific Clean Transportation Program funding has gone toward projects in low-income and disadvantaged communities.

## Highlights of Investments

As of December 2021, the CEC has invested more than \$1 billion in Clean Transportation Program funding. In many cases, projects are in progress, with ongoing siting, installation, construction, and demonstrations. Table 1 summarizes program investments, including the following highlights:

- Installed or planned 15,213 chargers for plug-in electric vehicles, including 4,277 at multi- and single-family homes, 155 for fleets, and 419 at workplaces; 8,403 public and shared private Level 2 and Level 1 chargers; and 1,713 public direct-current (DC) fast-chargers and 246 Level 2 chargers along highway corridors and urban metropolitan areas. Level 1 chargers provide charging through a 120-volt alternating-current (AC) plug, whereas Level 2 chargers provide charging through a 240-volt (typical in residential applications) or 208-volt (typical in commercial applications) AC plug. DC fast

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<sup>9</sup> The [CalEnviroScreen 3.0 tool](https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-30) is available online from the California Office of Environmental Health Hazard Assessment at <https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-30>.

chargers provide charging through a DC plug, typically at a rate of 50 kilowatts or higher.

- Created the California Electric Vehicle Infrastructure Project (CALeVIP) to provide streamlined Clean Transportation Program incentives for light-duty electric vehicle charging infrastructure.
- Funded 55 regional readiness planning grants, regional readiness implementation grants, and medium- and heavy-duty ZEV blueprint grants for communities and fleets that are ramping up for the adoption of ZEV technologies.
- Released new solicitations targeting high priority or underserved EV charging needs, including multi-family housing charging installations; charging infrastructure in rural communities; and charging infrastructure for high mileage on-demand transportation services.
- Released new solicitations to expand innovative and interoperable charging opportunities, including a vehicle-grid innovation laboratory; a future symposium on electric vehicle charging interoperability; and the demonstration of innovative charging solutions to accelerate their commercialization.
- Funded 80 publicly available hydrogen-fueling stations and approved funding for an additional 74 stations based on deployment progress, funding availability, and Clean Transportation Program Investment Plan funding allocations. Of these stations, 13 will accommodate medium- and heavy-duty vehicles as well as passenger vehicles. In addition, there are 23 privately funded stations under development. CEC staff expects that California will exceed the 100 station goal set by AB 8 by 2023. As of February 2022, 55 hydrogen fueling stations were open retail in California.
- Developed retail fueling standards to enable hydrogen sales on a per-kilogram basis.
- Prepared to launch the nation's first commercial vehicle fleet incentive project titled "EnergIIZE" to accelerate the deployment of electric and hydrogen infrastructure needed to fuel zero-emission trucks, buses, and equipment. The project will use a concierge-like model working directly with eligible applicants to plan and fund the purchase of charging and hydrogen fueling infrastructure. The \$50 million multiyear project will help communities most impacted by transportation-related pollution by meeting essential infrastructure needs and has a requirement that 60 percent of funds support low-income and disadvantaged communities. The project officially launched in March 2022.
- Released targeted grant funding solicitations to provide zero-emission charging and refueling infrastructure for transit buses and drayage trucks, the latter in direct partnership with CARB to provide vehicle funding incentives.
- Funded 27 manufacturing projects supporting in-state economic growth while reducing the supply-side barriers for alternative fuels and advanced technology vehicles, primarily in electric drive-related components and vehicles.
- Provided workforce training for more than 20,000 trainees and 277 businesses, helping prepare workers for the clean transportation economy and the opportunity to earn sustainable wages and expand employment opportunities.

- Launched 71 projects to promote the production of sustainable, low-carbon alternative fuels within California, with a cumulative annual production capacity equivalent to more than 158 million gallons of diesel fuel. Most of the projects use waste-based feedstocks such as dairy manure and municipal solid waste, which have some of the lowest carbon intensity pathways recognized under the Low Carbon Fuel Standard, a CARB regulation that requires the carbon intensity of transportation fuels to be cut by 20 percent by 2030.
- Funded five projects to produce 100 percent renewable hydrogen from in-state renewable resources. The hydrogen will be used for on-road fuel cell electric vehicles, both light-duty and medium-/heavy-duty.



**Table 1: Clean Transportation Program Investments as of December 2021**

<b>Funded Activity</b>	<b>Cumulative Awards to Date (in Millions)*</b>	<b># of Projects or Units</b>
<b>Alternative Fuel Production</b>		
Biomethane Production	\$73.86	29 Projects
Gasoline Substitutes Production	\$26.94	14 Projects
Diesel Substitutes Production	\$66.99	26 Projects
Renewable Hydrogen Production	\$16.93	5 Projects
<b>Alternative Fuel Infrastructure</b>		
Electric Vehicle Charging Infrastructure**	\$254.51	15,154 chargers
Hydrogen Fueling Infrastructure (Including Operations and Maintenance)	\$166.82	80 Public Fueling Stations
Medium- and Heavy-Duty ZEV Infrastructure	\$115.27	79 Projects
E85 Fueling Infrastructure	\$3.61	21 Fueling Stations
Upstream Biodiesel Infrastructure	\$6.98	7 Infrastructure Sites
Natural Gas Fueling Infrastructure	\$24.11	70 Fueling Stations
<b>Alternative Fuel and Advanced Technology Vehicles</b>		
NG and Propane Vehicle Deployment, Hybrid and ZEV Deployment (Including CVRP, HVIP, and Low-Income Mobility Incentives), and Advanced Technology Freight and Fleet Vehicles	\$250.40	14,516+ NG, Propane, Hybrid and ZEVs and 54 Demonstrations
<b>Related Needs and Opportunities</b>		
Manufacturing	\$55.32	27 Manufacturing Projects
Workforce Training and Development	\$34.33	20,000 Trainees
Fuel Standards and Equipment Certification	\$3.90	1 Project
Sustainability Studies	\$2.04	2 Projects
Regional Alternative Fuel Readiness	\$24.15	55 Regional Plans
Centers for Alternative Fuels	\$5.41	5 Centers
Technical Assistance and Program Evaluation	\$17.52	n/a
<b>Total</b>	<b>\$1.149 Billion</b>	<b>-</b>

Source: California Energy Commission. \*Includes all agreements that have been approved at a CEC business meeting or are expected for business meeting approval following a notice of proposed award. For canceled and completed projects, includes only funding received. \*\*Includes a total of \$186 million for the California Electric Vehicle Infrastructure Project to provide EV incentives throughout California, which will fund a yet-to-be-determined number of EV chargers.

Using funds from the Clean Transportation Program, the CEC has also leveraged the additional investment of more than \$709 million in private and other public funds. However, this amount represents only the minimal, contractually obligated amount of match funding provided toward Clean Transportation Program projects; the actual amount of investment prompted by the Clean Transportation Program funding exceeds this amount.

## **Summary of Program Funding for Disadvantaged Communities**

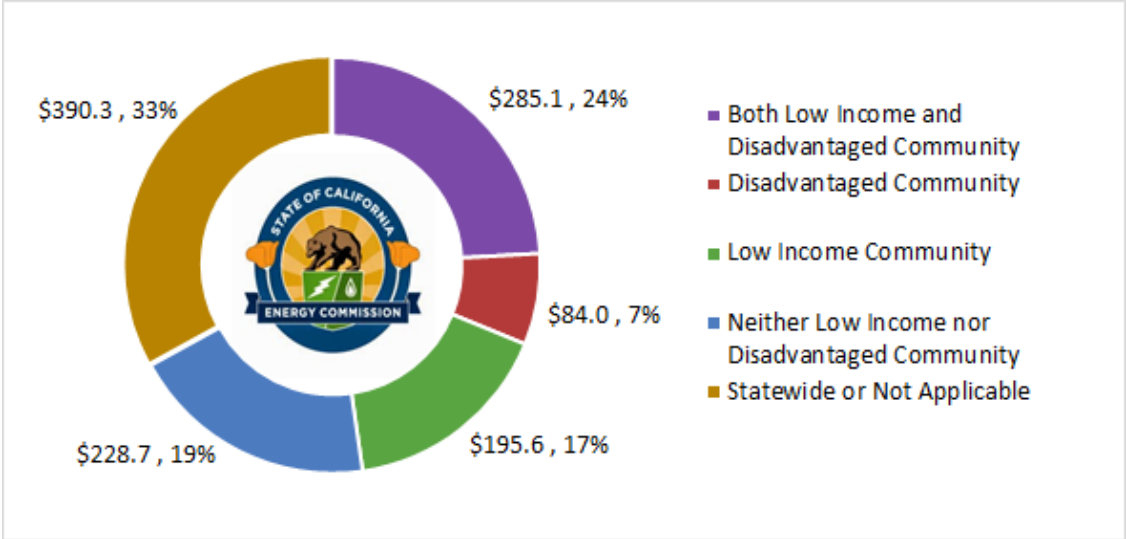
The CEC seeks to increase participation and benefits to disadvantaged and underrepresented communities from a diverse range of regions in implementing the Clean Transportation Program. As depicted in Figure 2, roughly 48 percent of Clean Transportation Program project funding has gone into disadvantaged communities or low-income communities or both.<sup>10</sup> The CEC seeks to invest more than 50 percent of funding to support projects benefitting low-income and disadvantaged communities for the remainder of the Clean Transportation Program.

The CEC recognizes that the location of a project is not the only metric of whether a project will benefit low-income and disadvantaged communities. The CEC will continue to work with the Clean Transportation Program Advisory Committee, DACAG, communities, and stakeholders to define and track project benefits to increase program equity and inclusion. These efforts include engaging in partnerships with community-based organizations and community organizers in project scoping and grant applications. Efforts also include identifying new qualitative and quantitative metrics beyond project location to evaluate the effects of projects on local communities and continuing to work with other state and local agencies to share critical lessons and community needs.

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<sup>10</sup> New to this investment plan update, these funding percentages incorporate CARB's Priority Population Maps, which show disadvantaged communities and low-income communities as defined for California Climate Investments. This map provides a more precise geospatial analysis tool for finding which projects fell within low-income or disadvantaged communities' boundaries. Previous CEC analysis used older demographic data and less granular GIS mapping. In conjunction with the SB 1000 Report (published December 2020) analysis, the demographic data and mapping have been refined to provide more accurate mapping and better count low-income and disadvantaged communities investments.

**Figure 2: Clean Transportation Program Funding in Disadvantaged and Low-Income Communities (in Millions)**



Source: California Energy Commission. As of November 17, 2021.

**Related Policies and Goals**

The CEC’s implementation of the Clean Transportation Program reflects the effect of numerous policies and goals. Table 2 highlights examples of the significant policy goals and milestones developed to reduce emissions and reduce petroleum use in California. CEC staff consulted with other state agencies and considered state policies when developing this Investment Plan Update.

**Table 2: Greenhouse Gas, Fuel, and Air Quality Goals and Milestones**

Policy Origin	Objectives	Goals and Milestones
Assembly Bill 32	GHG Reduction	Reduce GHG emissions to 1990 levels by 2020
Senate Bill 32	GHG Reduction	Reduce GHG emissions to 40 percent below 1990 levels by 2030
Executive Order B-55-18	GHG Reduction	Achieve carbon neutrality by 2045
Low Carbon Fuel Standard	GHG Reduction	Reduce carbon intensity of transportation fuels in California by 20 percent by 2030 Increase zero-emission vehicle infrastructure
Clean Air Act; California State Implementation Plans	Air Quality	80 percent reduction in NOx by 2031
Senate Bill 1275;  Executive Order B-16-2012;  Executive Order B-48-18;  Executive Order N-79-20	Increase Zero-Emission Vehicles	Infrastructure to accommodate 1 million electric vehicles by 2020 1 million zero-emission and near-zero-emission vehicles by 2023 1.5 million electric vehicles by 2025 250,000 electric vehicle chargers, including 10,000 DC fast chargers, and 200 hydrogen fueling stations by 2025 5 million zero-emission vehicles by 2030 100% of new passenger cars and truck sales will be ZEVs by 2035 100% of operating drayage trucks, off-road vehicles, and equipment will be ZEVs by 2035 100% of operating medium- and heavy-duty trucks and buses will be ZEVs, where feasible by 2045
Zero-Emission Vehicle Regulation	Increase Zero-Emission Vehicles	Increase the deployment of plug-in hybrid, battery, and fuel cell electric vehicles
Innovative Clean Transit Regulation	Increase Zero-Emission Vehicles	100 percent of all new transit buses will be zero-emission by 2029; all operating buses will be zero-emission by 2040
Advanced Clean Trucks Regulation	Increase Zero-Emission Vehicles	Requires truck manufacturers to transition from diesel trucks and vans to zero-emission trucks beginning in 2024. By 2045, every new truck sold in California will be zero-emission.

Source: California Energy Commission

**Federal Law: Clean Air Act, State Implementation Plans, and Mobile Source Strategy**

The federal Clean Air Act of 1970 (42 U.S.C. 7401) authorizes the U.S. Environmental Protection Agency (U.S. EPA) to establish National Ambient Air Quality Standards (NAAQS) for criteria air pollutants that are harmful to public health. To achieve these standards, the Clean Air Act directs states to develop State Implementation Plans (SIPs) that describe how an area will attain the NAAQS.

CARB reports that 28 million Californians live in communities that exceed the ozone and particulate matter standards set by the U.S. Environmental Protection Agency (EPA) and that the South Coast and San Joaquin Valley are the only two areas in the nation in extreme

nonattainment for the federal ozone standard. The concepts described in the *Draft 2020 Mobile Source Strategy* intend to address these problems through transitioning the mobile fleet to zero-emission, where feasible.<sup>11</sup>

## State Laws

### **Assembly Bill 32, Senate Bill 32, and the Greenhouse Gas Reduction Fund**

Assembly Bill 32 (Núñez, Chapter 488, Statutes of 2006), also known as the Global Warming Solutions Act of 2006, required CARB to adopt a statewide GHG emission limit for 2020 equivalent to the statewide GHG emission levels in 1990. Senate Bill 32 (Pavley, Chapter 249, Statutes of 2016) amended the Global Warming Solutions Act of 2006 to expand the emission targets of AB 32. The amendment set a statewide GHG emission limit for 2030 equivalent to 40 percent below emission levels in 1990. AB 32 and SB 32 directed CARB to develop a climate change scoping plan to describe the approach that California will take to reduce GHG emissions and achieve the state's climate change goals.

### **Senate Bill 350 and the Disadvantaged Communities Advisory Group**

SB 350, the Clean Energy and Pollution Reduction Act of 2015, requires that the CPUC and the CEC create a Disadvantaged Communities Advisory Group (DACAG) to advise on programs proposed to achieve clean energy and pollution reduction.

At a June 21, 2019, meeting of the DACAG, Clean Transportation Program staff solicited feedback on the March 27, 2019, draft of the *2019–2020 Investment Plan Update* from the DACAG members.<sup>12</sup> In response, the DACAG provided comments on the *2019–2020 Investment Plan Update* on June 28, 2019.<sup>13</sup> These comments included recommendations on how the plan update can effectively benefit communities disproportionately burdened by pollution and socioeconomic challenges. On April 16, 2020, DACAG provided comments on the *2020–2023 Investment Plan Update*.<sup>14</sup> Recommendations from both DACAG letters are included in Table 3, along with actions taken by the Clean Transportation Program to better address equity. Members of the Clean Transportation Program Advisory Committee, DACAG, and others will also have the opportunity to provide recommendations for the *2022–2023 Investment Plan Update*, as well as all future investment plans.

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11 [Draft 2020 Mobile Source Strategy](https://ww2.arb.ca.gov/sites/default/files/2020-11/Draft_2020_Mobile_Source_Strategy.pdf) is available at [https://ww2.arb.ca.gov/sites/default/files/2020-11/Draft\\_2020\\_Mobile\\_Source\\_Strategy.pdf](https://ww2.arb.ca.gov/sites/default/files/2020-11/Draft_2020_Mobile_Source_Strategy.pdf).

12 [DACAG meeting materials](https://www.cpuc.ca.gov/DACAG/) available at <https://www.cpuc.ca.gov/DACAG/>. The [previous version of this Investment Plan Update \(Lead Commissioner Report version\)](https://www.energy.ca.gov/altfuels/2018-ALT-01/documents/) is available at <https://www.energy.ca.gov/altfuels/2018-ALT-01/documents/>.

13 SB 350 Disadvantaged Communities Advisory Group. June 28, 2019. "[SB 350 Disadvantaged Communities Advisory Group Comments on 2019-2020 Investment Plan Update.](https://efiling.energy.ca.gov/GetDocument.aspx?tn=228878&DocumentContentId=60238)" Submitted to Docket 18-ALT-01, TN# 228878. Available at <https://efiling.energy.ca.gov/GetDocument.aspx?tn=228878&DocumentContentId=60238>.

14 SB 350 Disadvantaged Communities Advisory Group, "[SB 350 Disadvantaged Communities Advisory Group comments on 2020-2023 Investment Plan Update.](https://efiling.energy.ca.gov/Lists/DocketLog.aspx?docketnumber=19-ALT-01)" written on April 16, 2020, and submitted April 30, 2020, to Docket 19-ALT-01, TN# 232879. Available at <https://efiling.energy.ca.gov/Lists/DocketLog.aspx?docketnumber=19-ALT-01>.

**Table 3: Recommendations From the Disadvantaged Communities Advisory Group and Others, Along With the Actions Taken by the Energy Commission**

Recommendations From DACAG	Actions Taken by CEC
Moving 100 percent of program funding toward zero-emission fuels.	The Clean Transportation Program is supporting the emerging revolution in the transportation sector with significant investments in zero-emission vehicle infrastructure (both battery-electric and hydrogen fuel cell). Relative to previous Investment Plans, recent allocations have shifted significantly toward zero-emission fuels and technologies relative to non-zero-emission alternatives.
Funding projects exclusively in and benefiting disadvantaged communities.	Committed 50 percent of funding to support projects benefitting low-income and disadvantaged communities for the remainder of the Clean Transportation program. Working to better define, measure, and track community benefits from the Clean Transportation Program.
Expanding the definition of disadvantaged communities beyond the CalEnviroScreen definition.	Expanded solicitation eligibility to explicitly include California Native American tribes.  Through the CEC's CALeVIP program, some projects will require 25% of funds be spent in unincorporated towns and 50% of funds be spent in low-income and/or disadvantaged communities.
Increasing transparency and tracking expanded metrics to measure how projects "benefit" disadvantaged communities.	CEC staff continues to work with the CEC's Public Advisor's Office to inform and receive input from DACAG during solicitation development. The CEC is also expanding focus and methods used in the biennial Benefits Report, including documentation of 1) benefits for underrepresented communities and 2) air quality impacts and associated health outcomes.
Prioritizing and investing in community outreach and engagement.	1) Explicit inclusion of scoring criteria for drayage truck projects located in disadvantaged communities and low-income communities and development of an equity outreach and engagement plan <sup>15</sup> and 2) Established the IDEAL Communities Partnership focused on community engagement activities such as the establishment of technical assistance, conduct a ZEV Community Survey and Outreach Forum, and implement a ZEV Student Ambassador Program in partnership with the Foundation for California Community Colleges.
Expanding support for workforce development.	Dedicated Clean Transportation Program funding allocations that will expand workforce development beyond investments in state entities to include community-based workforce training and development in and near ZEV deployments in priority communities. The IDEAL ZEV Workforce Pilot is a new CEC community-based workforce initiative where CARB is a funding partner.

15 [GFO-20-606 Zero-Emission Drayage Truck and Infrastructure Pilot Project](https://www.energy.ca.gov/solicitations/2020-11/gfo-20-606-zero-emission-drayage-truck-and-infrastructure-pilot-project):

<https://www.energy.ca.gov/solicitations/2020-11/gfo-20-606-zero-emission-drayage-truck-and-infrastructure-pilot-project>.

Expanding the Clean Transportation Program Advisory Committee to increase representation of program beneficiaries, environmental justice communities, rural communities, tribes, and others.	Reconstituted and diversified the Clean Transportation Program Advisory Committee in 2020 to better reflect California communities and provide increased representation of program beneficiaries.
Prioritize investments in the medium- and heavy-duty vehicle category and target disadvantaged communities.	Funding allocation for this activity has increased dramatically after Fiscal Year 2021–2022 to meet the growing needs of charging and hydrogen fueling infrastructure for medium- and heavy-duty ZEVs, as well as demonstrate the state’s commitment to improving air quality, especially in low-income and disadvantaged communities.

Source: California Energy Commission

### **Assembly Bill 841: Electric Vehicle Infrastructure Training Program**

The Electric Vehicle Infrastructure Training Program (EVITP) website states that it is “a collaboration of industry stakeholders including automakers, electric vehicle supply equipment (EVSE) manufacturers, educational institutions, utility companies, electric industry professionals, and key EV industry stakeholders.”<sup>16</sup> Assembly Bill 841 (Ting, Chapter 372, Statutes of 2020) requires that the CPUC, CEC and CARB shall require that EV charging infrastructure located on the customer side of the electrical meter that is funded by those state entities be installed by a contractor with the appropriate license classification and at least one electrician on each crew who holds an EVITP certification. As part of AB 841, the CEC, in consultation with the CPUC, is tasked with conducting joint public workshops to determine if the EVITP curriculum and testing should be supplemented to include updated or additional topics necessary to ensure safe installation of charging infrastructure. The CEC, CARB, and CPUC held a public workshop April 16, 2021, and solicited public comments. The CEC will periodically review whether the EVITP curriculum should be supplemented, and EVITP will have six months to implement the supplemented curriculum.

### **Senate Bill 643: Fuel Cell Electric Vehicle Fueling Infrastructure and Hydrogen Production Statewide Assessment**

Senate Bill 643 (Archuleta, Chapter 646, Statutes of 2021) requires the CEC, in consultation with CARB and the CPUC, to prepare a statewide assessment of the fuel cell electric vehicle fueling infrastructure and fuel production needed to support the adoption of zero emission trucks, buses, and off-road vehicles. The CEC expects to complete the inaugural version of this report by the second half of 2023.

### **Executive Orders (EO)**

#### **EO B-55-18: Carbon Neutrality**

EO B-55-18 established a goal to achieve carbon neutrality as soon as possible and no later than 2045. The executive order also requires the state to achieve and maintain net negative greenhouse gas emissions thereafter.

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<sup>16</sup> [Electric Vehicle Infrastructure Training Program](https://evitp.org/about-us/) is available at <https://evitp.org/about-us/>.

## **EO B-16-12, B-48-18, and N-79-20: Zero-Emission Vehicles**

EO B-16-12 set a target of 1.5 million zero-emission vehicles on the road by 2025 and tasked various state agencies with specific actions needed to support this goal.<sup>17</sup> Subsequently, in January 2018, EO B-48-18 set an expanded target of 5 million zero-emission vehicles on the road by 2030, as well as a network of 200 hydrogen fueling stations and 250,000 electric vehicle charging stations, including 10,000 DC fast chargers, installed or constructed by 2025.<sup>18</sup> These executive orders have been part of the guidance for the electric vehicle charging and hydrogen fueling infrastructure investments of the Clean Transportation Program.

Executive Order N-79-20, signed by Governor Gavin Newsom on September 23, 2020, provides even more ambitious goals and requirements. These include 100 percent of in-state sales of passenger cars and trucks being ZEVs by 2035; 100 percent of operating medium- and heavy-duty vehicles being ZEVs by 2045, where feasible; and 100 percent of drayage trucks and off-road vehicles and equipment being ZEVs by 2035. The order also tasks CEC with providing an updated assessment of the infrastructure needed to support this level of ZEV adoption.

To meet the ambitious statewide targets set in Executive Order N-79-20, Governor Newsom tasked GO-Biz with collaborating with several agencies and partners to shepherd the administration's ZEV Market Development Strategy. The *California Zero-Emission Vehicle Market Development Strategy*<sup>19</sup> was published in February 2021 and is part of the ongoing effort to turn California's 100 percent ZEV vision into reality. The strategy is centered around four market pillars: vehicles, infrastructure, end users, and workforce. The pillars must all be fully supported and are built upon a foundation of five core principles: equity in every decision, embracing all zero-emission pathways, collective problem-solving, public actions driving greater private investment, and designing for system resilience and adaptability. GO-Biz continues to work with the CEC, CARB, and other state agencies through this process to determine what actions can be taken to meet ZEV market goals.<sup>20</sup>

## **Regulations by the California Air Resources Board**

### **Low Carbon Fuel Standard**

CARB adopted the Low Carbon Fuel Standard (LCFS) regulation in April 2009 with a goal of reducing the overall carbon intensity of fuels within the transportation sector by 20 percent by 2030. The LCFS sets a carbon intensity standard (or benchmark) that declines each year.

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17 [Executive Order B-16-12](https://www.ca.gov/archive/gov39/2012/03/23/news17463/index.html) available at <https://www.ca.gov/archive/gov39/2012/03/23/news17463/index.html>.

18 [Executive Order B-48-18](https://www.ca.gov/archive/gov39/2018/01/26/governor-brown-takes-action-to-increase-zero-emission-vehicles-fund-new-climate-investments/index.html) available at <https://www.ca.gov/archive/gov39/2018/01/26/governor-brown-takes-action-to-increase-zero-emission-vehicles-fund-new-climate-investments/index.html>.

19 The [California Zero-Emission Vehicle Market Development Strategy](https://static.business.ca.gov/wp-content/uploads/2021/02/ZEV_Strategy_Feb2021.pdf) is available at [https://static.business.ca.gov/wp-content/uploads/2021/02/ZEV\\_Strategy\\_Feb2021.pdf](https://static.business.ca.gov/wp-content/uploads/2021/02/ZEV_Strategy_Feb2021.pdf).

20 [Zero-Emission Vehicle Market Development Strategy](https://business.ca.gov/industries/zero-emission-vehicles/zev-strategy/) is available at <https://business.ca.gov/industries/zero-emission-vehicles/zev-strategy/>.



Providers of low-carbon fuels earn credits under the LCFS by producing fuels with a carbon intensity below the annual carbon intensity standard.

LCFS credits and deficits are denominated in metric tons of carbon dioxide equivalent (CO<sub>2</sub>e). Credit prices have ranging from a low of \$22 in May 2015 to a high of \$206 in February 2020, reaching all-time highs in 2019 and 2020.<sup>21</sup> Prices remained near \$200 through October 2021.

In September 2018, CARB adopted changes to the LCFS regulations that will benefit ZEVs and ZEV infrastructure. The amendments allow publicly accessible hydrogen fueling stations to earn hydrogen fueling infrastructure credits based on the capacity of the station. The amendments also provide credits for DC fast-charging equipment based on the power rating of the equipment. On the vehicle side, the amendments restructure the approach for providing PEV rebates at the time of purchase, funded through LCFS credit proceeds. The vehicle program is known as the Clean Fuel Reward (CFR).

### **Zero-Emission Vehicle Regulation**

CARB's Advanced Clean Cars program consists of a suite of regulations for reducing emissions from the state's light-duty fleet. One element of the Advanced Clean Cars program is the ZEV Regulation, which requires auto manufacturers to offer for sale specific numbers of the cleanest cars available, including full battery-electric vehicles, hydrogen fuel cell electric vehicles, and plug-in hybrid electric vehicles. CARB is working on updates to the ZEV Regulation under the Advanced Clean Cars II rulemaking, which will look at regulatory actions beyond 2025 that help ensure zero-emission technology options continue to grow in the market and are accessible to all consumers.

### **Innovative Clean Transit Regulation**

The Innovative Clean Transit Regulation<sup>22</sup> was adopted in December 2018 to replace the Fleet Rule for Transit Agencies. The regulation requires all public transit agencies to transition gradually to a 100-percent zero-emission bus fleet and encourages them to provide innovative first- and last-mile connectivity and improved mobility for transit riders.

Within California, trucks are the largest source of air pollution among all vehicles, responsible for 70 percent of the smog-causing pollution and 80 percent of carcinogenic diesel soot, despite numbering only 2 million among the 30 million registered vehicles in the state. To address this sector, on June 25, 2020, CARB adopted a first-in-the-world rule requiring truck manufacturers to transition trucks and vans toward zero-emission technologies beginning in 2024.<sup>23</sup>

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21 California Air Resources Board. November 2021. [LCFS Monthly Credit Price and Transaction Volumes Spreadsheet](https://www.arb.ca.gov/fuels/lcfs/dashboard/creditpriceserieswithoutargusopis.xlsx). Available at <https://www.arb.ca.gov/fuels/lcfs/dashboard/creditpriceserieswithoutargusopis.xlsx>.

22 California Air Resources Board [Innovative Clean Transit](https://ww2.arb.ca.gov/our-work/programs/innovative-clean-transit/about). Available at <https://ww2.arb.ca.gov/our-work/programs/innovative-clean-transit/about>.

23 California Air Resources Board. [California Takes Bold Step to Reduce Truck Pollution](https://ww2.arb.ca.gov/news/california-takes-bold-step-reduce-truck-pollution). Available at <https://ww2.arb.ca.gov/news/california-takes-bold-step-reduce-truck-pollution>.

## **Advanced Clean Fleets**

CARB is tasked with cleaning up the existing combustion fleet and accelerating the zero-emission market by developing a medium- and heavy-duty zero-emission fleet regulation. The goal of the regulation is to achieve a zero-emission truck and bus California fleet by 2045, everywhere feasible and significantly earlier for certain market segments such as last-mile delivery and drayage applications. The initial focus would be on high-priority fleets with vehicles that are suitable for early electrification, their subhauleders, and entities that hire them. The goal of this effort is to accelerate the number of medium- and heavy-duty zero-emission vehicle purchases to achieve a full transition to zero-emission vehicles in California as soon as possible.

## **Complementary Funding Programs**

### **California Energy Commission's School Bus Replacement Program**

In the November 2012 California general election, voters approved Proposition 39 to improve energy efficiency and expand clean energy generation in schools and community colleges. Senate Bill 110 (Committee on Budget and Fiscal Review, Chapter 55, Statutes of 2017) allocated funds from the implementation of Proposition 39 to improve energy efficiency at California schools. The energy efficiency measures in SB 110 include one-time funding of \$75 million for the retrofit or replacement of school buses.

The CEC administers this funding, and priority is given to school districts operating the oldest and most polluting diesel school buses, as well as to school buses operating in disadvantaged and low-income communities. The \$75 million in funding provided by SB 110 is being used exclusively for the purchase of battery-electric school buses, and this amount is being supplemented with more than \$14 million in Clean Transportation Program funds to provide the necessary charging infrastructure to operate the buses.

### **California Air Resources Board Funding Programs**

In addition to the CEC's Clean Transportation Program, AB 118 also created the Air Quality Improvement Program (AQIP), which CARB administers. The CEC and CARB have complementary responsibilities, with CARB serving as the lead agency on ZEV deployment and the CEC as the lead agency on ZEV fueling infrastructure and vehicle-grid integration. Coordination between agencies continues to be paramount to ensure strategic use of limited state funds. Since 2009, AQIP has provided deployment incentives for light-duty electric vehicles through the Clean Vehicle Rebate Project (CVRP); deployment incentives for alternative medium- and heavy-duty vehicles through the Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP); the Truck Loan Assistance Program, which helps small business truckers to secure financing for newer trucks to meet compliance deadlines; as well as funding for other advanced emission-reduction vehicle technologies for vehicles.

CARB also distributes Greenhouse Gas Reduction Fund (GGRF) capital through its Low Carbon Transportation Investments. The Legislature appropriated more than \$2.1 billion to CARB for Low Carbon Transportation Investments between 2013 and 2019. To support the rapidly

growing zero-emission vehicle market and support additional investments focused on equity, multiple funding sources are helping support Low Carbon Transportation Investments.

In November 2021, CARB approved the *FY 2021–22 Funding Plan for Clean Transportation Incentives* that included more than \$1.5 billion in incentive funding from the GGRF, the General Fund, the Air Pollution Control Fund, as well as \$28.64 million in clean transportation investments from AQIP. A detailed breakdown of these investments is shown in Table 4 below.

**Table 4: FY 2021-2022 CARB Clean Transportation Incentives Allocations**

<b>Project Category</b>	<b>Funding Allocation (in Millions)</b>
<b>Vehicle Purchasing Incentives – CVRP</b>	<b>\$525</b>
Clean Vehicle Rebate Project	\$515
Electric Bicycle incentives	\$10
<b>Clean Transportation Equity Investments</b>	<b>\$150</b>
Clean Cars 4 All	\$75
Financial Assistance	\$23.5
Clean Mobility Options	\$10
Clean Mobility in Schools Pilot Project	\$10
Sustainable Transportation Equity Project (STEP)	\$25
Outreach, Community Needs Assessments, Technical Assistance, and the One-Stop-Shop	\$5
Workforce Training and Development	\$1.5
<b>Heavy-Duty and Off-Road Equipment</b>	<b>\$873.09</b>
Clean Truck and Bus Vouchers (HVIP)	\$595.5
Clean Off-Road Equipment Vouchers (CORE)	\$194.95
Drayage Truck and infrastructure Pilot	\$40
New Demonstration & Pilot Projects	\$40
Truck Loan Assistance Program	\$28.64
<b>Total</b>	<b>\$1,548.09</b>

Source: California Air Resources Board.<sup>24</sup>

The FY 2021–22 state budget included \$1.5 billion in ZEV Package funding appropriated to CARB to accelerate an equitable ZEV transition in the light-duty and heavy-duty sectors. In addition, the 2021 ZEV Package included another \$405 million in funding for FY 2022–23. CARB is developing the FY 2022–23 Funding Plan for Clean Transportation through a public process. The plan will describe CARB’s proposed investments and is slated for board consideration in late 2022.

24 CARB. October 2021. [Proposed Fiscal Year 2021–22 Funding Plan for Clean Transportation Incentives](https://ww2.arb.ca.gov/sites/default/files/2021-10/fy21-22_fundingplan.pdf). Available at [https://ww2.arb.ca.gov/sites/default/files/2021-10/fy21-22\\_fundingplan.pdf](https://ww2.arb.ca.gov/sites/default/files/2021-10/fy21-22_fundingplan.pdf).

## **Investor-Owned Utility Investments in Electric Vehicle Charging Infrastructure**

In 2014, the CPUC adopted Decision 14-12-079 to allow consideration of utility ownership of electric vehicle charging stations and infrastructure on a case-specific basis. Subsequently, the CPUC approved infrastructure pilot programs for Pacific Gas and Electric Company (PG&E), San Diego Gas & Electric Company (SDG&E), and Southern California Edison (SCE) to install a total of up to 12,500 charging stations with initial budgets up to \$197 million.<sup>25</sup> In December 2018, the CPUC approved \$22 million in bridge funding for the SCE Charge Ready Pilot to build at least 1,000 more Level 2 chargers. In August 2020, the CPUC approved SCE's Charge Ready 2 infrastructure program, with a \$436 million budget that will fund about 38,000 electric vehicle chargers in the utility's service territory. In April 2021, the CPUC approved SDG&E's Power Your Drive Extension Program for \$43.5 million that will fund nearly 2,000 electric vehicle chargers.

Much of the CPUC's current ZEV work is focused on Senate Bill 350 implementation. The CPUC directed the six investor-owned electric utilities under the CPUC's jurisdiction to propose portfolios of transportation electrification programs and investments. Under this array of programs, the CPUC reports that the IOUs collectively hold \$1.48 billion in authorized unspent funding. The CPUC's current transportation electrification funding policy will last through 2024, after which it may implement a transportation electrification rebate program not through the IOUs. This action is proposed and not yet final.

Starting in 2022, after the passage of AB 841, utility-side EV infrastructure will be funded by ratepayers under the IOUs' general rate case proceedings instead of the aforementioned programs. These changes, formalized under Rule 29 for PG&E and SCE and Rule 45 for SDG&E, provide greater consistency and certainty for cost recovery of utility-side infrastructure upgrades in support of EV charging.

## **Volkswagen Diesel Emissions Settlement**

California received about \$423 million from the Volkswagen Environmental Mitigation Trust for projects to reduce the lifetime excess oxides of nitrogen (NO<sub>x</sub>) emissions caused by illegal devices installed in certain 2.0- and 3.0-liter diesel vehicles to defeat emissions tests. In May 2018, CARB approved a Beneficiary Mitigation Plan outlining how these funds will be spent.<sup>26</sup> In addition, 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.

California's Beneficiary Mitigation Plan includes five funding categories: \$130 million for zero-emission transit, school, and shuttle buses; \$90 million for zero-emission Class 8 freight and drayage trucks; \$70 million for zero-emission freight and marine projects; \$60 million for

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25 California Public Utilities Commission. [Decisions \(D.\)16-01-023, D.16-01-045, and D.16-12-065](http://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=6442454831). Available at <http://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=6442454831>.

26 California Air Resources Board. June 2018. [Beneficiary Mitigation Plan for the Volkswagen Environmental Mitigation Trust](https://ww2.arb.ca.gov/resources/documents/californias-beneficiary-mitigation-plan). Available at <https://ww2.arb.ca.gov/resources/documents/californias-beneficiary-mitigation-plan>.

combustion freight and marine projects; and \$10 million for ZEV infrastructure for light-duty vehicles. California's three largest air districts are administering these projects statewide. The first installment from each project category has been made available starting with the release of zero-emission bus money in fall 2019.

Volkswagen's \$800 million ZEV Investment Commitment will occur over a 10-year period. Eligible projects include the design, planning, construction, and operation and maintenance of qualified fueling infrastructure for plug-in electric vehicles and hydrogen fuel cell electric vehicles; brand-neutral education and public outreach to increase consumer awareness of ZEVs; programs or actions to increase public exposure or access or both to ZEVs without requiring a consumer purchase or lease (for example, programs for car-share and ride-hail services); and two "Green City" initiatives that may include the operation of ZEV car-sharing services, transit applications, and freight transport projects. Volkswagen has submitted the first three of four 30-month, \$200 million ZEV investment plans to CARB for approval. In June 2021, CARB approved Electrify America's third 30-month ZEV Investment Plan, which began January 1, 2022.

## CHAPTER 3:

# Funding Allocations for 2022–2023

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The funding allocations for FY 2022–2023, and the projected funding allocations for the subsequent fiscal year, are outlined in Table 5. For FY 2022–2023, \$95.2 million of Clean Transportation Program funds may be available for the purposes described in this Investment Plan Update. If a different amount of funding is available, the allocations in this document may be amended either before or after final adoption. On July 12, 2021, Governor Gavin Newsom approved Senate Bill 129 — the Budget Act of 2021 (Skinner, Chapter 69, Statutes of 2021),<sup>27</sup> which includes an additional \$255 million for FY 2022–2023 to be administered by the CEC. The additional funds will help close funding gaps in infrastructure deployment, accelerate charging and hydrogen fueling station deployment, and promote in-state ZEV and ZEV-related manufacturing, including infrastructure manufacturing and ZEV component manufacturing such as EV batteries.

The investments will help the markets for zero-emission vehicles and infrastructure grow to scale and, more importantly, serve as a foundation for an equitable and sustainable economic recovery by drawing private investments to California and creating jobs in manufacturing, construction, and engineering. The increased funds will create jobs and invest in ZEV refueling infrastructure for passenger vehicles, big rigs, port equipment, transit, and school buses while supporting more domestic ZEV manufacturing. These investments will allow California to lead the nation and pave the way to a cleaner, more healthy transportation system.

Table 5 shows an allocation of about \$50.1 million to support light-duty passenger vehicles (including light-duty vehicle charging and hydrogen refueling) and more than \$160 million to support medium- and heavy-duty vehicles in FY 2022–2023. Investments in medium- and heavy-duty ZEV infrastructure reflect the need to swiftly transition the most polluting vehicles toward zero-emission technologies in the most sensitive regions of the state.

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<sup>27</sup> [Senate Bill 129 \(Skinner, Budget Act of 2021\)](https://leginfo.ca.gov/faces/billNavClient.xhtml?bill_id=202120220SB129) is available at [https://leginfo.ca.gov/faces/billNavClient.xhtml?bill\\_id=202120220SB129](https://leginfo.ca.gov/faces/billNavClient.xhtml?bill_id=202120220SB129).

**Table 5: Proposed Investment Plan Allocations for FY 2022–2023 and Subsequent Fiscal Year (in Millions)**

Category	Funded Activity	2022-2023 <sup>1/</sup>	2023-2024 <sup>1/ 2/</sup>
Clean Transportation Program Zero-Emission Vehicles and Infrastructure	Light-Duty Electric Vehicle Charging Infrastructure and eMobility	\$30.1	\$13.8
General Fund Zero-Emission Vehicles and Infrastructure	Light-Duty Electric Vehicle Charging Infrastructure	-	-
Clean Transportation Program Zero-Emission Vehicles and Infrastructure	Medium- and Heavy-Duty Zero- Emission Vehicles and Infrastructure	\$30.1	\$13.8
General Fund Zero-Emission Vehicles and Infrastructure	Medium- and Heavy-Duty Zero- Emission Vehicles and Infrastructure	-	-
General Fund Zero-Emission Vehicles and Infrastructure	Drayage	\$85.0	\$80.0
General Fund Zero-Emission Vehicles and Infrastructure	Drayage and Infrastructure Pilot	-	-
General Fund Zero-Emission Vehicles and Infrastructure	Transit	\$30.0	\$30.0
General Fund Zero-Emission Vehicles and Infrastructure	School Bus	\$15.0	\$15.0
Clean Transportation Program Zero-Emission Vehicles and Infrastructure	Hydrogen Fueling Infrastructure	\$20.0	\$10.0 <sup>3/</sup>
General Fund Zero-Emission Vehicles and Infrastructure	Hydrogen Fueling Infrastructure	-	-
Clean Transportation Program Alternative Fuel Production and Supply	Zero- and Near Zero-Carbon Fuel Production and Supply	\$10.0	\$5.0
General Fund Manufacturing	ZEV Manufacturing	\$125.0	-
Clean Transportation Program Related Needs and Opportunities	Workforce Training and Development	\$5.0	\$5.0
	<b>Total Clean Transportation Program Fund</b>	<b>\$95.2</b>	<b>\$47.6</b>
	<b>Total General Fund</b>	<b>\$255 <sup>4/</sup></b>	<b>\$125 <sup>4/</sup></b>

Source: California Energy Commission.

1/ Subject to future Budget Act appropriations.

- 2/ The Clean Transportation Program is authorized through December 31, 2023; therefore, only half of the revenues/appropriations are anticipated in this fiscal year.
- 3/ The final column of proposed funding is a half year due to the program expiring in middle of the fiscal year.
- 4/ The anticipated general fund amounts in FY 2022–2023 and FY 2023–2024 have not been reduced to reflect administrative costs. Those fiscal year allocations will be reduced in accordance with direction in the associated Budget Act.





# **CHAPTER 4:**

## **Zero-Emission Vehicles and Infrastructure**

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The mass adoption of zero-emission vehicles (ZEVs), including plug-in electric vehicles (PEVs) and fuel cell electric vehicles (FCEVs), is critical to California’s decarbonization goals, air quality standards goals, and petroleum reduction goals. California has made significant progress toward advancing the adoption of ZEVs by surpassing the 1 million PEVs sold milestone at the end of 2021.

The CEC is the lead agency on ZEV infrastructure investment and analysis. The CEC’s investments will catalyze the development and deployment of economically and environmentally sustainable ZEV infrastructure, with a focus on gaps in access for California’s most impacted communities. The CEC investments will enable and leverage private sector investment in ZEV infrastructure.

### **Light-Duty Electric Vehicle Charging Infrastructure**

#### **Quantifying Charging Infrastructure for Light-Duty Vehicles**

To track progress toward the state’s 2025 goal, the CEC conducts quarterly surveys, starting in July 2020, to obtain combined counts of public- and shared-access chargers within California. Table 6 below provides estimates of the existing number of public or shared Level 2 and DC fast chargers within the state as of December 2021. The table also provides estimates of the number of chargers to be installed from allocated or upcoming Clean Transportation Program funds, as well as the number of connectors to be installed based on announced plans from other major funding programs, which are tracked by the CEC. This estimate anticipates the additional funding from the ZEV Package under Senate Bill 129 — Skinner Budget Act of 2021, which provides light-duty electric vehicle charging infrastructure funding with the purpose of reducing the shortfall to the goal, to go primarily towards Level 2 charger deployment to meet the state’s 2025 charger goal.

**Table 6: Progress Toward 250,000 Chargers by 2025**

	Level 2 Chargers	DC Fast Chargers
Existing Chargers (Estimated)*	71,236	7,158
Anticipated Chargers for Which Funding Has Been Allocated (including anticipated funding from Clean Transportation Program)**	186,385	4,511
<b>Total</b>	257,611	11,669
2025 Goal (Executive Order B-48-18)	240,000	10,000
<b>Gap From Goal</b>	0	0
AB 2127 Report's 2030 Estimate of Charging Needs	1,126,855	37,461
<b>Gap from 2030 Estimates</b>	869,244	25,792

Source: California Energy Commission. Analysis as of March 2022. \*Existing charging ports estimated based on available data from U.S. Department of Energy's Alternative Fuels Data Center surveys to electric vehicle network service providers, utilities, and public agencies in California. Not included in this table are an estimated 629 statewide public or shared-private Level 1 chargers. \*\*Derived from public presentations and statements by utilities, California Public Utilities Commission, CARB, other entities, and the CEC. Includes PG&E's application for EV Charge 2 under CPUC review. Assumes funding from State Budget Act of 2021 will primarily go towards Level 2 to close the infrastructure gap. Estimates are subject to change as solicitations are released. Does not include funding for new charging infrastructure under the Governor's proposed budget for Fiscal Year 2022-2023.

### **Light-Duty Vehicle Findings From the AB 2127 Electric Vehicle Charging Infrastructure Assessment**

Assembly Bill 2127 (Ting, Chapter 365, Statutes of 2018) requires the CEC, working with CARB and the CPUC, to prepare and update biennially a statewide assessment of the electric vehicle charging infrastructure. The assessment must focus on the number and types of charging infrastructure needed to support levels of electric vehicle adoption required for the state to meet its goals of deploying at least 5 million ZEVs on California roads by 2030. Executive Order N-79-20 directs the CEC to update the AB 2127 statewide assessment to evaluate the ZEV infrastructure needed to meet the new targets.

The inaugural *Assembly Bill 2127 Electric Vehicle Charging Infrastructure Assessment Analyzing Charging Needs to Support Zero-Emission Vehicles in 2030*<sup>28</sup> (AB 2127 Report) was adopted by the CEC in June 2021.

To quantify the number of charging stations needed to service the growing population of light-duty PEVs in California, the CEC partnered with the National Renewable Energy Laboratory (NREL) and the University of California, Davis, to develop three quantitative analysis tools covering various vehicle classes, use cases, and local conditions: Electric Vehicle Infrastructure

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28 Alexander, Matt, Noel Crisostomo, Wendell Krell, Jeffrey Lu, and Raja Ramesh. July 2021. [Assembly Bill 2127 Electric Vehicle Charging Infrastructure Assessment: Analyzing Charging Needs to Support Zero-Emission Vehicles in 2030 – Commission Report. California Energy Commission](https://www.energy.ca.gov/programs-and-topics/programs/electric-vehicle-charging-infrastructure-assessment-ab-2127). Publication Number: CEC-600-2021-001-CMR. Available at <https://www.energy.ca.gov/programs-and-topics/programs/electric-vehicle-charging-infrastructure-assessment-ab-2127>.

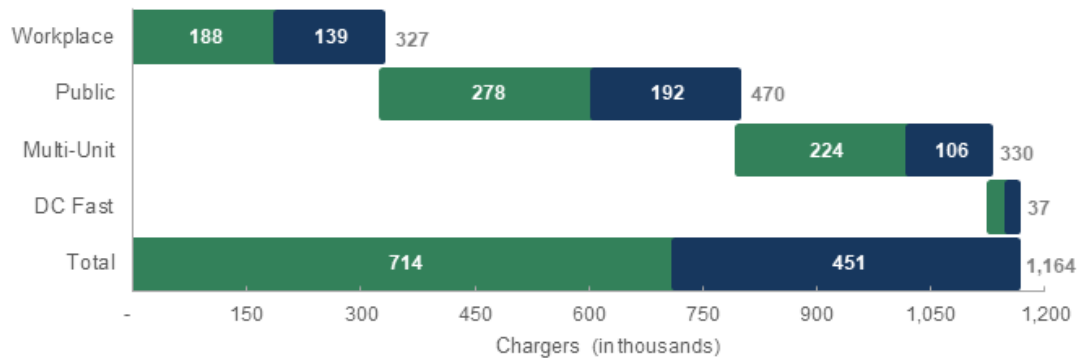
Projections 2 (EVI-Pro 2), Electric Vehicle Infrastructure for Road Trips (EVI-RoadTrip), and Widespread Infrastructure for Ride-hailing EV Deployment (WIRED).

EVI-Pro, developed in collaboration with NREL, is a planning tool that helps determine the number, locations, and types of chargers required to meet the local travel and charging needs of California's light-duty PEV drivers. The original EVI-Pro 1 analysis formed the basis for the Executive Order B-48-18 target of 250,000 chargers statewide by 2025. An update to the model, EVI-Pro 2, expands infrastructure projections to support 5 million ZEVs and beyond by 2030 and incorporates evolving technology and market conditions. In addition to the 5 million ZEVs by 2030 scenario, the *AB 2127 Report* included an additional scenario using CARB's *Draft 2020 Mobile Source Strategy*. The report projected nearly 8 million ZEVs by 2030, which, at that time, was an estimate of the trajectory needed to achieve the Executive Order N-79-20 target of 100 percent light-duty ZEV sales by 2035.

Separate from EVI-Pro 2, the EVI-RoadTrip model, also developed in collaboration with NREL, projects the number and locations of DC fast chargers needed specifically to enable long-distance (100+ mile) interregional road trips for BEVs within and across California's borders. Moreover, the WIRED model, developed by UC Davis, assesses the need for charging infrastructure demanded by Transportation Network Company (TNC) vehicles, initially in three major California regions: San Diego County, the Greater Los Angeles Region, and the San Francisco Bay Area.

For passenger vehicle charging in 2030, combining the results of these three models, the *AB 2127 Report* projects that nearly 1.2 million public and shared private chargers will be needed to support 8 million ZEVs. Figure 3 shows the number and types of chargers estimated in the report.

**Figure 3: Projected 2030 Charger Counts to Support 5 Million and 8 Million Light-Duty Zero-Emission Vehicles**



**Models project that California will need more than 700,000 shared private and public chargers in 2030 to support 5 million ZEVs as called for in AB 2127 and nearly 1.2 million chargers to support 8 million ZEVs by 2030. Counts for chargers at workplaces, public destinations, and multiunit dwellings generally indicate the number of Level 2 chargers needed. In some cases, Level 1 chargers may be sufficient at select multiunit dwellings. These values do not include chargers at single-family homes.**

Source: CEC and National Renewable Energy Laboratory.

In addition to providing quantitative discussions of charging infrastructure needs, the *AB 2127 Report* provides a qualitative review of charging infrastructure needs.<sup>29</sup> Highlights of such qualitative findings include the following:

- North American market players are generally moving toward a unified DC fast charging standard known as the “Combined Charging System (CCS).” There are three connectors (CCS, CHAdeMO, and Tesla) used for DC fast charging in North America today. The movement toward a single connector type will reduce network costs and maximize convenience.
- Given the additional load PEVs represent for the electric grid, vehicle-grid integration will be a valuable tool to support grid reliability and ensure that drivers can access the cleanest and cheapest electricity possible. Convenient, interoperable, and widespread vehicle-grid integration depends on standardized communication protocols to enable seamless communication among vehicles, chargers, and other actors.
- Charger deployments should be targeted toward the needs of the local community, built environment, and use case. This targeting means there is no one-size-fits-all charging solution. Generally speaking, the best-fit charging solution will maximize electric miles enabled by a charger at the lowest overall cost while reflecting local needs and constraints and supporting equitable access for all Californians. Fostering innovative or unique charging products and opportunities will help ensure that these solutions proliferate.

<sup>29</sup> Ibid. For more information on these qualitative findings, see Chapter 5: Meeting California’s Technological Charging Infrastructure Needs.

## **Findings From the California Electric Vehicle Charging Infrastructure Assessment: Senate Bill 1000 Report**

Senate Bill 1000 (Lara, Chapter 368, Statutes of 2018) requires the CEC, as part of the development of the Clean Transportation Program Investment Plan Update, to assess whether chargers are disproportionately deployed by income level, population density, or geographical area.<sup>30</sup> If the CEC finds that chargers have been disproportionately deployed, the CEC shall use Clean Transportation Program funds, to the extent authorized by law, and other mechanisms to deploy chargers more proportionately, unless the CEC finds that the disproportionate deployment was reasonable and furthered state energy and environmental policies as articulated by the CEC.

Staff published the first *SB 1000 Electric Vehicle Charging Infrastructure Deployment Assessment* on December 30, 2020. The distributions of PEVs, public chargers, and populations are correlated, but public chargers are unevenly distributed by income, population density, and geography. On average, low-income communities have fewer public Level 2 and DC fast chargers combined per capita than middle- or high-income communities.<sup>31</sup> High-population-density census tracts contain fewer public chargers per capita than lower-density census tracts.

The latest analysis assesses drive times from census tract population centers to the nearest public fast charger during peak traffic. Drive time analysis allows for the identification of charging network gaps that discourage travel within California communities and travel to and from those communities. Communities with drive times of 10 minutes or more have less public fast charging coverage and basic access. Rural communities<sup>32</sup> are further from public fast charging than urban communities (Figure 4). Preliminary findings suggest that, while about 88 percent of urban communities are within 10 minutes of a public DC fast charger, only 40 percent of rural communities are that close. About 11 percent of all low-income communities are rural. These communities have the least access to public fast charging. At least 69 percent are 10 minutes or more from a public DC fast charger, which is more than any other group (Table 7). Finally, Figure 5 shows that several disadvantaged communities in the Los Angeles

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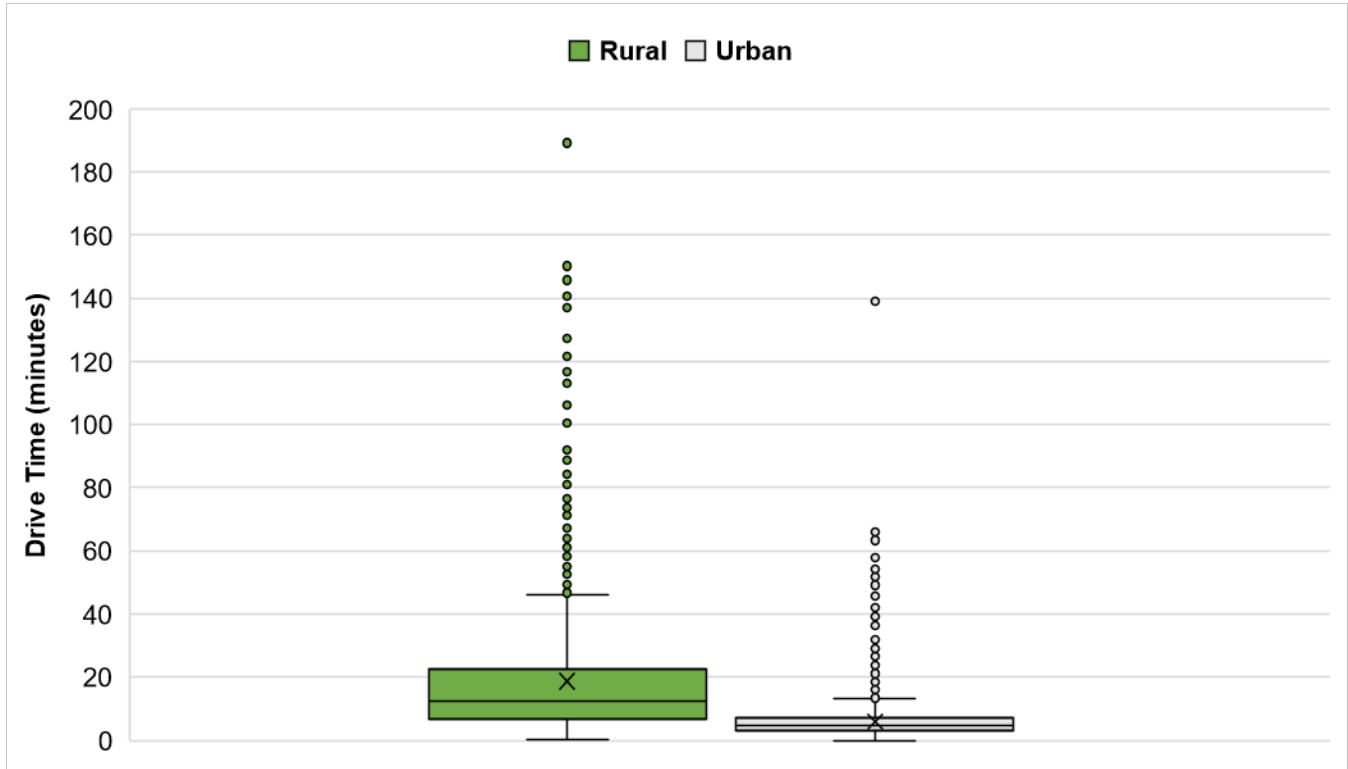
30 More information about the SB 1000 reporting is available at <https://www.energy.ca.gov/programs-and-topics/programs/clean-transportation-program/electric-vehicle-infrastructure>

31 Low-income communities are "census tracts with median household incomes at or below 80 percent of the statewide median income or with median household incomes at or below the threshold designated as low income by the Department of Housing and Community Development's list of state income limits adopted pursuant to Health and Safety Code Section 50093" (Assembly Bill 1550, Gomez, Chapter 369, Statutes of 2016). Middle-income communities are census tracts with median household incomes between 80 to 120 percent of the statewide median income or with median household incomes between the threshold designated as low and moderate income by the Department of Housing and Community Development's list of state income limits adopted pursuant to Health and Safety Code Section 50093. High-income communities are census tracts with median household incomes at or above 120 percent of the statewide median income or with median household incomes at or above the threshold designated as moderate income by the Department of Housing and Community Development's list of state income limits adopted under Health and Safety Code Section 50093.

32 Rural communities are census tracts with population where at least 50 percent of the census tract's land area is rural. Staff calculated rural area using the U.S. Census Bureau's 2010 rural census block designations. At the time of analysis, these were the most recent data available.

area have long drives to public fast charging. The CEC has created drive time maps showing rural, low-income, and disadvantaged communities with less public fast charging coverage. These can be used to guide CTP DC fast charging investments within underserved communities. The CEC expects to publish these results in a staff report in May 2022.

**Figure 4: Drive Time to the Nearest DC Fast Charging Station by Urban and Rural Communities**



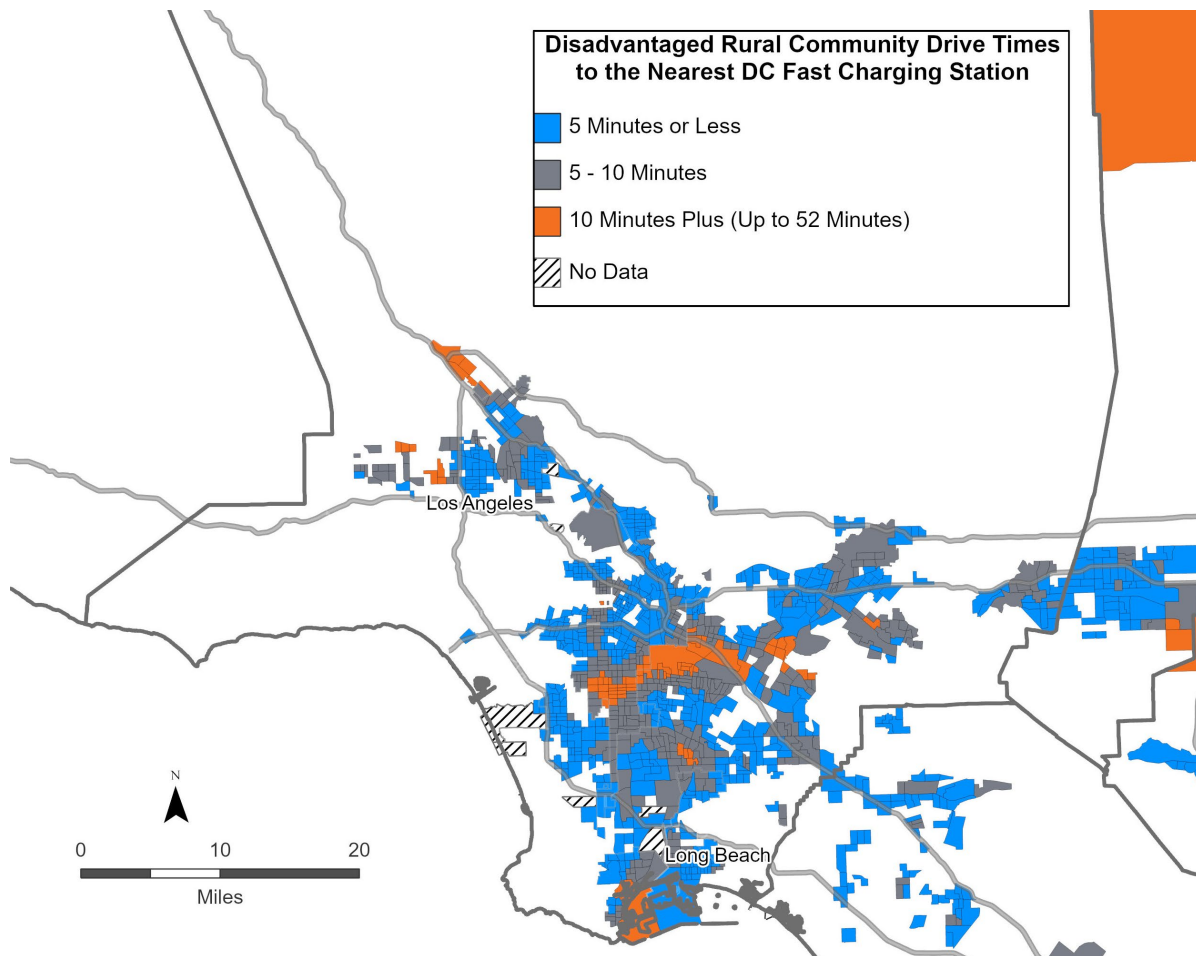
Source: U.S. Census Bureau 2010 Urban and Rural Classifications, U.S. Department of Energy’s Alternative Fuels Data Center Charger Data as of February 2021, and California Air Resources Board California Hydrogen Infrastructure Tool Roadway Data.

**Table 7: Drive Time Ranges by Income Level and Urban or Rural Area**

Income and Community Type	0 to 5 mins	6 to 9 mins	10 plus mins	N/A	Total
Low Rural	16%	14%	69%	1%	100%
Low Urban	61%	28%	11%	0%	100%
Middle Rural	19%	22%	58%	1%	100%
Middle Urban	62%	24%	14%	0%	100%
High Rural	25%	29%	45%	1%	100%
High Urban	54%	32%	14%	0%	100%

Source: California Energy Commission Analysis using data from the U.S. Census Bureau 2010 Urban and Rural Classifications, U.S. Census Bureau 2014-2018 American Community Survey Median Household Income and Average Household Size 5-Year Estimates, California Department of Housing and Community Development 2020 State Income Limits, U.S. Department of Energy Alternative Fuels Data Center as of February 2, 2021, and California Air Resources Board California Hydrogen Infrastructure Tool roadway data.

**Figure 5: Map of Los Angeles Area Disadvantaged Community Drive Times to the Nearest DC Fast Charging Station**



Source: California Energy Commission analysis using data from the U.S. Census Bureau 2010 Urban and Rural Classifications, California Environmental Protection Agency CalEnviroScreen 3.0, U.S. Department of Energy Alternative Fuels Data Center as of February 2, 2021, and California Air Resources Board California Hydrogen Infrastructure Tool roadway data.

### **Clean Transportation Program Funding**

The CEC has supported the rollout of light-duty PEVs by awarding more than \$250 million in Clean Transportation Program funding for electric vehicle charging infrastructure. Partly because of these investments, California has the largest network of publicly accessible electric vehicle chargers in the nation.

Clean Transportation Program investments have funded electric vehicle charging stations (EVCSs) at many types of locations, as detailed in Table 7. The “private access” chargers include home chargers that are generally dedicated to serving only one vehicle. The “shared access” chargers include fleets, workplaces, and multifamily housing chargers that may serve several vehicles but are not necessarily public. The “public access” chargers include public Level 2 chargers, as well as corridor and urban metropolitan DC fast chargers. Finally, the “mixed access” chargers include shared private and public access chargers.



**Table 7: Chargers Funded by the Clean Transportation Program as of December 31, 2021**

	Private Access	Shared Private Access	Shared Private Access	Shared Private Access	Public Access	Public Access	Mixed Access	Total
Charger Type / Setting	Level 2 - Residential (Single & Multifamily)	Level 2 - Fleet	Level 1 and Level 2 - Workplace	Level 2 - Residential (Multifamily)	Level 1 and Level 2 - Public	Level 2 and DCFC - Corridor/ Urban Metro	Level 2 and DCFC - CALeVIP*	-
Installed	3,936	155	419	341	3,108	487	1,221	<b>9,667</b>
Planned	0	0	0	0	0	45	5,501	<b>5,546</b>
Total	<b>3,936</b>	<b>155</b>	<b>419</b>	<b>341</b>	<b>3,108</b>	<b>532</b>	<b>6,722</b>	<b>15,213</b>

Source: California Energy Commission. Does not include chargers that have yet to be approved at a CEC business meeting or connectors that have yet to be funded under CALeVIP. \*Planned CALeVIP chargers = number of chargers with rebate funding reserved. Mixed Access includes shared private and public access chargers.

### **California Electric Vehicle Infrastructure Project (CALeVIP)**

In December 2017, the CEC introduced the California Electric Vehicle Infrastructure Project (CALeVIP) to provide streamlined Clean Transportation Program incentives for light-duty electric vehicle charging infrastructure. The incentives provided through CALeVIP simplify the funding process and accelerate charger deployment compared to the previously used grant solicitations. Each CALeVIP project provides incentives for the purchase and installation of electric vehicle infrastructure in specific regions throughout the state, with funding targeted at regions that have low rates of infrastructure installation or lack adequate incentives from utilities and other sources.

Through 2021, the CEC has allocated \$200 million (\$186 million for rebates and \$14 million for administrative fees) for charger rebates through CALeVIP; however, not all of these funds have been paid out to, or reserved by, incentive recipients. CALeVIP has launched 12 regional incentive projects covering 36 counties. One additional incentive project has been announced and will provide incentives for Level 2 chargers in four counties from a previous incentive project that had funding available only for DC fast chargers. Table 8 shows the CALeVIP projects. Dedicated funding amounts or higher incentive amounts or both are also available under CALeVIP for project sites within disadvantaged communities and multifamily complexes. CEC staff continues to coordinate closely with local governments and councils of governments to leverage other funding opportunities to increase chargers in focused locations to maximize the effectiveness of limited Clean Transportation Program funds.

**Table 8: CALeVIP Investments**

Incentive Project	Launch Date	Counties	CEC Rebate Funding (in Millions)	Additional Rebate Funding From Partners (in millions)	Technologies
Fresno County	December 2017	Fresno	\$2.66	-	Level 2
Southern California	August 2018	Los Angeles, Orange, Riverside, San Bernardino	\$29	-	DC Fast Chargers
Sacramento County	April 2019	Sacramento	\$14	\$1.5	Level 2 and DC Fast Chargers
Northern California	May 2019	Shasta, Humboldt, Tehama	\$4	-	Level 2 and DC Fast Chargers
Central Coast	October 2019	Monterey, Santa Cruz, San Benito	\$6	\$1	Level 2 and DC Fast Chargers
San Joaquin Valley	December 2019	San Joaquin, Kern, Fresno	\$15.34	-	Level 2 and DC Fast Chargers
Sonoma Coast	July 2020	Mendocino, Sonoma	\$5.1	\$1.5 (over three years)	Level 2 and DC Fast Chargers
San Diego County	October 2020	San Diego	\$15.8	\$5.9 (over three years)	Level 2 and DC Fast Chargers
Peninsula-Silicon Valley	December 2020	San Mateo, Santa Clara	\$33	\$21.4 (over four years)	Level 2 and DC Fast Chargers
Inland Counties	May 2021	Butte, El Dorado, Imperial, Kings, Merced, Napa, Nevada, Placer, Solano, Stanislaus, Sutter, Tulare, Yolo	\$17.5	-	Level 2 and DC Fast Chargers
South Central Coast	July 2021	San Luis Obispo, Santa Barbara, Ventura	\$7.1	\$4.9 (over two years)	Level 2 and DC Fast Chargers
Alameda County	December 2021	Alameda	\$14.5	\$2.8	Level 2 and DC Fast Chargers
Southern California Level 2	April 2022	Los Angeles, Orange, Riverside, San Bernardino	\$22	\$1	Level 2
		<b>Totals</b>	<b>\$186</b>	<b>\$40</b>	

Source: California Energy Commission.

### Second Block Grants for Light-Duty EV Charging Infrastructure

In April 2021 the CEC released a solicitation seeking up to two implementers for block grants for light-duty EV charging infrastructure. The two implementers that received the highest scores were announced in September 2021, and both were approved at the CEC's December 2021 Business Meeting. Each new block grant has the funding authority of up to \$250 million, which would be added as future funding allocations become available. The two block grant

implementers will coordinate with one another and the CEC to design projects that complement one another. Staff expects that one block grant will be developed to focus on charger incentives that meet stricter readiness requirements as a means of minimizing charger installation times. The other will be designed to fund installations that may need more assistance or time. Both block grants will solicit feedback from the public on concepts and design elements. The application processes and project requirements may vary between the two as they will be designed to best serve each project. Each block grant recipient plans to launch its first project by late 2022.

### **Targeted Projects for Increasing Access and Innovation for Charging Infrastructure and ZEV Mobility**

In addition to the use of block grants to efficiently distribute incentives for broader charging infrastructure deployment, the Clean Transportation Program also provides funding to solicitations and projects that target specific needs for charging infrastructure.

- On November 24, 2021, the CEC announced the Reliable, Equitable, and Accessible Charging for multi-family Housing (REACH) solicitation. This solicitation will demonstrate replicable and scalable models for large-scale deployment of EV charging infrastructure capable of maximizing access and EV travel for multifamily housing (MFH) residents. Proposed projects must include charger installations that will benefit and be used by MFH residents within disadvantaged communities, low-income communities, or a combination of both and are encouraged to pursue installations for affordable housing. This is an active solicitation with results to become available later this year.
- On December 14, 2021, the CEC announced the Clean Transportation Program Rural Electric Vehicle (REV) Charging solicitation. This solicitation will 1) demonstrate replicable and scalable models that can dispatch EV charging stations to serve rural EV drivers; 2) support travel by EV drivers, especially those in low-income or disadvantaged communities; 3) provide EV charging access in rural areas that are not served or inadequately served by charging stations; 4) provide support and maintenance services to ensure reliable and readily accessible chargers; and 5) engage local rural communities and businesses in increasing charger awareness and promoting EV adoption. This is an active solicitation with results to become available later this year.
- The Charging Access for Reliable On-Demand Transportation Services (CARTS) was released August 31, 2021, with up to \$6 million in grant funds for projects that will support electric vehicle charging infrastructure or high-mileage on-demand transportation services, including services such as ride-hailing, taxis, and meal grocery delivery. On February 14, 2022, the CEC announced the proposed awards of more than \$16 million, which is an increase in the original funding amount.
- The CEC is partnering with CARB through an interagency agreement to expand program eligibility and funding under the Clean Mobility Options (CMO) Program. The CMO Program is a statewide program that offers vouchers for shared mobility projects in traditionally underserved communities, aiming to increase residents' access to clean transportation and zero-emission mobility solutions. The interagency agreement will add

\$8 million to the original CARB funding of \$37 million for additional vouchers, technical assistance, and outreach to communities not identified in the first round of funding. Projects are required to be operational for four years, and the interagency agreement will conclude in 2025.

### **Projects to Support Innovations and Standardization in Charging**

Through the Clean Transportation Program, the CEC has invested in funding opportunities to support innovative charging solutions as well as the testing and standards that can support the principles of interoperability, competition and customer choice, cost control, and convenience.

- In August 2020, the CEC released the “BESTFIT Innovative Charging Solutions” solicitation, which offered funding to projects that demonstrate transformative technology solutions. They are meant to accelerate the successful commercial deployment of EV charging for both light-duty and MD/HD applications. There is no one-size-fits-all solution to charging needs, and there is instead a need to have a portfolio of charging solutions that complement one another.
- The Vehicle-Grid Innovation Lab (ViGIL) solicitation was released on May 21, 2021. This solicitation will increase the capacity and throughput of electric vehicle supply equipment standards testing at a laboratory or laboratories. The funding will support the expansion of testing for both light-duty and MD/HD electric vehicle charging equipment. On October 14, 2021, the CEC announced a proposed award of nearly \$2 million in grant funding.
- The Vehicle Interoperability Testing Symposium (VOLTS) solicitation was released September 24, 2021. This solicitation will support the interoperability of electric vehicle charging with a focus on convening stakeholders to conduct interoperability tests, develop and finalize products and standards, and discuss requirements to overcome common technology barriers. On January 6, 2022, the CEC announced an award of nearly \$1 million to a proposed contractor.

### **Planning and Readiness**

The CEC has provided funding to support regional alternative fuel readiness plans, with a new focus on zero-emission technologies. The Regional Alternative Fuel Readiness Planning allocation provides funding for planning that prepares for and expedites the launch of alternative fuel infrastructure and vehicles.

The CEC has conducted six grant solicitations for regional readiness planning, providing more than \$27 million for 58 agreements. Since the first regional readiness planning projects were approved in 2011, the zero-emission vehicle sector has matured significantly. Most regions in California have developed regional readiness plans as a result of this funding.

On August 12, 2020, the CEC released the “Electric Vehicle Ready Communities Challenge Phase II — Blueprint Implementation Solicitation.” This solicitation was Phase II of a two-phase effort for electric vehicle-ready communities. Phase I (GFO-17-604) provided funds to develop replicable blueprints that identify the actions needed to accelerate implementation of electrified transportation at the regional level.

Phase II was a competitive solicitation with \$7.5 million in grant funding available to implement projects developed and identified in Phase I. Phase II was open only to entities that completed Phase I blueprints within one year of their agreement start date. The solicitation resulted in four grant awards totaling about \$7.5 million, which include Contra Costa Transportation Authority, Kern Council of Governments, City of Sacramento, and Ventura County Regional Energy Alliance. In September 2021, the CEC added more than \$9 million to the Phase II solicitation by using funds from the Clean Transportation Program Investment Plan's Recovery and Reinvestment funding category from FY 2020–2021. This reallocation allowed the full funding of three additional projects: San Francisco Department of the Environment, the County of Los Angeles Internal Services Department, and the City of Long Beach Harbor Department, and the complete funding for the Kern Council of Governments, which was originally only partially funded.

### **Increasing Consumer Awareness of EV Charging Opportunities Through Expanded Installation of Signs**

Despite strong growth in ZEV sales and PEV charger installations, large numbers of Californians have limited awareness of PEV charging opportunities or ZEV mobility. Long-term attitudinal survey research from the UC Davis Institute for Transportation Studies indicates that more than 50 percent of Californians have limited awareness of ZEV purchase or PEV charging opportunities.<sup>33</sup> Informing larger numbers of California drivers about ZEVs will become increasingly important to meet California's vehicle and climate goals. One strategy to build consumer awareness is to increase the number of physical signs indicating nearby public PEV charging stations. Further, signs will aid existing PEV drivers by helping them locate stations near their homes or commute routes.

There are just 50 indicator signs along California freeways. As a result, many EV drivers and potential EV drivers are likely unaware of charging opportunities. Lack of awareness contributes to range anxiety, the concern that a PEV cannot meet a driver's needs for range and convenient refueling. This lack of awareness constrains PEV sales. In contrast, gas stations are highly visible to urban, suburban, rural, and freeway drivers due to the large, colorful display signs. Fossil fuel drivers benefit from the big neon signs and large footprint of gas stations. Further, they benefit from highway, surface street, and off-ramp signs indicating where gasoline can be found.

CEC staff has begun exploring opportunities to increase the number of physical signs throughout the state. Working collaboratively with staff from GO-Biz, California Department of Transportation (Caltrans), CPUC, and CARB, and in consultation with major charger companies, CEC staff is investigating strategies to increase the installation of physical indicator signs. One possible strategy is to use grant funding opportunities, such as the Regional Readiness Planning Grants, to provide funding to install signs along freeways and roadways.

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33 Kurani, Ken. 2019. "[The State of Electric Vehicle Markets, 2017: Growth Faces an Attention Gap.](https://ncst.ucdavis.edu/research-product/state-electric-vehicle-markets-2017-growth-faces-attention-gap)" NCST Policy Brief, <https://ncst.ucdavis.edu/research-product/state-electric-vehicle-markets-2017-growth-faces-attention-gap>.

## Summary

Issued in January 2018, Executive Order B-48-18 set a directive to install 250,000 ZEV charging ports, including 10,000 DC fast charging ports, in California by 2025. Based on existing public and private commitments, Clean Transportation Program staff estimates that California should be meet the goal of 250,000 chargers and 200 hydrogen stations. However, based on AB 2127 analysis, California will need to deploy additional infrastructure by 2025 and 2030. For passenger vehicle charging in 2030, the AB 2127 analysis projects that California will need nearly 1.2 million public and shared-private chargers to support the roughly 8 million ZEVs needed to keep pace with the goals of Executive Order N-79-20.

Staff recommends an aggressive near-term funding solution to help close this gap and ensure equitable access. Staff will also consider land use, housing policies, and Sustainable Community Strategies<sup>34</sup> as they relate to ZEV infrastructure investments. To help achieve this adoption, the CEC is allocating \$30.1 million in Clean Transportation Program funding for light-duty electric vehicle charging infrastructure for FY 2022–2023. These funding allocations will provide the buildout of EV infrastructure that can create much-needed jobs and support economic development in response to COVID-19 while narrowing the EVSE gap.

## Medium- and Heavy-Duty Zero-Emission Vehicles and Infrastructure

Freight and transit vehicles serve as a pillar to the California economy, providing indispensable functions for domestic goods movement, international trade, mass transportation, and other essential services. Clean Transportation Program funding in this sector has historically focused on medium- and heavy-duty vehicles, defined here as vehicles with a gross vehicle weight rating above 10,000 pounds. These vehicles represent a small share of California registered vehicle stock, accounting for about 1 million out of 31 million vehicles, or 2 percent; however, this small number of vehicles is responsible for about 23 percent of on-road GHG emissions in the state because of comparatively low fuel efficiency and high number of miles traveled per year.<sup>35</sup> Medium- and heavy-duty vehicles additionally account for one-third of statewide NO<sub>x</sub> and 25 percent of PM<sub>2.5</sub> emissions from on-road transportation in California.<sup>36</sup> For these reasons, medium- and heavy-duty vehicles represent a significant opportunity to reduce GHG emissions and criteria emissions while focusing on a small number of vehicles. Nonroad freight

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34 California Air Resources Board. "[Sustainable Communities Strategies](https://ww2.arb.ca.gov/our-work/programs/sustainable-communities-program/what-are-sustainable-communities-strategies)." More information: <https://ww2.arb.ca.gov/our-work/programs/sustainable-communities-program/what-are-sustainable-communities-strategies>.

35 Based on analysis from California Energy Commission Energy Assessments Division, with data from the California Department of Motor Vehicles. California Air Resources Board. June 22, 2018. "[California Greenhouse Gas Inventory for 2000-2018](https://ww3.arb.ca.gov/cc/inventory/data/tables/ghg_inventory_scopingplan_sum_2000-18.pdf)." Available at [https://ww3.arb.ca.gov/cc/inventory/data/tables/ghg\\_inventory\\_scopingplan\\_sum\\_2000-18.pdf](https://ww3.arb.ca.gov/cc/inventory/data/tables/ghg_inventory_scopingplan_sum_2000-18.pdf).

36 California Air Resources Board. "[Almanac Emission Projection Data](https://www.arb.ca.gov/app/emsinv/2017/emssumcat_query.php?F_YR=2020&F_DIV=3&F_SEASON=A&SP=SIP105ADJ&F_AREA=CA#7)." Available at [https://www.arb.ca.gov/app/emsinv/2017/emssumcat\\_query.php?F\\_YR=2020&F\\_DIV=3&F\\_SEASON=A&SP=SIP105ADJ&F\\_AREA=CA#7](https://www.arb.ca.gov/app/emsinv/2017/emssumcat_query.php?F_YR=2020&F_DIV=3&F_SEASON=A&SP=SIP105ADJ&F_AREA=CA#7).

vehicles, such as forklifts and other cargo handlers, have similar or supporting purposes and potential for emission reductions.

### **Charging Infrastructure for Medium- and Heavy-Duty Vehicles**

As part of the analyses conducted for the *AB 2127 Report*, the CEC evaluated infrastructure needs to support medium- and heavy-duty vehicles through the Medium- and Heavy-Duty Electric Vehicle Infrastructure Load, Operations, and Deployment (HEVI-LOAD) model in collaboration with Lawrence Berkeley National Laboratory. This model aims to characterize regional charging infrastructure needs for public, shared private, and private charging for on-road medium- and heavy-duty electric vehicles. It will determine the number, locations, and types of charger deployments and examine suitable power levels ranging from overnight charging (<50 kilowatts [kW]) to public fast charging (multimegawatt) for the range of applications envisioned in California's transition to ZEVs. HEVI-LOAD leverages CARB's *Draft 2020 Mobile Source Strategy*, which projected, at the time of the *Draft 2020 Mobile Source Strategy*, that 180,000 medium- and heavy-duty electric vehicles will be needed in 2030 to achieve state climate and air quality goals and comply with Executive Order N-79-20. Preliminary modeling, which considered 50-kW and 350-kW charging power levels, suggests that to charge these vehicles, 157,000 DC fast chargers will be needed.

In addition to providing quantitative estimates of charging for medium- and heavy-duty vehicles, the *AB 2127 Report* also provides qualitative descriptions of the charging needs of medium- and heavy-duty vehicles.

While private light-duty vehicles typically see extended periods of downtime and have flexible usage requirements, medium- and heavy-duty vehicles often adhere to demanding operation patterns that make infrastructure planning for these vehicles a unique challenge. Charging infrastructure planning for the medium- and heavy-duty sector requires close attention to the specific vehicle uses and environments, high-power charging demands, lack of consistency in charging connectors, and landlord-tenant relationships. The result of such operator-specific complexities is that the most appropriate charger type — whether it be a conductive connector, pantograph, or wireless charger — may vary significantly from site to site, even for ostensibly similar vehicles.

### **Hydrogen Fueling Infrastructure for Medium- and Heavy-Duty Vehicles**

Fuel cell electric vehicles using hydrogen offer another zero-emission transportation option for California's medium- and heavy-duty sectors and short-range and long-range applications. Hydrogen fuel cell and battery-electric technologies present different strengths and challenges, and hydrogen fuel cell vehicles may serve an important role in applications that would be difficult to transition to battery electric. Moreover, the further development and deployment of medium- and heavy-duty fuel cell vehicles will help accelerate the growth of hydrogen production and reach economies of scale earlier than with light-duty vehicles alone. These cost reductions may help support the further commercialization of all fuel cell vehicles, including light-duty fuel cell vehicles.

Companies are producing or planning to produce heavy-duty vehicles with hydrogen fuel cell electric powertrains, including transit buses and tractor-trailer trucks. These vehicles, and the

fleets that operate them, may require dedicated fueling infrastructure to ensure the safety, security, and fuel supply of the vehicles. The CEC anticipates expanding its hydrogen focus toward hydrogen fueling infrastructure that is capable of supporting medium-duty and heavy-duty vehicles.

### **Clean Transportation Program Funding**

In October 2019, CEC staff conducted a workshop to explore various solicitation concepts that prioritized infrastructure to support the use of zero-emission medium- and heavy-duty advanced vehicle technologies within the California freight system, transit bus fleets, and other sectors.<sup>37</sup> The concepts evolved into solicitations that cover a wide range of support for medium- and heavy-duty zero-emission vehicle infrastructure. Similar to the light-duty investments, the CEC intends to use a complementary approach of block grants and in-house funding solicitations.

### **Energy Infrastructure Incentives for Zero-Emission Commercial Vehicles (EnergIIZE Commercial Vehicles)**

Block grants are important tools to rapidly deploy funds to support infrastructure deployment. In March 2022 the CEC and CALSTART launched the EnergIIZE Commercial Vehicles block grant. This block grant for MD/HD zero-emission vehicle infrastructure incentives is intended to be a cornerstone of the CEC's deployment strategy.

Under this grant solicitation, the CEC sought one block grant recipient to design and implement an incentive mechanism (similar to CALeVIP) for various medium- and heavy-duty zero-emission vehicle refueling infrastructure incentive projects throughout California. In December 2020, the CEC selected applicant CALSTART, Inc. to implement the block grant incentive with an initial budget of \$17 million. On March 17, 2021, the project was approved at a CEC business meeting. The block grant project EnergIIZE Commercial Vehicles has \$50 million available for incentives, and the CEC has the authority for up to \$276 million, which was approved a December 2022 CEC business meeting.

### **Targeted Projects for Medium- and Heavy-Duty ZEV Infrastructure**

The EnergIIZE block grant will complement the several in-house solicitations that the CEC has used over the years and is currently deploying. In-house competitive solicitations are valuable tools to target specific segments or needs. They can be issued either solely by the CEC or in partnership with other agencies, such as CARB. The following grants funding opportunities target use cases throughout the state.

- "Zero-Emission Transit Fleet Infrastructure Deployment." Released in July 2020, this grant solicitation announced the availability of up to \$20 million to fund the electric vehicle charging or hydrogen refueling infrastructure needed to support the large-scale conversion of transit bus fleets to ZEVs. Funding was divided into categories to support different fleet types. However, no applications were received in the "Small Fleet/Rural"

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<sup>37</sup> California Energy Commission. October 25, 2019. [Staff Workshop for Medium- and Heavy-Duty Zero-Emission Vehicles](https://www.energy.ca.gov/event/workshop/2019-10/staff-workshop-medium-and-heavy-duty-zero-emission-vehicles-and). Available at <https://www.energy.ca.gov/event/workshop/2019-10/staff-workshop-medium-and-heavy-duty-zero-emission-vehicles-and>.



or “Multiple Fleets/Shared” categories. In the “Small Fleet/Urban” category, \$5 million awards were proposed for one electrification project and one liquid hydrogen refueling project. In the “Large Fleet/Urban” category, a \$6 million electrification and microgrid project was proposed for funding, as was a \$4 million hydrogen refueling project, with \$2 million on general funds added. Subsequently, three additional transit fleet infrastructure projects were awarded, totaling \$14.2 million using general funds.

- “Zero-Emission Drayage Truck and Infrastructure Pilot Project.” In a joint solicitation with CARB, the CEC allocated \$20.1 million from the Clean Transportation Program to fund the zero-emission drayage truck infrastructure and installation, as well as any workforce training and development components. CARB allocated \$24 million from its FY 2019–20 Funding Plan for Clean Transportation Incentives to fund the purchase of on-road zero-emission Class 8 trucks. This solicitation seeks to support large-scale deployments of on-road, zero-emission Class 8 drayage and regional haul trucks, as well as the infrastructure needed for service operation. On July 15, 2021, the CEC approved two projects at a CEC business meeting, one with South Coast Air Quality Management District for a battery-electric infrastructure project and one with the Center for Transportation and the Environment for a hydrogen refueling infrastructure project.
- “Hydrogen Fuel Cell Demonstrations in Rail and Marine Applications at Ports.” Released in July 2020, this solicitation was a collaborative effort between the CEC’s Clean Transportation Program and the CEC’s Natural Gas Research and Development Program. This solicitation sought to fund the design, integration, and demonstration of hydrogen fuel cell systems and hydrogen fueling infrastructure for locomotive and commercial harbor craft applications at California ports. In December 2020, the CEC announced several proposed awardees from this solicitation, including one \$4 million award of Clean Transportation Program funding toward shared hydrogen refueling infrastructure at the Port of West Sacramento. On March 17, 2021, three projects from the CEC’s Natural Gas Research and Development Program were approved at a CEC business meeting.
- “BESTFIT Innovative Charging Solutions.” This solicitation, previously described in the Light-Duty Electric Vehicle Charging Infrastructure section, included eligibility for projects to demonstrate innovative electric vehicle charging solutions for light-duty and medium- and heavy-duty vehicles. On April 16, 2021, the CEC announced a total of more than \$4.1 million in medium- and heavy-duty vehicle sector awards. Three additional medium- and heavy-duty projects were funded using general funds, totaling in additional nearly \$4.3 million.
- “Blueprints for Medium- and Heavy-Duty Zero-Emission Vehicle Infrastructure.” Released in July 2020, this solicitation offered up to \$3 million to fund planning “blueprints” that will identify actions and milestones needed for the implementation of medium- and heavy-duty zero-emission vehicles and the related electric charging or hydrogen refueling infrastructure. The solicitation included a set-aside for public entities. On April 8, 2021, the CEC announced nearly \$4 million in proposed funding to support public agencies and nearly \$2 million in proposed funding to support private entities. On August 16, 2021, a revised NOPA was posted proposing an additional 12 blueprint projects for award, totaling about \$2.4 million using general funds.

On February 28, 2022, the CEC held another workshop focused on identifying funding opportunities for future medium- and heavy-duty ZEV infrastructure projects.<sup>38</sup> Concepts presented by CEC staff for consideration included:

- **Hydrogen Refueling:** This concept seeks projects to build hydrogen refueling stations that would have a public fueling component for light-duty FCEVs and have a public or private component for fueling medium and heavy-duty vehicles.
- **School District Vehicle Grid Integration:** This concept seeks projects from electric vehicle service providers to partner with public school districts, county offices of education, or transportation joint power authorities in areas likely to experience power outages due to public safety power shutoffs or fire danger to minimize operational costs and improve resiliency in emergency situations. These electric vehicle service providers would install bidirectional DCFC charging stations at key sites throughout the school districts, resulting in a final turnkey solution for other school bus operators to adopt.
- **Truck Parking EV Charging and Hydrogen Refueling:** This concept seeks projects focused on the parking and charging or refueling needs or both of independent owner operators and long-haul and regional-haul drivers, including the potential to fund centralized locations for overnight public charging.
- **Warehouse and Regional Trucking:** This concept seeks projects to support medium- and heavy-duty warehouse and regional trucking. Projects may support heavy-duty regional-haul fleets that stay within a 300-mile radius from a home base and medium-duty, last-mile delivery fleets that are in or near a metropolitan area servicing warehouse distribution and fulfillment centers.
- **Innovative EV Charging and Hydrogen Refueling Technologies:** This concept would replicate and improve upon the original “BESTFIT Innovative Charging Solutions” solicitation. This concept would target and fund innovative medium- and heavy-duty charging or hydrogen refueling solutions or both.
- **Mobility-as-a-Service Models:** This concept seeks projects that would provide EV charging or hydrogen refueling infrastructure to support medium- and heavy-duty mobility-as-a service applications, including charging as a service and infrastructure as a service.
- **Rural Small Transit Fleet Infrastructure Deployment:** This concept seeks projects to fund the EV charging or hydrogen refueling infrastructure needed to support the conversion of small rural transit fleets to zero-emission.
- **Large-Scale Ultra-Fast Charging Stations:** This concept seeks projects that would allow for the large-scale buildout for ultra-fast charging station infrastructure.
- **Medium- and Heavy-Duty Blueprint Planning Documents:** This concept would be similar to the previously released grant funding opportunity titled “Blueprints for Medium- and

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38 CEC. “[Staff Workshop on Funding Allocations for Future Medium- and Heavy-Duty Charging and Refueling Infrastructure Projects](https://www.energy.ca.gov/event/workshop/2022-02/staff-workshop-funding-allocations-future-medium-and-heavy-duty-charging-and-refueling-infrastructure-projects).” Available at <https://www.energy.ca.gov/event/workshop/2022-02/staff-workshop-funding-allocations-future-medium-and-heavy-duty-charging-and-refueling-infrastructure-projects>.

Heavy-Duty Zero-Emission Vehicle Infrastructure” and would seek blueprint planning projects to accelerate the deployment of medium- and heavy-duty ZEVs and ZEV infrastructure with a holistic view of transportation planning.

- Infrastructure Concepts to Complement CARB Demonstration and Pilot Project Concepts: This concept seeks to complement CARB’s proposed FY 2021–2022 demonstration and pilot projects with the necessary ZEV infrastructure. CARB’s proposed FY 21/22 demonstration and pilot projects include projects focused on “Municipal Green Zones,” “Resilient Zero-Emission Vessel Charging Project,” “Modular Zero-Emission Capable Cargo Handling Equipment Demonstration,” “Emission Reductions From Oceangoing Vessels,” and “Zero-Emission Intrastate Line-Haul Locomotive.”
- Medium- and Heavy-Duty Loan Pilot: This concept would complement the CECs grant opportunities by making loans available for medium- and heavy-duty zero-emission infrastructure projects. The CEC continues to seek information from the public to determine the viability of and interest in a medium- and heavy-duty loan program.

Because of limited funds, the CEC may not pursue all of these funding opportunities or may provide grant funding for concepts not listed above or both. Decisions regarding funding implementation will be developed based on stakeholder feedback, emerging needs or opportunities, alignment with key state policies, and other considerations.

## Summary

To meet state GHG and air-quality goals, this sector will need to transition to zero-emission technologies, and the resources required for this to be an equitable transition exceed available public funding. CEC staff expects an increasing demand for dedicated charging and fueling infrastructure for medium- and heavy-duty ZEVs funded through the Clean Transportation Program and by other state incentive programs. As the state’s lead agency for ZEV infrastructure deployment, the CEC will focus on the infrastructure needs, both dedicated infrastructure and publicly accessible infrastructure, of medium- and heavy-duty ZEVs. In addition, the CEC will seek ways to include grid integration, integrated storage solutions, and charging management as complementary technologies. Staff will also consider land use, housing policies, data and analysis from AB 2127 and SB 643, and Sustainable Community Strategies as they relate to medium- and heavy-duty ZEV infrastructure investments.

For FY 2022–2023, the CEC allocates \$30.1 million in Clean Transportation Program funding and \$130 million in general funds dedicated to medium- and heavy-duty to meet the growing needs of charging and hydrogen fueling infrastructure for medium- and heavy-duty ZEVs, as well as demonstrate the state’s commitment to improving air quality. In accordance with Senate Bill 129 and pending legislative approval, this \$130 million will be allocated to the specific categories of drayage, transit, and school bus applications.

## Hydrogen Fueling Infrastructure

Assembly Bill 8 (Perea, Chapter 401, Statutes of 2013) directs the CEC to allocate \$20 million annually, not to exceed 20 percent of the funds appropriated by the Legislature, from the Alternative and Renewable Fuel and Vehicle Technology Fund for planning, developing, and

building hydrogen-fueling stations until there are at least 100 publicly available stations in California.

## **Evaluating the Deployment of FCEVs and Hydrogen Fueling Stations**

Assembly Bill 8 requires CARB to evaluate the need annually for additional publicly available hydrogen fueling stations. This evaluation includes the quantity of fuel needed for the actual and projected number of hydrogen-fueled vehicles (based on DMV registrations and automaker projections), geographic areas where fuel will be needed, and station coverage.

Based on this evaluation, CARB reports to the CEC the estimated number of needed stations; areas where additional stations will potentially be needed; and minimum operating standards, such as number of dispensers, filling protocols, and pressure. CARB estimates station and FCEV projections for up to six years in the future, based on mandatory survey information provided by vehicle manufacturers for the next three model years and voluntary information for an additional three following model years.

CARB released the *2021 Annual Evaluation of Fuel Cell Electric Vehicle Deployment & Hydrogen Fuel Station Network Deployment* (annual evaluation) report in September 2021 to comply with the requirements of Assembly Bill 8.<sup>39</sup> In this assessment, CARB stated that “[t]oday’s hydrogen network development plans are unprecedented in California’s history and a major milestone in supporting ZEV deployment. Early goals for the fueling network and FCEV market may be within reach. California will be well on its way to developing a viable market for FCEVs as a strategic component of meeting the State’s ZEV deployment targets.” CARB also reported that 61,100 FCEVs are projected by 2027 based on auto manufacturer survey responses.

In December 2021, the CEC and CARB released the *Joint Agency Staff Report on Assembly Bill 8: 2021 Annual Assessment of Time and Cost Needed to Attain 100 Hydrogen Fueling Stations in California*.<sup>40</sup> The report states that when 90 funded stations are open, the network will have enough fuel to support nearly 100,000 FCEVs. Since the release of the report, two stations that were in development canceled, changing the total funded stations to 88. These 88 stations include 80 that are receiving grant funding and 8 that are privately funded under the CEC agreement. The report states that awardees of the most recent CEC funding solicitation (GFO-19-602) are expected to develop as many as 82 additional stations (including 8 to be privately funded under CEC agreements) if fully funded through future appropriations of Clean Transportation Program funds. In addition, 7 privately funded stations are anticipated outside CEC agreements. Adding all these numbers together makes 177 publicly available light-duty stations. The CEC estimates that California will have in excess of 100 open retail stations by

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39 California Air Resources Board. September 2021. [2021 Annual Evaluation of Fuel Cell Electric Vehicle Deployment & Hydrogen Fuel Station Network Development](https://ww2.arb.ca.gov/sites/default/files/2021-09/2021_AB-8_FINAL.pdf). Available at [https://ww2.arb.ca.gov/sites/default/files/2021-09/2021\\_AB-8\\_FINAL.pdf](https://ww2.arb.ca.gov/sites/default/files/2021-09/2021_AB-8_FINAL.pdf).

40 Baronas, Jean, Gerhard Achtelik, et al. 2020. [Joint Agency Staff Report on Assembly Bill 8: 2020 Annual Assessment of Time and Cost Needed to Attain 100 Hydrogen Refueling Stations in California](https://ww2.energy.ca.gov/2020publications/CEC-600-2020-008/CEC-600-2020-008.pdf). California Energy Commission and California Air Resources Board. Publication Number: CEC-600-2020-008. Available at <https://ww2.energy.ca.gov/2020publications/CEC-600-2020-008/CEC-600-2020-008.pdf>.

the end of 2023, thereby meeting the original AB 8 minimum requirement of 100 stations. Funding from last year's ZEV Package is expected to help California meet the 200-station goal. With the addition of stations from GFO-19-602, the state anticipates having hydrogen refueling capability to serve up to 290,000 light-duty FCEVs, which is more than four times the project demand for 2027.

The report also highlighted that the state has expanding options for hydrogen supply. The CEC has invested in new hydrogen production plants, and private sector investments are increasing the options for hydrogen supply. Stations have relied on few suppliers in the past, and supply chain issues could affect a large portion of the network. GFO-19-602 requires stations funded under the solicitation to have a second supply agreement as backup to ensure station operators do not rely on a single supply source, and these expanding supply options will lessen the effect of a single-source disruption.

### **Clean Transportation Program Funding to Date**

Through the Clean Transportation Program, the CEC has provided nearly \$166 million of funding to support 80 publicly available hydrogen stations capable of light-duty vehicle fueling, including associated operations and maintenance. As of February 2022, 55 hydrogen fueling stations were open retail in California.

Furthermore, the three awardees under Solicitation GFO-19-602 can receive additional grant funds of up to \$85.9 million for subsequent batches of stations depending on performance, funding availability, and Clean Transportation Program Investment Plan Update funding allocations. If fully funded, the solicitation combined with privately funded stations should result in 177 stations, with at least 13 stations being capable of fueling light-, medium-, and heavy-duty vehicles. This leveraged infrastructure will address several markets and accelerate the development of commercial fuel cell electric trucks with the potential to reduce local air pollution from the goods movement sector.

Stations funded by the Clean Transportation Program before GFO-19-602 are required to dispense fuel with at least 33 percent renewable hydrogen content, and stations resulting from GFO-19-602 are mandated to reach at least 40 percent of the hydrogen from renewable sources. Many open retail stations are dispensing hydrogen with about 90 percent renewable content (mostly through the purchase of biogas credits in lieu of renewable hydrogen produced directly from renewable sources).

### **Other Sources of Project Support**

The Hydrogen Refueling Infrastructure (HRI) credit provision of the Low Carbon Fuel Standard (LCFS) became effective in January 2019. This provision allows eligible hydrogen fueling station operators to earn HRI credits based on the capacity of the hydrogen station for a

limited period, rather than being limited to credit generation based on the amount of hydrogen fuel dispensed.<sup>41</sup>

One hydrogen fueling station funding recipient has received \$5 million from the Volkswagen Mitigation Trust fund to support the development of five hydrogen refueling stations as part of GFO-19-602. The use of the \$5 million mitigation trust funds and cooperation among CARB, the Bay Area Air Quality Management District, and the CEC will reduce the time and funding required to reach the statutory goal of at least 100 publicly available hydrogen fueling stations operating in California. This approach will fund additional stations to set California on the path toward 200 stations.

## Summary

For FY 2022–2023, the CEC allocates \$20 million of Clean Transportation Program funds for hydrogen fueling infrastructure, consistent with AB 8.<sup>42</sup> Stations funded under GFO-19-602 will have larger fueling capacities than most of the stations that the CEC funded early in the program. These stations should be able to provide fueling capability adequate to support more than the number of FCEVs that are projected in 2027 as reported in CARB’s annual evaluation based on auto manufacturer survey responses. The expected fueling capability will also enable additional FCEV market penetration beyond 2027. However, the CEC, in collaboration with CARB, will continue to monitor the market.

CEC staff expects there will be an excess of 100 stations in operation by the end of 2023, on the path to reaching the 200-station target, enabled by economies of scale achieved through the combination of (1) the Clean Transportation Program multiyear, multistation funding solicitation (GFO-19-602), (2) LCFS HRI credits, (3) increased private investment, and (4) a one-time general fund investment from Fiscal Year 2021–2022. With this in mind, the funding allocations of this investment plan propose a \$10 million allocation (which equates to 20 percent of the expected funds for the Clean Transportation Program in 2023) for hydrogen fueling infrastructure for the final half-year of this multiyear investment plan. The CEC will evaluate whether the proposed allocation for the final year of the program is sufficient to meet the needs of the FCEV market and will adjust as needed in annual revisions to the plan. This evaluation will be informed by CARB’s annual evaluation, as well as input from the Advisory Committee, Disadvantaged Communities Advisory Group, and other stakeholders.

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41 California Air Resources Board [Resolution 18-34](https://www.arb.ca.gov/fuels/lcfs/rulemakingdocs.htm) information is available at <https://www.arb.ca.gov/fuels/lcfs/rulemakingdocs.htm>. This modification to the LCFS provides credits to hydrogen fueling station owners for 15 years, with the credits being calculated based on the nameplate capacity of the station not to exceed 1,200 kilograms of hydrogen per day and the availability (or uptime) of the station relative to the permitted hours of operation. The amount of dispensed hydrogen is subtracted from the calculation of HRI credits so that credits are not double earned.

42 California Health and Safety Code Section 43018.9.

# CHAPTER 5:

## Alternative Fuel Production and Supply

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### Zero- and Near-Zero-Carbon Fuel Production and Supply

The California transportation sector relies largely on petroleum, which accounts for 89 percent of ground transportation fuel used in the state.<sup>43</sup> Low-carbon substitute fuels that can displace the roughly 14 billion gallons of petroleum-based gasoline and 3.3 billion gallons of petroleum-based diesel used per year in California have the potential to provide immediate and long-term opportunities to reduce GHG emissions and criteria air pollution.<sup>44</sup> Biofuels — defined in this document as nonpetroleum diesel substitutes, gasoline substitutes, and biomethane — represent the largest existing stock of alternative fuel in the California transportation sector.<sup>45</sup> In addition, production of and demand for renewable hydrogen are expected to increase in the coming years as more hydrogen fuel cell electric vehicles are sold and applications in other sectors expand.

The carbon intensity of renewable fuels can vary significantly depending on the pathway, which accounts for the specific feedstock and production process of the fuel. CARB provides carbon intensity values for most transportation fuels as part of the LCFS. The carbon intensity value accounts for the life-cycle GHG emissions of the fuel, including production, transportation, and consumption, and is reported in grams of carbon dioxide equivalent greenhouse gases per megajoule (gCO<sub>2</sub>e/MJ).<sup>46</sup> Maximizing renewable fuel production from the lowest carbon pathways represents a key opportunity to reduce near-term GHG emissions in combustion engines and fuel cell electric vehicles. Clean Transportation Program funding uniquely drives innovative biofuel production plants to California, which may otherwise come from out of state.

### Fuel Type Overview

#### Renewable Diesel and Biodiesel

In 2019, renewable diesel was the most common diesel substitute in California, with 609 million diesel-gallon equivalents sold.<sup>47</sup> Renewable diesel that meets the fuel specification

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43 Based on analysis from California Energy Commission Energy Assessments Division, with data from the California Department of Motor Vehicles.

44 Ibid.

45 The term “gasoline substitutes” refers to any liquid fuel that can directly displace gasoline in internal combustion engines, including ethanol and renewable drop-in gasoline substitutes. The term “diesel substitutes” refers to any liquid fuel that can significantly displace diesel fuel, including biodiesel and renewable diesel. These definitions differ from similar terms used by CARB under the LCFS, which are broader and include fuels such as electricity, natural gas, and hydrogen.

46 Consult the glossary for the definition of “megajoule.”

47 California Air Resources Board. October 30, 2020. [CARB Data Dashboard](https://ww3.arb.ca.gov/fuels/lcfs/dashboard/dashboard.htm) Available at <https://ww3.arb.ca.gov/fuels/lcfs/dashboard/dashboard.htm>.

requirements of ASTM International Standard D975 is fungible, or interchangeable, with conventional diesel fuel and can be used in existing diesel engines and fuel infrastructure. Biodiesel is another diesel substitute; however, unlike renewable diesel, it is not fully fungible with conventional diesel fuel.

Renewable diesel and biodiesel have carbon intensities up to 92 percent lower than diesel fuel, depending on the pathway used.<sup>48</sup> Together, renewable diesel and biodiesel accounted for about 45 percent of LCFS credits in 2019.<sup>49</sup> Of the 3.8 billion gallons of diesel fuel consumed in California in 2019, about 830 million (or 22 percent) were from low-carbon biodiesel or renewable diesel.

Within California, there are limited distribution methods for the different types of low-carbon fuels. As LCFS continues to encourage increased production and supply of low-carbon fuels in California, the infrastructure to distribute low-carbon fuels will have to be in place to meet California's low-carbon fuel production potential and consumption needs, as well as accomplish California's greenhouse gas emission goals.

### **Ethanol and Renewable Gasoline**

Ethanol is the only widely available gasoline substitute for gasoline-powered vehicles and is used primarily as a fuel additive with gasoline. California limits ethanol blends in conventional gasoline to 10 percent, although the U.S. EPA permits blends of up to 15 percent for a conventional engine and 85 percent for a flex-fuel engine. Though ethanol continues to be the largest volume alternative fuel used in California, in-state ethanol use has not substantially changed since 2011.

Renewable gasoline is a potential gasoline substitute, although it is undergoing research and development and is not commercially available. Renewable crude oil products can serve as a fully fungible substitute for petroleum crude oil at refineries. Renewable crude oil is in the research and development phase.

### **Biomethane**

Biomethane (or "renewable natural gas") is a commercially mature biofuel that serves as a low- or negative-carbon substitute for conventional natural gas. Biomethane from anaerobic digestion of wastewater sludge can reduce GHG emissions by as much as 92 percent below diesel. Biomethane derived from high-solids anaerobic digestion of prelandfill food and green wastes has a carbon intensity around *negative* 23 gCO<sub>2</sub>e/MJ (or roughly 125 percent below diesel), indicating that the pathway contributes a net GHG emission reduction. Biomethane

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48 Compared to California diesel (102.01 gCO<sub>2</sub>e/MJ), with biodiesel carbon intensity as low as 8.63 gCO<sub>2</sub>e/MJ and renewable diesel carbon intensity as low as 16.89 gCO<sub>2</sub>e/MJ. Based on data from the [LCFS Fuel Pathway Table](https://www.arb.ca.gov/fuels/lcfs/fuelpathways/current-pathways_all.xlsx) (April 16, 2019), available at [https://www.arb.ca.gov/fuels/lcfs/fuelpathways/current-pathways\\_all.xlsx](https://www.arb.ca.gov/fuels/lcfs/fuelpathways/current-pathways_all.xlsx).

49 California Air Resources Board. April 30, 2019. "[LCFS Quarterly Data Spreadsheet.](http://www.arb.ca.gov/fuels/lcfs/lrtqsummaries.htm)" Available at <http://www.arb.ca.gov/fuels/lcfs/lrtqsummaries.htm>.



derived from dairy biogas has the lowest carbon intensity approved under the LCFS — about negative 255 gCO<sub>2</sub>e/MJ.<sup>50</sup>

The potential of low-carbon biomethane to replace natural gas in the transportation sector is based on the availability of waste-based feedstocks, and estimates vary on technical and economical availability. The University of California, Davis, Institute of Transportation Studies indicated an economically feasible potential of roughly 623 million diesel gallon equivalents (DGE). According to the U.S Department of Energy's *2016 Billion Ton Report*, slightly higher estimates indicate that waste residues from in-state dairies, landfills, food diversion, and wastewater treatment plants could be used to produce biomethane in volumes ranging from 750 million to 1.2 billion gallons DGE per year. This would displace 23 percent to 36 percent of the on-road diesel fuel consumption in California.<sup>51</sup> However, based on other studies provided by NREL, the technical availability (under preferable market conditions) could be four times higher.<sup>52</sup> Regardless, given the limited availability, the carbon reduction benefits from biomethane need to be prioritized for specific transportation applications (as well as other purposes), where appropriate.

## Renewable Hydrogen

Senate Bill 1505 (Lowenthal, Chapter 877, Statutes of 2006) requires that at least 33.3 percent of hydrogen used for transportation come from renewable sources. As part of the Low Carbon Fuel Standard credits for ZEV infrastructure that took effect in January 2019, qualifying stations must have a renewable content of 40 percent or higher. Renewable hydrogen is typically produced through steam reformation of biomethane or through electrolysis using water and renewable electricity. Other renewable hydrogen production pathways are also being explored through research and development efforts globally.

According to the California Independent System Operator, increasing amounts of renewable power generation may result in electricity oversupply as California renewable power requirements grow from 33 percent to 50 percent.<sup>53</sup> Renewable hydrogen production is being investigated as a viable technology for beneficial use of this surplus renewable energy. While the capital costs of electrolyzers have decreased, the overall cost of renewable hydrogen remains high and is not expected to be competitive with fossil-based hydrogen for 10 years; however, the use of renewable electricity could contribute to reductions in capital costs for renewable hydrogen production. Additional cost-reduction methods include improvements in

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50 California Air Resources Board. October 31, 2018. "[LCFS Pathway Certified Carbon Intensities.](https://www.arb.ca.gov/fuels/lcfs/fuelpathways/pathwaytable.htm)" Available at <https://www.arb.ca.gov/fuels/lcfs/fuelpathways/pathwaytable.htm>.

51 U.S. Department of Energy. July 2016. [2016 Billion Ton Report: Advancing Domestic Resources for a Thriving Bioeconomy.](https://www.energy.gov/sites/prod/files/2016/12/f34/2016_billion_ton_report_12.2.16_0.pdf) Available at [https://www.energy.gov/sites/prod/files/2016/12/f34/2016\\_billion\\_ton\\_report\\_12.2.16\\_0.pdf](https://www.energy.gov/sites/prod/files/2016/12/f34/2016_billion_ton_report_12.2.16_0.pdf).

52 California Energy Commission staff. 2017. [2017 Integrated Energy Policy Report.](https://www.energy.ca.gov/data-reports/reports/integrated-energy-policy-report/2017-integrated-energy-policy-report) California Energy Commission. Publication Number: CEC-100-2017-001-CMF. Available at <https://www.energy.ca.gov/data-reports/reports/integrated-energy-policy-report/2017-integrated-energy-policy-report>.

53 California Independent System Operator. "[Managing Oversupply.](http://www.caiso.com/informed/Pages/ManagingOversupply.aspx)" <http://www.caiso.com/informed/Pages/ManagingOversupply.aspx>.

how hydrogen is treated, stored, and delivered, as well as economies of scale afforded by expanding applications of hydrogen fuel.

### Clean Transportation Program Funding to Date

To date, the CEC has awarded nearly \$210 million to 68 low-carbon fuel production projects. These awards are summarized by fuel type in Table 9.

**Table 9: Summary of Clean Transportation Program Low-Carbon Fuel Production Awards as of February 3, 2022**

Fuel Type	Qualifying Proposals* Submitted	Funds Requested by Qualifying Proposals* (in Millions)	Awards Made	Funds Awarded (in Millions)
Gasoline Substitutes	28	\$71.8	14	\$31.8
Diesel Substitutes	62	\$187.1	26	\$75.1
Biomethane	71	\$221.4	33	\$92.6
Renewable Hydrogen	13	\$38.7	5	\$16.9
<b>Total</b>	<b>174</b>	<b>\$519</b>	<b>78</b>	<b>\$216.4</b>

Source: California Energy Commission. Does not include results from GFO-19-601, which was funded through a separate source of funding called the California Climate Investment Fund. \*The term “qualifying proposals” refers to proposals that received at least a passing score.

The Clean Transportation Program investments into low-carbon fuel production are typically focused on either smaller precommercial projects or large community- or commercial-scale projects. The smaller, precommercial projects have typically focused on transformative technology solutions that have the potential to increase yields, productivity, or cost-effectiveness of low-carbon fuel production. The CEC funds these pilot and demonstration projects with the expectation that, after successful operations at this scale, the technology will be suitable for commercial use. These precommercial projects are focused on advanced new technologies and approaches that can subsequently be expanded into wider markets.

In April 2021, the CEC released GFO-20-608 titled “Ultra-Low Carbon Fuel Production: Commercial-Scale Production Facilities & Blending Infrastructure.” This solicitation was an offer to fund ultra-low carbon transportation fuel production at new and existing advanced fuel production plants and fuel blending infrastructure projects. The solicitation provided \$9 million from the Clean Transportation Program, and in November 2021, the CEC issued a NOPA of five grants to fully use the funding.

Also in April 2021, the CEC released GFO-20-609 titled “Renewable Hydrogen Transportation Fuel Production.” This solicitation was an offer to fund the construction and/or expansion of hydrogen production facilities that produce renewable hydrogen transportation fuel using in-state renewable resources. The solicitation provided \$9 million from the Clean Transportation Program, and in February 2022, the CEC issued a NOPA for three grants to fully use the funding.

## Other Sources of Funding

Other state and federal programs provide support and incentives to low-carbon fuel producers. For instance, the California Department of Food and Agriculture (CDFA) awarded \$35.2 million in October 2017 for anaerobic digesters at dairies through the Dairy Digester Research and Development Program (DDRDP) and awarded \$72.4 million for additional dairy digester projects in 2018. In 2019, the CDFA awarded additional funding of more than \$67.3 million for these activities. In October 2020, the CDFA awarded nearly \$25.4 million in grant funding to methane reduction projects across the state. These projects, part of the DDRDP and the Alternative Manure Management Program (AMMP), will reduce greenhouse gas emissions from manure on California dairy and livestock farms. Twelve DDRDP projects totaling \$16.5 million and 13 AMMP projects totaling \$8.9 million are being funded through the most recent round of funding. The CEC will work with these agencies to ensure future funding awards are complementary.

In addition, the LCFS and the Renewable Fuel Standard (the federal program that requires transportation fuel sold in the United States to contain a minimum volume of renewable fuels) can support low-carbon fuel producers by creating markets for carbon credits and renewable fuels. The incentives earned through the LCFS provide steady financial support to low-carbon fuel producers, distributors, and blenders in California. In 2019, about 81.3 percent of LCFS credits were granted for biofuels including biomethane, ethanol, biodiesel, and renewable diesel.<sup>54</sup> These credits equate to an incentive of more than \$1.36 billion for biofuel producers and retailers if sold at the average credit price of \$191 for 2019.<sup>55</sup> CARB and CEC staff expects that the LCFS will serve as the state's primary source of financial support for low-carbon fuel production and distribution.

## Summary

The CEC will continue to examine the best use of funds in these categories through a public stakeholder process and backed up with data and analysis. Several factors will be considered, including the near-term petroleum and GHG emission reduction potential of low-carbon, drop-in gasoline or petroleum replacement, the need to decarbonize hydrogen production, and market conditions. There may also be opportunities to expand or otherwise improve the limited distribution of liquid biofuels (whether for drop-in substitutes or blending).

Some fuel types and pathways have shown minimal improvement in carbon intensity or cost-effectiveness in recent funding solicitations, which may indicate that the technology or process has fully matured. The CEC may evaluate renewable fuel types and production pathways to determine when state incentives are no longer necessary. As the market for low-carbon fuels continues to develop, the CEC may also consider alternative funding mechanisms, such as revolving loan or loan guarantee programs, which may be more suitable for large projects and developed industries.

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54 California Air Resources Board. March 26, 2021. "[LCFS Quarterly Data Spreadsheet.](http://ww3.arb.ca.gov/fuels/lcfs/dashboard/figure2_053120.xlsx)" Available at [http://ww3.arb.ca.gov/fuels/lcfs/dashboard/figure2\\_053120.xlsx](http://ww3.arb.ca.gov/fuels/lcfs/dashboard/figure2_053120.xlsx).

55 Ibid.

For FY 2022–2023, the CEC allocates \$10 million in Clean Transportation Program funding for zero- and near-zero-carbon fuel production and supply. Funding priorities for this allocation may include increasing the in-state production of low-carbon fuels from waste-based feedstocks such as woody biomass from forest or agricultural sources, supporting upstream blending infrastructure, and improving the state’s supply of renewable hydrogen from renewable electricity or biomethane.

# CHAPTER 6:

## Related Opportunities

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### Manufacturing

Electric vehicles were the number one California export in 2020.<sup>56</sup> California is also home to more than 360 companies with 70,000 employees that work directly on zero-emission transportation, including vehicles, components, infrastructure, and research.<sup>57</sup> California has 43 ZEV-related manufacturers and leads the nation in ZEV manufacturing jobs.

The range of ZEV platforms includes light-, medium-, and heavy-duty on- and off-road vehicles. Some of the Clean Transportation Program-funded companies are completely vertically integrated, such as Proterra and Zero Motorcycles. Other companies manufacture parts and components, such as electric vehicle chargers, electric powertrains, and battery control systems, as represented by ChargePoint, Motiv Power Systems, and Freewire Technologies. Support for California's ZEV supply chain companies can be seen by the incentives offered through the California Alternative Energy and Advanced Transportation Financing Authority, California Competes, and the CEC's Clean Transportation Program.

Since the inception of the Clean Transportation Program, five solicitations have been issued under the manufacturing category totaling \$55 million for 27 projects. Clean Transportation Program grants have been invaluable in attracting companies to California, leveraging the state's policy objectives, scaling growth in-state and abroad, and creating jobs.

Some California ZEV manufacturers have established formal worker relationships with organized labor. BYD Coach and Bus in Lancaster (Los Angeles County) has established an apprenticeship program with Sheet Metal Workers Local 105 and Antelope Valley College. Proterra Inc. in the City of Industry (Los Angeles County) announced in November 2019 it's joining the United Steelworkers. Manufacturing jobs are critical to disadvantaged communities, low-income communities, and small businesses. More than 800 manufacturing jobs have been created or retained under the Clean Transportation Program manufacturing portfolio.

The Budget Act of 2021 provides \$125 million of general fund money in Fiscal Year 2021–2022 for the CEC to invest in manufacturing grants to "increase in-state manufacturing of zero-emission vehicles, zero-emission vehicle components, and zero-emission vehicle charging or refueling equipment." An additional \$125 million for the same activity was included in the Governor's budget plan for Fiscal Year 2022–2023.

Implementation of a successful grant program for in-state manufacturing requires collaboration and alignment with state agencies that provide funding and support, such as the

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56 US Census Bureau. "[State Export From California](https://www.census.gov/foreign-trade/statistics/state/data/ca.html)" is available at <https://www.census.gov/foreign-trade/statistics/state/data/ca.html>.

57 CALSTART. "[CALSTART's California ZEV Jobs Study](https://calstart.org/wp-content/uploads/2021/02/CA-ZEV-Jobs-Study-Final-0203.pdf)." January 2021. Available at <https://calstart.org/wp-content/uploads/2021/02/CA-ZEV-Jobs-Study-Final-0203.pdf>.

California Business Investment Services in the Governor’s Office of Business and Economic Development, the California Alternative Energy and Advanced Transportation Financing Authority in the State Treasurer’s Office, and the California Employment Training Panel. Program success will also include engagement with the economic and business development entities of local cities and counties who provide frontline services to manufacturing companies. To this end, staff is working with these entities to promote ZEV manufacturing and have conducted workshops to allow public input and deeper engagement with ZEV manufacturers and supply chains to leverage this opportunity. The first of such workshops was held October 29, 2021, on ZEV and ZEV-Related Manufacturing, and the second was held January 25, 2022, on a block grant for battery manufacturing.

The Zero Emission Transportation Manufacturing grant funding opportunity will make \$60 million available for projects that will increase in-state manufacturing of ZEVs, ZEV components, EV batteries, and ZEV infrastructure. This grant funding opportunity was released on March 30, 2022.<sup>58</sup>

The ZEV Battery Manufacturing Block Grant solicitation will offer \$25 million in grant funds for projects that will increase in-state manufacturing of ZEV batteries. An implementer selected through a competitive solicitation will award these funds to manufacturers through a process in collaboration with the CEC. These secondary awards will be at least \$1 million, potentially up to \$10 million, each. This block grant solicitation is expected to be released in June 2022.

The CEC will have the ability to increase the total awards under both of these funding solicitations, based on both the remaining funding in Fiscal Year 2021-2022 as well as the potential addition of \$125 million anticipated for Fiscal Year 2022–2023, pending legislative appropriation in that year’s budget.

## **Workforce Training and Development**

Investments into workforce training and development are critical to the advancement of ZEV markets. More than \$36 million has been invested in workforce projects for more than 21,000 trainees, faculty, and trainers. Workforce investments are driven by state policies and priorities, needs of the ZEV market, support for job placement, and economic sustainability in priority communities which includes:

- Directing workforce investments and accruing benefits to disadvantaged and low-income communities.
- Paring workforce projects in ZEV deployment areas.
- Requiring ZEV workforce plans for solicitations and incentives.
- Building new partnerships for co-investments, job growth, and community workforce priorities.
- Supporting high-road principles, job quality, and job quantity.

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<sup>58</sup> CEC. [GFO-21-605 - Zero-Emission Transportation Manufacturing](https://www.energy.ca.gov/solicitations/2022-03/gfo-21-605-zero-emission-transportation-manufacturing). Available at: <https://www.energy.ca.gov/solicitations/2022-03/gfo-21-605-zero-emission-transportation-manufacturing>

- Addressing workforce, market trends, and growth in all ZEV industries.

The CEC recently announced the IDEAL (Inclusive, Diverse, Equitable, Accessible, and Local) ZEV Workforce Pilot, which provided more than \$6 million in funding for workforce training and development that supports ZEVs, ZEV infrastructure, and ZEV-related commercial technologies in California.

The IDEAL ZEV Workforce Pilot solicitation issued in partnership with CARB provides workforce partnerships that will grow new ZEV workforces that can be replicated in priority communities. Moreover, there will be an augmentation to an existing workforce investment required to address immediate ZEV workforce needs for medium- and heavy-duty vehicles. Project examples that will be coming online include:

- **Tribal ZEV Training Project** – The National Indian Justice Center (NJIC) will partner with 23 tribes and the Electric Vehicle Infrastructure Training Program (EVITP) to develop ZEV and EV charging curriculum, conduct training, and create a workforce pipeline from tribal communities to into ZEV industries and occupations.
- **ZEV Truck Programs** – San Diego Miramar College successfully launched a light-duty ZEV program at seven community colleges in priority communities in the state. A new \$1.8 million augmentation to an existing agreement with the college will support the establishment of medium- and heavy-duty vehicle ZEV programs to meet workforce needs for technicians in growing ZEV deployment areas.
- **EVITP Training and Certification** – The need for certified EVITP electricians is strong and requires support especially in non-urban areas and in priority communities. Kern Community College District, in partnership with colleges in rural areas, will support electric vehicle charging infrastructure electricians/contractors and EVITP examinees in becoming EVITP certified.
- **ZEV Service Technician Educational Pathway Project** – Fresno City College will partner with three Fresno County high schools to establish a dual-enrollment program, conduct classroom and lab training on EVs, and administer ZEV Internships with local automotive dealerships.

In 2021, Senate Bill 589 (Chapter 732, Statutes of 2021) was signed by Governor Newsom. SB 589 requires, as part of the AB 2127 statewide charging infrastructure assessment, that the CEC “identify workforce development and training resources needed to meet these goals,” which will be addressed in the CEC’s upcoming update to the inaugural AB 2127 report. Findings from this SB 589 analysis will further inform funding allocations and implementation decisions for workforce training within the Clean Transportation Program.

## Summary

Based on the state’s ZEV regulations, increased deployment of ZEVs, and the need to meet critical ZEV training needs, especially in priority communities, the CEC allocates \$5 million for workforce training and development in FY 2022–2023. The CEC will continue to explore new public-private partnerships and leverage limited resources to determine how Clean Transportation Program funding can best be invested to maximize the benefits of this funding. Workforce training and development investments will continue to support priority communities,

meet ZEV industry needs, create workforce partnerships, and advance job quality and quantity across the entire ZEV workforce ecosystem.



## GLOSSARY

**AIR POLLUTANT** — Amounts of foreign or natural substances occurring in the atmosphere that may result in adverse effects to humans, animals, vegetation, or materials or any combination thereof.

**ANAEROBIC DIGESTION** — A biological process in which biodegradable organic matter is broken down by bacteria into biogas, which consists of methane (CH<sub>4</sub>), carbon dioxide (CO<sub>2</sub>), and trace amounts of other gases. The biogas can be further processed into a transportation fuel or combusted to generate heat or electricity.

**BATTERY-ELECTRIC VEHICLE** — A type of electric vehicle that derives power solely from the chemical energy stored in rechargeable batteries.

**BIODIESEL** — A transportation fuel for use in diesel engines that is produced through the transesterification of organically derived oils or fats. Transesterification is a chemical reaction between oil and alcohol that forms esters (in this case, biodiesel) and glycerol.

**BIOMETHANE** — A pipeline-quality gas that is fully interchangeable with conventional natural gas and can be used as a transportation fuel to power natural gas engines. Biomethane is most commonly produced through anaerobic digestion or gasification using various biomass sources. Also known as renewable natural gas (RNG).

**BRITISH THERMAL UNIT (Btu)** — A unit of heat energy. One Btu is equal to the amount of energy required to raise the temperature of 1 pound of water by 1 degree Fahrenheit at sea level. One Btu is equivalent to 252 calories, 778 foot-pounds, 1,055 joules, or 0.293 watt-hours.

**CALENVIROSCREEN** — A screening method that can be used to help identify California communities that are disproportionately burdened by multiple sources of pollution. The CalEnviroScreen tool combines different types of census tract-specific information into a score to determine which communities are the most burdened or "disadvantaged."

**CARBON DIOXIDE EQUIVALENT** — A measure used to compare emissions from various greenhouse gases based upon the related global warming potential. The carbon dioxide equivalent for a gas is derived by multiplying the mass of the gas by the associated global warming potential.

**CARBON INTENSITY** — A measure of greenhouse gas emissions by weight per unit of energy. A common measure of carbon intensity is grams of carbon dioxide equivalent greenhouse gases per megajoule of energy (gCO<sub>2</sub>e/MJ).

**CRITERIA AIR POLLUTANT** — An air pollutant for which acceptable levels of exposure can be determined and for which the U.S. Environmental Protection Agency has set an ambient air quality standard. Examples include ozone (O<sub>3</sub>), carbon monoxide (CO), nitrogen oxides (NO<sub>x</sub>), sulfur oxides (SO<sub>x</sub>), and particulate matter (PM<sub>10</sub> and PM<sub>2.5</sub>).

**DISADVANTAGED COMMUNITIES** — Disadvantaged communities refers to the areas throughout the state that most suffer from a combination of economic, health, and

environmental burdens. These burdens include poverty, high unemployment, air and water pollution, presence of hazardous wastes, as well as high incidence of asthma and heart disease.

**DIRECT CURRENT FAST CHARGER** — Equipment that provides charging through a direct-current plug, typically at a rate of 50 kilowatts or higher.

**ELECTRIC VEHICLE** — A vehicle that uses an electric propulsion system. Examples include battery-electric vehicles, hybrid electric vehicles, and fuel cell electric vehicles.

**ELECTROLYSIS** — A process by which a chemical compound is broken down into associated elements by passing a direct current through it. Electrolysis of water, for example, produces hydrogen and oxygen.

**EQUITY** — Refers to the fair treatment, meaningful involvement, and investment of resources through clean transportation programs, incentives, and processes for all Californians so that race, color, national origin, or income level are not barriers to increased opportunities, benefits, and sustainability.

**ETHANOL** — A liquid that is produced chemically from ethylene or biologically from the fermentation of various sugars from carbohydrates found in agricultural crops and cellulosic residues. Used in the United States as a gasoline octane enhancer and oxygenate, or in higher concentration (E85) in flex-fuel vehicles.

**FEEDSTOCK** — Any material used directly as a fuel or converted into fuel. Biofuel feedstocks are the original sources of biomass. Examples of biofuel feedstocks include corn, crop residue, and waste food oils.

**FLEX-FUEL VEHICLE** — A vehicle that uses an internal combustion engine that can operate on alcohol fuels (methanol or ethanol), regular unleaded gasoline, or any combination of the two from the same fuel tank.

**FUEL CELL** — A device capable of generating an electrical current by converting the chemical energy of a fuel (for example, hydrogen) directly into electrical energy.

**FUEL CELL ELECTRIC VEHICLE** — A type of electric vehicle that derives power from an onboard fuel cell.

**GREENHOUSE GAS** — Any gas that absorbs infrared radiation in the atmosphere. Common examples of greenhouse gases include water vapor, carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), halogenated fluorocarbons (HCFCs), ozone (O<sub>3</sub>), perfluorinated carbons (PFCs), and hydrofluorocarbons (HFCs).

**HIGH-SOLIDS ANAEROBIC DIGESTION** — High-solids anaerobic digestion process is one in which the percentage of total solids of the feedstock is greater than 15 percent and little or no water is added to the digester.

**HYBRID VEHICLE** — A vehicle that uses two or more types of power, most commonly using a combustion engine together with an electric propulsion system. Hybrid technologies typically expand the usable range of electric vehicles beyond what an electric vehicle can achieve with

batteries alone and increase fuel efficiency beyond what an internal combustion engine can achieve alone.

**INVESTOR-OWNED UTILITY** — A private company that provides a utility, such as water, natural gas, or electricity, to a specific service area. The California Public Utilities Commission regulates investor-owned utilities that operate in California.

**LANDFILL GAS** — Gas generated by the natural degradation and decomposition of municipal solid waste by anaerobic microorganisms in sanitary landfills. The gases produced, carbon dioxide and methane, can be collected by a series of low-level pressure wells and processed into a medium-Btu gas that can be further processed into a transportation fuel or combusted to generate heat or electricity.

**LEVEL 1 CHARGER** — Equipment that provides charging through a 120-volt alternative-current plug.

**LEVEL 2 CHARGER** — Equipment that provides charging through a 240-volt (typical in residential applications) or 208-volt (typical in commercial applications) alternative-current plug. This equipment requires a dedicated 40-amp circuit.

**LOW-INCOME COMMUNITIES/HOUSEHOLDS** — Defined as the census tracts and households, respectively, that are either at or below 80 percent of the statewide median income, or at or below the threshold designated as low-income by the California Department of Housing and Community Developments 2018 Income Limits.

**METRIC TON** — A unit of weight equal to 1,000 kilograms (2,205 pounds).

**MEGAJoule** — One million joules. A joule is a unit of work or energy equal to the amount of work done when the point of application of force of 1 newton is displaced 1 meter in the direction of the force. One British thermal unit is equal to 1,055 joules.

**METHANE** — A light hydrocarbon that is the main component of natural gas. It is the product of the anaerobic decomposition of organic matter or enteric fermentation in animals and is a greenhouse gas. The chemical formula is CH<sub>4</sub>.

**MICROMETER** — One millionth of a meter, equal to roughly 0.00004 inches.

**NATIONAL AMBIENT AIR QUALITY STANDARDS** — A set of standards established by the U.S. EPA for six criteria air pollutants, measured by the amount of each pollutant for a specified period.

**NATURAL GAS** — A hydrocarbon gas found in the earth composed of methane, ethane, butane, propane, and other gases.

**NO<sub>x</sub>** — Oxides of nitrogen, a chief component of air pollution that is commonly produced by the burning of fossil fuels.

**OVERGENERATION** — A condition that occurs when total electricity supply exceeds total electricity demand. This condition may negatively affect the reliable operation of the regional, state, or interstate electrical grid.

**PARTICULATE MATTER** — Any material, except pure water, that exists in a solid or liquid state in the atmosphere. The size of particulate matter can vary from coarse, wind-blown dust particles to fine-particle combustion products.

**PATHWAY** — A descriptive combination of three components including feedstock, production process, and fuel type.

**PLUG-IN ELECTRIC VEHICLE** — A type of vehicle that is equipped with a battery than can be recharged from an external source of electricity. It may or may not also have an internal combustion engine.

**PLUG-IN HYBRID ELECTRIC VEHICLE** — A type of hybrid vehicle that is equipped with a larger, more advanced battery that can be recharged from an external source of electricity. This larger battery allows the vehicle to be driven on battery power alone, gasoline fuel alone, or a combination of electricity and gasoline.

**ZERO-EMISSION VEHICLE** — A vehicle that produces no pollutant emissions from the onboard source of power.

# APPENDIX A:

## LIST OF ACRONYMS

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AB	Assembly Bill
AMMP	Alternative Manure Management Program
AQIP	Air Quality Improvement Program
ARPA-E	Advanced Research Projects Agency – Energy
ASE	Automotive Serve Excellence
ATL	Initiative Advanced Transportation and Logistics Initiative
BEV	battery-electric vehicle
CaFCP	California Fuel Cell Partnership
CA-GREET	California Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation Model
CALeVIP	California Electric Vehicle Infrastructure Project
CalRecycle	California Department of Resources Recycling and Recovery
CARB	California Air Resources Board
CCS	Combined Charging System
CEC	California Energy Commission
CHIT	California Hydrogen Infrastructure Tool
CMO	Clean Mobility Options
CNG	compressed natural gas
CO <sub>2</sub> e	carbon dioxide-equivalent greenhouse gases
COE	county office of education
CPUC	California Public Utilities Commission
CSFAP	California Sustainable Freight Action Plan
CVRP	Clean Vehicle Rebate Project
DAS	Division of Apprenticeship Standards
DC	direct current
DDRDP	Dairy Digester Research and Development Program
DGE	diesel gallon-equivalent
EPIC	Electric Program Investment Charge
ETAP	Energy Transit Apprenticeship Program
EVs	electric vehicles
EVCS	electric vehicle charging station
EVI-Pro	Electric Vehicle Infrastructure Projections
EVITP	Electric Vehicle Infrastructure Training Program
FCEV	fuel cell electric vehicle
FY	fiscal year
GFO	grant funding opportunity
GGE	gasoline gallon-equivalent
GGRF	Greenhouse Gas Reduction Fund
gCO <sub>2</sub> e/MJ	grams of carbon dioxide-equivalent greenhouse gases per megajoule

GO-Biz	California Governor's Office of Business and Economic Development
GHG	greenhouse gas
HVIP	Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project
HRI	hydrogen fueling infrastructure
I-Bank	Infrastructure and Economic Development Bank
ICT	Innovative Clean Transit
LCFS	Low Carbon Fuel Standard
LCTI	Low Carbon Transportation Investment
LIC	Low-income communities
MJ	megajoule
MMTCO <sub>2</sub> e	million metric tons of carbon dioxide-equivalent greenhouse gases
NAAQS	National Ambient Air Quality Standards
NO <sub>x</sub>	oxides of nitrogen
NOPA	notice of proposed award
NREL	National Renewable Energy Laboratory
PM <sub>2.5</sub>	particulate matter, 2.5 micrometers and smaller
PEV	plug-in electric vehicle
PG&E	Pacific Gas and Electric Company
PHEV	plug-in hybrid electric vehicle
PON	program opportunity notice
RFS	Renewable Fuel Standard
SB	Senate Bill
SCE	Southern California Edison
SDG&E	San Diego Gas & Electric Company
SIP	State Implementation Plan
SoCal Gas	Southern California Gas Company
U.S. EPA	United States Environmental Protection Agency
USW	United Steelworkers
VTA	Santa Clara Valley Transport
ZEV	zero-emission vehicle