

**Appendix E: 2024 Senate Bill 1403 School Bus Incentive Program
Report**

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Introduction

Thousands of children ride school buses in California every day, and older combustion school buses continue to be a major source of exposure to air pollution amongst California children. Efforts to replace the aging school bus fleet in California therefore remain a priority due to the adverse health effects of diesel particulate matter and children's increased vulnerability. Increasing the number of deployments of zero-emission school buses supports California's broader air quality goals as well as the State's numerous climate change goals. Recently, California passed Assembly Bill (AB) 1279 (Muratsuchi, Chapter 337, Statutes of 2022). This bill establishes the State's science-based policy to achieve carbon neutrality as soon as possible, but no later than 2045; to maintain net negative greenhouse gas emissions thereafter; and to ensure that by 2045, statewide anthropogenic greenhouse gas emissions are reduced at least 85% below 1990 levels. The California Air Resources Board's (CARB) 2022 Scoping Plan Update¹ lays out a comprehensive path to achieve the targets set in AB 1279 and acknowledges that transitioning the transportation sector to zero-emission is pivotal to achieving the mandate in AB 1279. The urgent need to address emissions from the transportation sector is further emphasized in Governor Newsom's Executive Order N-79-20,² which directs the on-road medium and heavy-duty fleet, including school buses, to transition to zero-emission by 2045 wherever feasible. Additionally, in 2023 the Legislature passed a new bill that would require all new purchases or contracts of school buses made by local educational agencies to be 100% zero-emission starting in 2035.³

California has administered incentive programs to support the replacement of the State's aging school bus fleet for decades, and the State has made significant progress in cleaning up the school bus fleet. CARB, the California Energy Commission, local air districts, utilities, school buses manufacturers, school districts, and communities continue to work collaboratively to replace older diesel buses with zero-emission and other cleaner school buses. California continues to lead the nation in zero-emission school bus deployments and is poised to deploy even more zero-emission school buses in the coming years.

Senate Bill (SB) 1403 (Lara, Chapter 370, Statutes of 2018) requires that CARB, in consultation with the California Energy Commission, provide an annual report outlining the State's school bus incentive programs and progress made towards cleaning the State's school bus fleet as part of the broader Heavy-Duty Investment Strategy. In the following sections, the report will provide an overview of the existing state school bus fleet, the funding committed to date and the need for funding, and the State's strategy to transition the school bus fleet to zero-emission by 2045.

¹ California Air Resources Board (2022). [2022 Scoping Plan for Achieving Carbon Neutrality](https://ww2.arb.ca.gov/resources/documents/2022-scoping-plan-documents).
<https://ww2.arb.ca.gov/resources/documents/2022-scoping-plan-documents>

² Executive Order N-79-20: <https://www.gov.ca.gov/wp-content/uploads/2020/09/9.23.20-EO-N-79-20-Climate.pdf>

³ AB 579 (Ting, Chapter 445, Statutes of 2023)

State School Bus Fleet

Defining the California school bus fleet has been an ongoing and extensive project, and it is critical to understand the school bus fleet composition in order to project the funding needs for cleanup. There is no single data source that gives a complete picture of the State's school bus population. To provide this update, staff compiles data from the California Highway Patrol School Bus Inspection Program, the current Department of Motor Vehicles Vehicle registration database, and data from the various State funding programs that have replaced or plan to replace school buses. In 2023, staff completed a comprehensive update of the California school bus inventory. Based on this review, staff estimates there are approximately 20,000 public and private school buses in California.

This year, staff focused the review on updating information on planned and completed school bus replacements and deployments that were supported by State and federal incentive programs. As State and federal incentives remain the primary mechanism by which school districts obtain funding to replace aging school district vehicles, this methodology provides a means to measure progress in the State's efforts to replace aging school buses with new zero-emission buses or other cleaner options. Staff expects to conduct another comprehensive review and update of the State's school bus inventory using California Highway Patrol and Department of Motor Vehicle data in 2025.

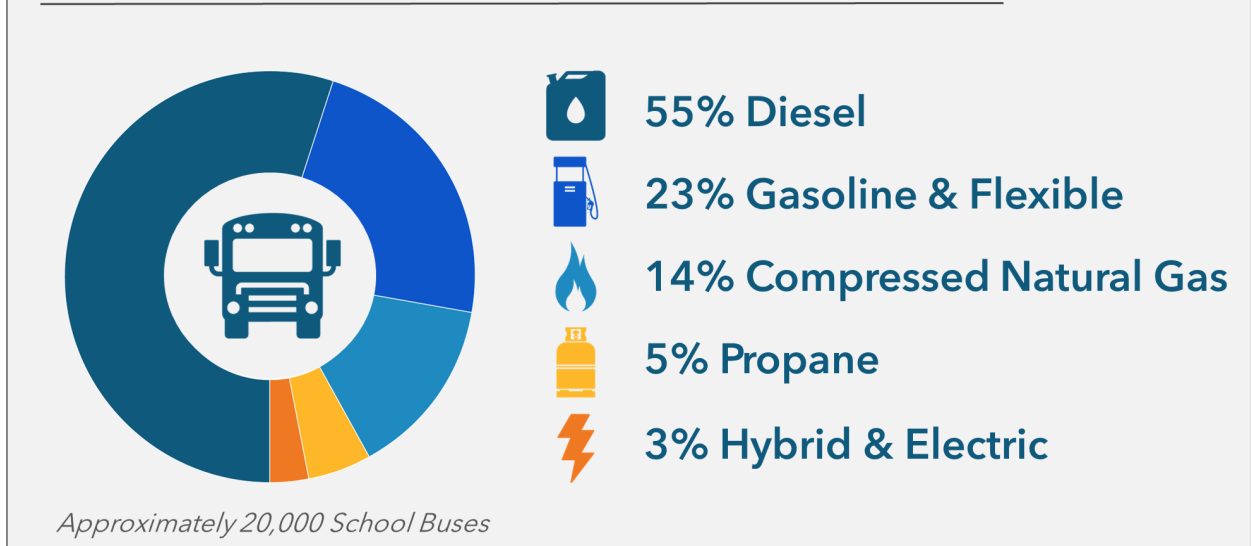
Highlights of the 2023 School Bus Inventory

As noted above, the methodology staff used in this report was an update to the 2023 inventory based on State and federally funded school bus projects that have been planned or completed. Thus, a summary of the findings from the 2023 inventory is presented in the following sections. More details can be found in the [2023 SB 1403 School Bus Incentives Program Report](#).

Fuel Type

Understanding the fuel type of the school bus fleet is critical to determine which buses are in greatest need of replacement as certain fuel types emit more pollution, with diesel as the highest concern. Figure E-1 depicts the California School Bus Population by fuel type as determined in the 2023 inventory.

Figure E-1: California School Bus Population By Fuel Type



Approximately 55% of the combined public and private school bus fleet is diesel. The rest of the school bus fleet is made up of gasoline and flexible fuel (a gasoline blend with up to 85% ethanol), compressed natural gas (CNG), propane, and hybrid and battery electric. The percentage of CNG buses is 14%. Hybrid and battery electric school buses currently make up approximately 3% of the inventory.

Of the publicly owned buses, over 9,600 are diesel fueled, or approximately 62% of the public fleet.

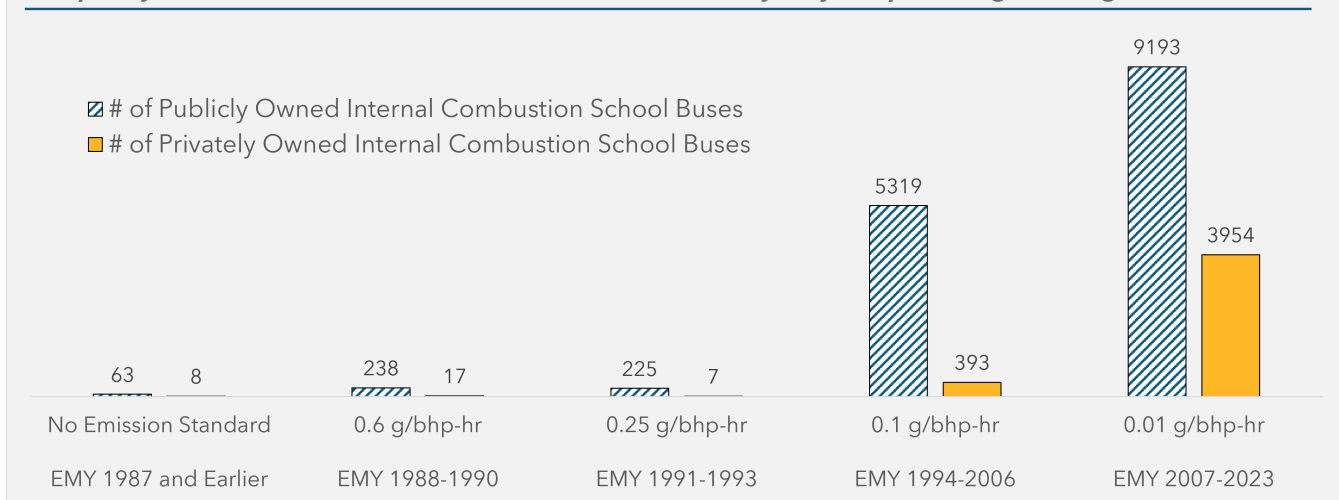
Age of Fleet

While California has made steady progress in replacing the oldest school buses operating in the state, many school buses in California are quickly approaching, or have exceeded the industry standard turnover age.

Typically, school buses are expected to have a lifespan of between 12 to 15 years. The average publicly owned school bus in California is 14 years old (vehicle model year 2010), and a quarter of publicly owned school buses are more than 20 years old (vehicle model year 2003 and older). And in some cases, even older buses are still operating. In the 2023 school bus inventory, staff found 68 diesel school buses in the oldest category with bus model years of 1978-1988, and 91% of those are publicly owned. These are the school buses of greatest concern that need to be turned over since they were designed to meet the less stringent, higher-emitting, emission standard that existed at the time. Figure E-2 shows the age distribution of the internal combustion school bus fleet as determined through the 2023 school bus inventory.

One out of four publicly owned school buses in California is more than 20 years old

Figure E-2: Comparison of Publicly and Privately Owned School Buses with Internal Combustion Engines Grouped by California Particulate Matter Emission Standard for Heavy-Duty Compression Ignition Engines



Acronym Key: grams per brake horsepower hour (g/bhp-hr), engine model year (EMY)

Figure E-2 shows that, while most publicly owned and privately owned school buses are from engine model years 2007 through engine model year 2023 and subject to more recent emission standards, a significant portion of publicly owned school buses are older and subject to much less stringent standards. Compared to other states, California operates one of the oldest fleets. A recent report by the World Resources Institute found that California operates the sixth highest number of pre-2010 diesel school buses in the country, behind Oklahoma, Idaho, Oregon, Kansas and South Dakota.⁴

Replacing the oldest diesel buses remains a top priority for the State. Further details describing the rationale for focusing on the oldest diesel buses are contained in the following section.

The Need for Replacement

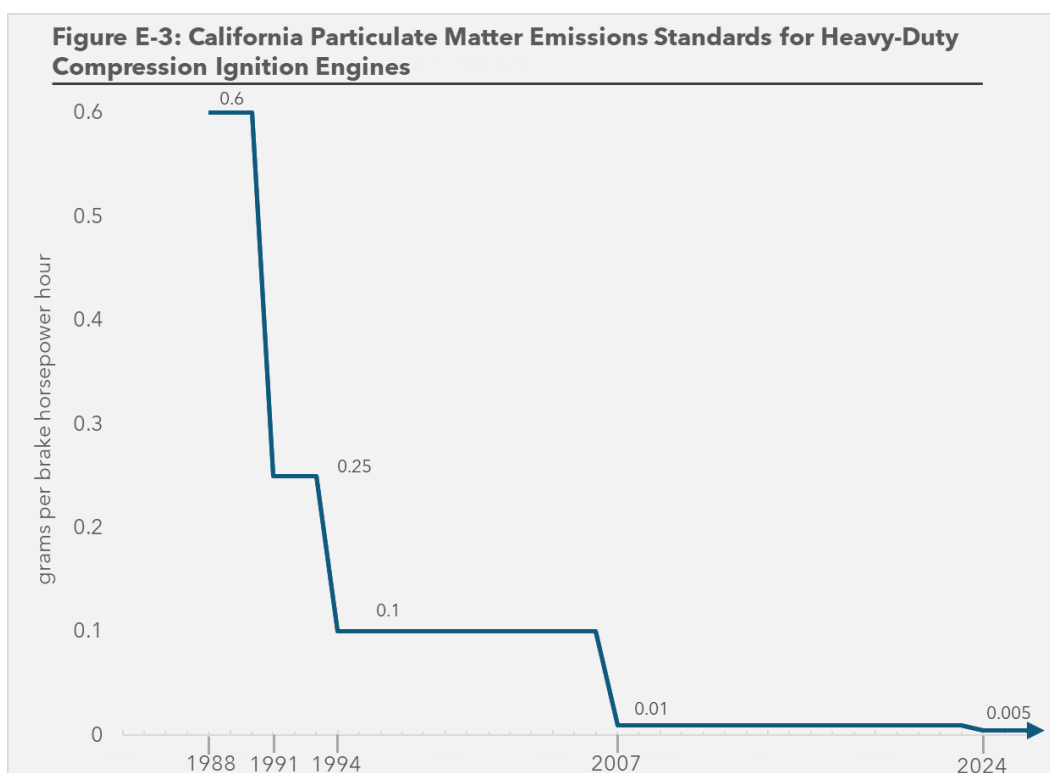
Diesel-fueled school buses are CARB’s main area of focus because diesel particulate matter is a toxic air contaminant, and children are particularly vulnerable to health impacts from these pollutants. Toxic air contaminants may have health impacts at any amount, but at high concentrations particulate matter can reduce lung development and have immediate adverse health effects. With continued exposure particulate matter has lasting health impacts later in life.⁵

⁴ World Resources Institute (2024). “Electrifying US school bus fleets equitably to reduce air pollution exposure in under-served communities”. <https://electricschoolbusinitiative.org/sites/default/files/2024-08/Electrifying%20US%20school%20bus%20fleets%20equitably%20%28August%202024%29.pdf>

⁵ California Air Resources Board (2004). “The Children’s Health Study Final Report”. <https://ww2.arb.ca.gov/resources/documents/childrens-health-study>

Actions taken by the State to reduce children’s exposure to vehicle-related pollutants include smoke opacity testing and idling restrictions. Diesel-fueled school bus fleets must be regularly tested for excessive smoke with periodic smoke inspections.⁶ The periodic smoke inspections will be replaced by compliance tests of the school bus’s emission control system pursuant to Clean Truck Check beginning in 2025.⁷ Additionally, all combustion school buses are restricted from idling at or near public or private schools.⁸ Drivers must turn off engines immediately after arriving at a school and restart no more than 30 seconds before departure.

Emission standards passed at the state and federal level have also been used to help reduce children’s exposure to harmful pollutants, including particulate matter and nitrogen oxides. Figure E-3 illustrates how particulate matter emission standards have become more stringent over time.



The Heavy-Duty Omnibus Regulation,⁹ which took effect December 22, 2021, phases in more stringent emission standards with a new particulate matter standard of 0.005 g/bhp-hr

⁶ Title 13, California Code of Regulations, Section 2180-2819
⁷ Title 13, California Code of Regulations Sections 2195- 2199
⁸ Title 13, California Code of Regulations, Section 2480
⁹ Title 13, California Code of Regulations, Section 1956.8

starting with 2024 model year engines. This represents a 50% reduction from the previous standard that took effect starting with model year 2007 engines.

Emission standards apply to new engines and do not require fleets to upgrade existing technology, so on their own, emission standards do not reduce pollution from vehicles that are already on the road. To address emissions from vehicles that are already on the road, in-use regulations, or regulations that apply to vehicles and equipment that is currently in operation, require fleets to take measures to reduce emissions from their existing fleet. Under the Truck and Bus Regulation,¹⁰ CARB requires diesel-fueled school buses over 14,000 pounds gross vehicle weight rating to be equipped with a particulate matter exhaust filter (retrofitted or original equipment), or they must operate less than 1,000 miles per year. The presence of particulate matter exhaust filters reduces particulate matter emissions by at least 85%. Nearly all engines that have an engine model year of 2007 or newer come assembled from the manufacturer equipped with a particulate matter exhaust filter.

Older diesel school buses are more polluting with higher deterioration of the engines and particulate matter filters due to aging, and these buses expose children, a sensitive population group, to more emissions. The turnover of the oldest and dirtiest school buses is essential for reducing exposure to pollutants.

Improving Safety Standards - Turnover Means Safer Buses on the Road

In addition to reducing emissions, another reason to turn over the oldest school buses in the inventory is the improvement of school bus safety standards, including seatbelt safety laws and the child safety alert systems. California law required that Type 1 school buses (school buses designed to carry more than 16 passengers) manufactured on or after July 1, 2005, be equipped with three-point seat belts. These requirements took effect even earlier for smaller school buses. California law required three-point seat belts on all Type 2 school buses (generally school buses that are designed to carry fewer than 16 passengers) manufactured on or after July 1, 2004.¹¹ While the initial legislation did not require that old buses be retrofit with seatbelts, AB 1798 (Chu, Chapter 206, Statutes of 2018) requires that all school buses transporting students must have seat belts by July 1, 2035. Staff found that just over a quarter of the buses in the publicly owned school bus fleet are model year 2003 and earlier and were not subject to current seat belt safety standards and will likely need to be replaced or retrofit to comply with the new law.

¹⁰ Title 13, California Code of Regulations, Section 2025

¹¹ California Vehicle Code CVC, Section 27316

Funding Committed to Date

The State has reached a significant new milestone in its efforts to clean-up the school bus fleet with the launch of its single largest investment in zero-emission school bus replacements. The Zero-Emission School Bus and Infrastructure (ZESBI) project launched on May 14, 2024, with \$500 million appropriated from the 2023 State budget through SB 114 (Committee on Budget and Fiscal Review, Chapter 48, Statutes of 2023). ZESBI is expected to fund approximately 1,000 zero-emission school bus replacements with the initial \$500 million appropriation, and preliminary awards are anticipated to be announced in the fall of 2024. While the launch of ZESBI represents a significant scale-up of the State's efforts to replace school buses with cleaner options, together, CARB and the California Energy Commission (CEC) have been laying the groundwork and implementing school bus replacement programs for over a decade. In total, the State has spent or allocated \$1.98 billion on school bus replacements, with \$1.3 billion supporting zero-emission school bus programs. These investments have supported the purchase of over 2,300 zero-emission school buses.



While the Legislature had previously indicated its intent to appropriate an additional \$500 million for zero-emission school buses in the 2024 State budget, California faced a significant budget shortfall in fiscal year 2024-2025 and ultimately no new school bus funding was appropriated for this year. However, the Legislature reaffirmed its commitment to zero-emission school bus replacements by indicating its continued intent to appropriate \$500 million for zero-emission school buses in the 2025 State budget.¹²

Even though the Legislature did not appropriate new funds for zero-emission school buses in 2024, previously appropriated funding continued to be used for school bus projects. Since the 2023 SB 1403 report, an additional \$73 million of State incentive dollars have been reported, mostly through broader incentive programs that provide funding to a variety of cleaner truck and bus projects, including school buses, such as the Carl Moyer Memorial Air Quality Standards Attainment Program, the Community Air Protection Incentives, and the Clean Trucks and Buses Voucher Incentive Project (HVIP).

Figure E-4 illustrates the newly spent or allocated funding reported in each SB 1403 Report and the cumulative amount.

¹² SB 153 (Committee on Budget and Fiscal Review, Chapter 38, Statutes of 2024).

Figure E-4: Senate Bill 1403 Report Spent or Allocated Funding (Millions)

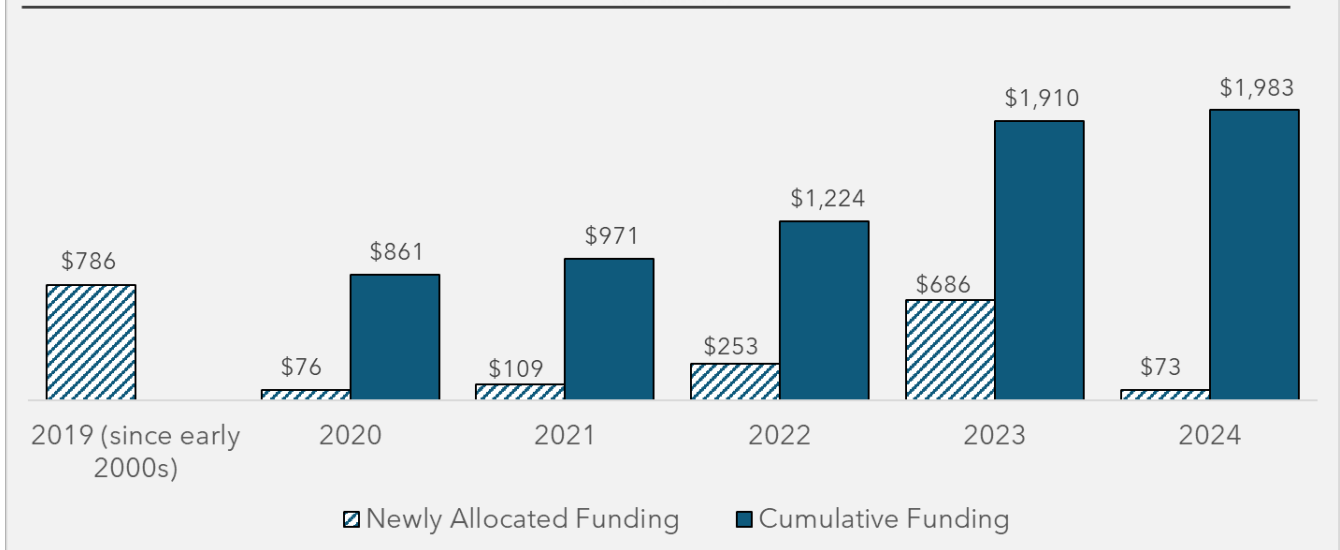


Figure does not include any funding from federal sources such as Diesel Emissions Reduction Act Funding or United States Environmental Protection Agency Clean School Bus Funding

Table E-1 summarizes State school bus funding that has gone to school bus cleanup to support exhaust retrofits, full vehicle replacements, and supporting infrastructure through incentive programs that are ongoing, in progress, and have concluded. Incentive programs are defined as ongoing if they currently have funding available or are expected to reopen in the future. Incentive programs that are in progress are not currently accepting new applications and at this time are not expected to reopen for applications again in the future. Recipients of funding from those incentives deemed in progress may be at various stages of the application process, and in some cases final awards may not have yet been announced. Finally, the concluded incentive programs category represents historic incentive programs that are now fully completed and not expected to receive additional funding in the near future.

Table E-1: Summary of State School Bus Incentive Programs– Through May 2025

Funding Source	Amount Spent/ Allocated	ZE School Buses Funded	Amount Allocated/Spent on ZE School Buses & Infrastructure
Ongoing incentive programs	\$1,137.6 million	1,445	\$835.8
Incentive programs in progress	\$515.8 million	888	\$495 million
Concluded incentive programs	\$329.6 million	28	\$7.5 million
Total	\$1.983 billion	2,361	\$1.3 billion

Acronym Key: Zero-emission (ZE)

Table E-2 describes the incentive programs that are ongoing, Table E-3 describes the in progress incentive programs that are no longer accepting applications but still have active projects, and Table E-4 describes concluded incentive programs. Many of the zero-emission school buses represented in Tables E-2 through E-4 are presented in an online [dashboard](#) that shows zero-emission trucks and bus deployments that were funded in full or in part by CARB incentive programs. The CEC also has the [Zero-Emission Vehicle dashboard](#) which displays all CEC funded zero-emission school buses and chargers.

Ongoing School Bus Incentive Funding

In recent years, California has increased its investments in school bus replacement and other zero-emission technology incentive programs, and local educational agencies can continue to apply for many of these programs today. While ZESBI is the only ongoing incentive program that is dedicated to school bus replacements, broader incentive projects such as HVIP, the Carl Moyer Memorial Air Quality Attainment Program, and Community Air Protection Incentives continue to be ongoing and major sources of funding for school districts. The investments from these ongoing programs are described in Table E-2 followed by descriptions of each individual program.

Table E-2: Ongoing State School Bus Incentive Programs—Through May 2025

Funding Source	Amount Spent/Allocated	Projects	ZE School Buses	Amount Allocated/Spent on ZE School Buses & Infrastructure
Zero-Emission School Bus and Infrastructure (ZESBI) Project (CARB and CEC) since 2024 ^a	\$500 million	Project selection in progress- expected to fund 1,000 ZE school buses	NA	\$500 million
Carl Moyer Program & Carl Moyer State Reserve ^b since 1998	\$56.4 million	225 school buses 17 infrastructure projects	85	\$33.5 million
HVIP since 2010 (not including the Public School Bus Set-Aside)	\$201 million	1,238 school buses	1,181	\$198.6 million
EnergIIZE since 2021 (not including the Public School Bus Set-Aside)	\$2 million	58 chargers for ZE school buses	0	\$2 million
Clean Mobility in Schools Pilot Project since 2018	\$8.9 million	36 school buses & infrastructure	36	\$8.9 million
Community Air Protection Incentives ^b since 2017	\$115 million	424 school buses, 10 infrastructure projects	291	\$92.8 million
Assembly Bill 923 ^c since 2008	\$254.3 million	Retrofits, school buses, natural gas tanks, & infrastructure	NA	NA
Total**	\$1,137.6 million		1,445^d	\$835.8 million

Acronym Key: Zero-emission (ZE), Energy Infrastructure Incentives for Zero-Emission Commercial Vehicles (EnergIIZE), Clean Truck and Bus Voucher Incentive Project (HVIP)

^a Represents funding sources that are dedicated to school bus cleanup

^b Statistics are through November 30, 2023

^c Data reported to CARB by local air districts as of August 8, 2023

^d 148 zero-emission school buses were co-funded by projects listed above, so 148 was subtracted from the total to avoid double counting

Zero-Emission School Bus and Infrastructure Incentive Project

The *Zero-Emission School Bus and Infrastructure (ZESBI)* Incentive Project provides grants to local educational agencies to replace heavy-duty, internal combustion school buses with new zero-emission school buses along with supporting infrastructure. ZESBI was created through a coordinated effort between CARB and CEC, and was launched in May 2024 with \$500 million of funding provided through SB 114. ZESBI funding prioritizes small and rural local educational agencies, and local educational agencies that serve a high percentage of students who are foster youth, receive free or reduced-price meals, or are English learners. A portion of the ZESBI grant can be used to supplement the local educational agency's student transportation programs and may be used to support additional infrastructure, upgrades of department buildings or transportation yards, fleet planning, workforce training and related activities. The State has expressed its intent to provide an additional \$500 million for this program in fiscal year 2025-26.

The ZESBI project's joint application was launched in May 2024 and the application window will tentatively close in September 2024. Preliminary awards will be issued shortly after.

Carl Moyer Memorial Air Quality Standards Attainment Program

The *Carl Moyer Memorial Air Quality Standards Attainment Program* (Moyer) is a voluntary grant program that reduces air pollution from vehicles and equipment by providing incentive funds to private companies and public agencies to purchase cleaner-than-required engines, equipment, and emissions reduction technologies. Moyer is implemented as a partnership between CARB and California's 35 local air districts. By funding emissions reductions that are surplus—earlier and/or beyond what is required by regulation—Moyer complements California's regulations. Moyer provides funding for eligible school bus replacement, repower, and conversion projects, as well as funding for other vehicle types. Replacement engines certified to the 2010 emissions standards or cleaner are eligible. Local air districts administer the program and may prioritize funds based on local community needs.

Clean Truck and Bus Voucher Incentive Project (HVIP)

The *Clean Truck and Bus Voucher Incentive Project* (HVIP), also referred to as HVIP Standard, offers funding to help offset the incremental cost of zero-emission medium- and heavy-duty truck and bus purchases, including school buses. HVIP is designed to be easy to use; HVIP approved dealers complete the application on behalf of the fleet, and fleets are not required to scrap an existing vehicle. HVIP Standard is available statewide on a first-come, first-served basis, and all public school districts and third-party school transportation providers that serve public school districts are eligible for funding.

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

The *Energy Infrastructure Incentives for Zero-Emission Commercial Vehicles* (EnergIIZE) Project is intended to accelerate the deployment of infrastructure needed to fuel medium- and heavy-duty vehicles. The project is administered by CEC and opened its first round of funding in April 2022. Since its opening, EnergIIZE has offered funding through four primary lanes: 1) the Electric Vehicle (EV) Fast Track Lane for fleets with battery electric vehicles already on order or delivered; 2) the EV Jump Start Funding Lane for fleets that meet certain equity criteria such as operating in a disadvantaged or low-income community or being a small or minority owned business; 3) the EV Public Charging Station Funding Lane for fleets or station owners interested in deploying publicly accessible charging infrastructure; and 4) the Hydrogen Funding Lane for fleets and station owners seeking to deploy hydrogen refueling infrastructure. Local educational agencies are eligible for infrastructure funding under all four lanes. Through May 2024, EnergIIZE has offered nearly \$2 million in preliminary awards for school district infrastructure projects.

Clean Mobility in Schools

Clean Mobility in Schools funds clean transportation and mobility strategies, including zero-emission vehicles and zero-emission vehicle supply equipment in schools (K-12); car sharing for staff at schools to use zero-emission vehicles; active transportation projects; curriculum development; workforce training; and outreach to students, parents, and the community. CARB launched a joint application for Clean Mobility in Schools and Sustainable Transportation Equity Project funds in 2023. Ultimately, CARB awarded five new Clean Mobility in Schools projects from the 2023 request for proposals, totaling \$28 million. These new projects will fund zero-emission car share, bike share, bike mechanic workshops, route optimization projects for zero-emission school bus fleets in rural and tribal areas of the state, and more.

Community Air Protection Incentives

Community Air Protection Incentives projects support the Community Air Protection Program. Local air districts select projects to reduce emissions exposure in overburdened communities and communities selected to participate in the program, according to guidance from members of those communities. School bus replacements, infrastructure, and other clean mobility projects for schools are eligible project categories, among many others, and many community groups have consistently voiced priority for school bus projects when describing community needs.

AB 923

Assembly Bill 923 (Firebaugh, Chapter 707, Statutes of 2003) authorizes local air districts to receive funding through a surcharge on motor vehicle registration fees for vehicles registered within that air district. These funds, commonly referred to as AB 923 funds, may only be used in certain ways laid out in the statute that help reduce air pollution within the

district. Air districts may utilize AB 923 dollars to fund school bus replacements in accordance with the Lower Emission School Bus Program guidelines or Carl Moyer Memorial Air Quality Attainment Program guidelines, however air districts administer these funds and may choose to fund other project types such as agricultural projects or early vehicle retirement projects, depending on local needs.

In Progress School Bus Incentive Funding

In addition to the ongoing incentive projects, there are several incentive projects that, while still in progress, are not expected to re-open for additional applications. In some cases, these incentive projects will not reopen because their funding source was a one-time appropriation or investment and they are now fully subscribed, while in other cases these incentives served as preliminary pilots and have now been streamlined into other ongoing incentive programs. These incentive programs are summarized in Table E-3 below, and additional updates on the status of these programs are provided in the following sections.

Table E-3: In Progress State School Bus Incentive Programs—Through May 2025

Funding Source	Amount Spent/Allocated	Projects	ZE School Buses	Amount Allocated/Spent on ZE School Buses & Infrastructure
Clean Truck and Bus Vouchers (HVIP) and EnergIZE Public School Bus Set-Aside (CARB and CEC) ^a <i>since 2021</i>	\$300 million	399 zero-emission school buses and 165 infrastructure projects	399	\$300 million
Volkswagen Mitigation Trust <i>since 2018</i>	Up to \$65 million	151 school buses	151	\$60 million
Rural School Bus Pilot Project ^a <i>since 2016</i>	\$56 million	199 school buses	110	\$43 million
School Bus Replacement Program (CEC) ^a <i>since 2019</i>	\$75 million	228 zero-emission electric school buses	228	\$75 million

Funding Source	Amount Spent/Allocated	Projects	ZE School Buses	Amount Allocated/Spent on ZE School Buses & Infrastructure
Clean Transportation Program (CEC) <i>since 2012</i>	\$19.8 million	25 natural gas school buses, 5 natural gas & 228 electric infrastructure projects	0	\$17 million
Total**	\$515.8 million		888	\$495 million

^a Represents funding sources that are dedicated to school bus cleanup.

Acronym Key: Zero-emission (ZE)

HVIP and EnergIIZE Public School Bus Set-Aside

The HVIP Public School Bus Set-Aside and EnergIIZE School Bus Infrastructure Funding Lane are coordinated efforts by CARB and CEC to promote the deployment of zero-emission school buses and complementary infrastructure. The HVIP Public School Bus Set-Aside offers funding intended to cover nearly, if not all, of the cost of new zero-emission school buses for public school districts and other qualifying entities located in small-sized air districts and medium-sized air districts, which historically have had access to fewer funding opportunities compared those located in large air districts. EnergIIZE provides incentives for zero-emission vehicle infrastructure related costs associated with those school buses. In total, \$270 million was appropriated to the HVIP Public School Bus Set-Aside for zero-emission school bus incentives and \$30 million was appropriated for electric school bus infrastructure projects that would support the school buses awarded through the HVIP Public School Bus Set-Aside.

The program launched for its first year of funding in March 2022, and then opened for a second round in June 2023. In the two years of funding, the program supported the replacement of nearly 400 school buses at 105 school districts and public charter schools. As of May 2024, EnergIIZE’s Public School Bus Set Aside has offered over \$9.1 million in preliminary awards for California local educational agency infrastructure projects. While the programs are now closed to new applications, applications that were previously submitted are still undergoing review. The lessons learned from the Public School Bus Set-Aside, paired with additional State funding appropriated through Senate Bill 114 (Committee on Budget and Fiscal Review, Chapter 48, Statutes of 2023), assisted CARB and CEC in creating

the ZESBI project, which is the most recent incentive program for zero-emission school buses and associated infrastructure.

Volkswagen Environmental Mitigation Trust

The *Volkswagen Environmental Mitigation Trust* was established through a settlement to mitigate the excess oxides of nitrogen emissions caused by Volkswagen's illegal actions. California's plan designated up to \$65 million for zero-emission school bus replacements, which is administered by the San Joaquin Valley Air Pollution Control District. The school bus category of the program is oversubscribed and is no longer accepting applications.

Rural School Bus Pilot Project

The *Rural School Bus Pilot Project* provided grants for the purchase of commercially available cleaner school bus technologies such as zero-emission and low carbon fuel options (renewable fuels). The project was focused on supporting school bus replacements for local educational agencies located in small air districts, as small air districts often had less access to incentive funding. After several years of successful implementation, the Rural School Bus Pilot Project transitioned from a pilot to a full-scale project administered as the HVIP Public School Bus Set-Aside and then ZESBI. Over \$56 million has been administered through the Rural School Bus Pilot Project to support the replacement of nearly 200 school buses, 55% of which will be replaced with zero-emission school buses.

School Bus Replacement Program

SB 110 (Committee on Budget and Fiscal Review, Chapter 55, Statutes of 2017) appropriated funds to establish the *School Bus Replacement Program* of the California Energy Commission (CEC). SB 110 provided one-time funding of \$75 million from Proposition 39 for the replacement and scrap of old diesel school buses in disadvantaged and low-income communities throughout California. CEC prioritized battery electric school buses that were ready for vehicle-to-grid integration with this funding. In total, CEC awarded 62 school districts funding to purchase 228 battery electric school buses. As of June 2024, all of the school buses were delivered, and grantees are now in the final stages of project implementation and data collection.

Clean Transportation Program

CEC allocated over \$6 million from *Clean Transportation Program* funds for 25 compressed natural gas (CNG) school bus replacements and supporting fueling infrastructure. All of the CNG school buses were delivered by December 2020 and all the supporting CNG infrastructure has been completed. Additionally, CEC utilized funding from the Clean Transportation Program to fund infrastructure for the 228 battery electric school buses funded through the School Bus Replacement Program. All buses have now been delivered and grantees are in the final stages of data collection.

Concluded School Bus Incentive Funding

Several of California’s earliest school bus incentive programs and pilots of zero-emission school bus replacements have now fully concluded. The [Lower Emission School Bus Program](#), funded with money from the Proposition 1B bond act, which authorized \$200 million for replacing and retrofitting zero-emission school buses, was fully expended by June 2014. Similarly, the [Sacramento Regional Zero-Emission School Bus Deployment Project](#), one of the earliest large-scale deployments of zero-emission school buses in the state, was completed in 2021. While the projects in this category are no longer active, they provided important lessons and a foundation for the recent larger scale zero-emission incentive projects. For example, local air districts may use the Lower Emission School Bus Program guidelines to fund projects using AB 923 dollars.

Table E-4: Concluded State School Bus Incentive Programs–Through May 2025

Funding Source	Amount Spent/Allocated	Projects	ZE School Buses	Dollars Spent on ZE School Buses & Infrastructure
Lower-Emission School Bus Program <i>since 2001</i> ^a	\$310 million	7,456 retrofits, 1,642 school buses	0	\$0
Supplemental Environmental Projects for School Buses ^a <i>since 2012</i>	\$5.1 million	11 retrofits, 20 school buses, 297 recalled filter replacements	0	\$0
Sacramento Regional Zero-Emission School Bus Deployment -Project ^a <i>since 2017</i>	\$14.5 million (State & match contribution)	28 school buses & infrastructure	28	\$7.5 million
Total**	\$329.6 million		28	\$7.5 million

Acronym Key: Zero-emission (ZE)

^a Represents funding sources that are dedicated to school bus cleanup

Federal and Local Funding

While not reflected in Table E-1, new federal programs and several local programs are worth noting because they are oriented to help replace old school buses with cleaner buses with a heavy focus on zero-emission school buses.

Clean School Bus Program

The *Clean School Bus Program*, administered by the United States Environmental Protection Agency (U.S. EPA), provides \$5 billion in funding over 5 years from 2022 to 2026 for the replacement of existing school buses with low- and zero-emission school buses. Clean school buses include those that reduce emissions and operate entirely or in part using alternative fuels. U.S. EPA may cover up to 100% of the vehicle cost and infrastructure through grants, rebates, or contracts. The Clean School Bus Program allows U.S. EPA to prioritize applications that will replace buses serving high need local education agencies, tribal schools, and rural or low-income areas. The program structure has varied between funding rounds and has historically offered both rebates and grant programs.

As of July 2024, U.S. EPA has awarded approximately \$1.78 billion in Clean School Bus rebates. While program requirements prohibit any single state from receiving more than 10% of the total available funds, California holds the highest number of awards. Roughly 9%, or \$159 million of rebate funding has been awarded to projects in California, and these awards will support the replacement of over 560 zero-emission school buses. An additional 24 California-based projects requesting to replace over 300 school buses remain on the waiting list, showcasing the high demand in California for funding for zero-emission school bus replacements.

U.S. EPA has also awarded \$965 million in Clean School Bus Program grants funding. The Clean School Bus grants program was a competitive funding opportunity that targeted larger clean school bus deployments. The grants program allowed third-party student transportation providers to apply on behalf of multiple school districts, including school districts located in different states. Because of this, the exact dollar amount that was awarded to projects in California is not yet available, however, at least \$88 million has been awarded to projects in California to support the deployment of over 230 zero-emission school buses.

Clean Heavy-Duty Vehicles Grant Program

In April 2024, U.S. EPA launched a new funding program, the *Clean Heavy-Duty Vehicles Grant Program*, which invests \$1 billion from the Inflation Reduction Act to replace existing Class 6 and Class 7 combustion vehicles with zero-emission vehicle. The funding opportunity includes two sub-programs: one for school buses and one for vocational vehicles. U.S. EPA anticipates awarding 70% of the available funding to school bus replacement projects through the school bus sub-program. The program opened for applications in April 2024 and closed in July 2025. Applicants are expected to be notified of their selection in late 2024.

Diesel Emission Reduction Act

Another federal program, the *Diesel Emission Reduction Act State Grants*, a long-standing incentive program administered by U.S. EPA to replace diesel engines with cleaner

alternatives, has also provided over \$7.3 million in federal funding for school bus replacement projects in California.

Local Air District Programs

Additionally, many of California's air districts offer funding for school bus replacements using local dollars, such as Assembly Bill 923 funds. For example, The Bay Area Air Quality Management District has supported the replacement of over 95 zero-emission school buses in the past 3 years using a combination of State funds with local Transportation Fund for Clean Air Regional Fund and the Mobile Source Incentive Fund. All of the replacements were located in Air District priority communities, which include AB617 communities, disadvantaged communities, and low-income communities. In southern California, 35 new compressed natural gas school buses and 62 zero-emission electric school were funded using local funds through South Coast Air Quality Management District's Lower Emission School Bus Program were placed in operation in 2023 and 2024.

Local air districts may also partner with other local and regional government entities to support school bus projects. The Sacramento Metropolitan Air Quality Management District has partnered with the Sacramento Area Council of Governments to administer the Sacramento Emergency Clean Air Transportation Program. The program is expected to support the purchase of 30 zero-emission school buses in the Sacramento Federal Nonattainment Area for a total of \$3 million. Additionally, Sacramento Metropolitan Air Quality Management District is using \$2.55 million of local funding to support the purchase of an additional 11 zero-emission buses.

Funding Needs

Funding continues to be a major obstacle for school districts that are seeking to replace their aging school bus fleets, particularly for school districts seeking to purchase zero-emission school buses. Based on a comprehensive assessment of funding for home-to-school transportation conducted by the Legislative Analyst's Office in 2014,¹³ school districts primarily receive transportation funding through the State legislative process. Incentive opportunities offered by the State, local air districts, federal government and others continue to play a critical role in achieving the goal of fully transitioning California's school bus fleet to zero-emission by 2045. The recently committed State and federal school bus funding will help California make significant progress in reducing the emissions of the school bus fleet.

¹³ Legislative Analyst's Office (2014). [Review of School Transportation in California.](https://lao.ca.gov/reports/2014/education/school-transportation/school-transportation-022514.pdf)
<https://lao.ca.gov/reports/2014/education/school-transportation/school-transportation-022514.pdf>

As reported in the 2023 SB 1403 Report, there are approximately 20,000 school buses in the statewide fleet, about 15,000 of which are publicly owned and equipped with internal combustion engines. Of those 15,000 publicly owned school buses, about 600 are slated to be scrapped and replaced by zero-emission buses through recently awarded State grants to local educational agencies. To fully turn over the remaining publicly owned fleet to zero-emission school buses is estimated to cost a total of \$5.7 billion. To align the turnover with the State mandate that all operations of medium- and heavy-duty vehicles to be zero-emission by 2045, it would take 21 years at a rate of 5% turnover per year, or approximately 685 school buses per year, to replace all the publicly owned internal

To fully replace the existing public school bus fleet with zero-emission school buses by 2045 will cost roughly **\$270 million per year** for 21 years

combustion school buses. To fund the replacement of these school buses it would cost approximately \$270 million annually for zero-emission battery electric technology. To complete this transition by 2035 would require replacing roughly 1,300 buses per year for an estimated cost of \$525 million per year. These figures do not include infrastructure costs, total cost of ownership savings, or additional training/support. Additionally, this figure does not consider any potential increases in the number of school buses operating in the state or account for the cost of repairs or replacements of zero-emission buses once they are deployed. These figures do not include the first round of the Zero-Emission School Bus and Infrastructure project grants which are expected to result in approximately 1,000 zero-emission school buses. Additionally, staff estimates the \$500 million for zero-emission school buses and infrastructure that the Legislature has indicated its intent to provide in fiscal

year 2025-26 will support the replacement of an additional 1,000 zero-emission school buses and installation of associated infrastructure. Additional funding from federal programs and for infrastructure will further advance California's zero-emission school bus fleet. Over the next two years, the U.S. EPA Clean School Bus Program is expected to provide an additional \$2.25 billion in funding for school bus replacements nationwide.

With tight budgets, limited resources, and competing requests for funding, replacing California's school bus fleet continues to occur enthusiastically, but gradually. Ongoing funding is necessary to continue turning over the school bus fleet.

California's Funding Strategy

There are over 1,000 public school districts in California, each with their own unique school transportation strategies and challenges. Recognizing that a one-size-fits-all approach does not work for such a diverse set of public school districts, the State maintains a portfolio of funding opportunities to address the unique needs of school districts across the state. While each program within the portfolio of public school bus funding has its own unique guidelines and requirements, every program aims to transition California's school bus fleet

to cleaner technologies and encourages the use of zero-emission school buses wherever possible. The portfolio is designed to ensure that all school districts across the state have access to funding for the cleanest fuel type available that meets their needs, to allow for fleet expansion while encouraging the retirement of older buses, and to provide opportunities for innovative financing mechanisms.

Table E-5 provides a brief comparison of these key elements for many of the main, ongoing school bus funding programs.

Zero-Emission Wherever Possible

Reflecting California's clear commitment to zero-emission transportation, most of the State's ongoing incentive programs focus on zero-emission technologies.

While CARB incentives are designed to prioritize zero-emission buses wherever possible, there are tradeoffs to consider when it comes to school bus replacement. Considerations include the lower upfront costs of conventional fueled school buses and immediate short-term emissions benefits versus the long-term emissions benefits of upgrading to zero-emission school buses. Some of the school buses operating in the state are more than 30 years old, so even a diesel-to-diesel replacement represents an immediate reduction of emissions and particulate matter exposure, and a safety improvement. As a result, some programs that require scrappage allow for replacement with internal combustion vehicles. For example, in the Carl Moyer Memorial Air Quality Program the replacement school bus can be any engine certified to the 2010 emissions standards or cleaner, including zero-emission, hybrids, alternative fuels, and new diesel buses. However, diesel vehicles have a long operational lifespan. Therefore, replacing older school buses with diesel could prolong eventual turnover to zero-emission school buses.

Replacing the Aging Fleet

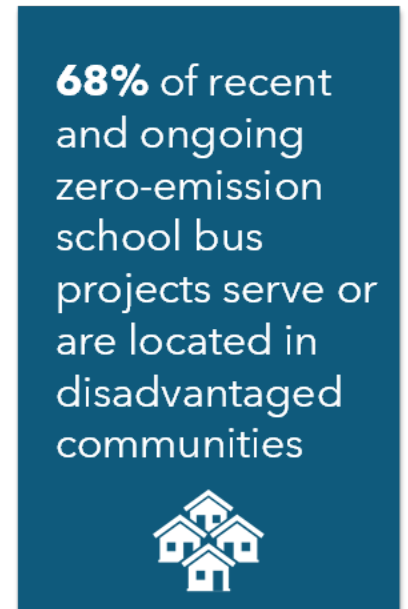
As discussed in the previous sections, there are substantial air quality, climate, and safety benefits to retiring the oldest school buses and replacing them with new models. To maximize these benefits, many of the programs within the State's school bus funding portfolio require scrappage of an old bus, and there are often requirements specifying the minimum age of the bus to be replaced. Staff analyze data on the age of the California school bus fleet to determine what minimum age requirements should be set to maximize emissions reductions and other benefits from the projects.

Another method to clean up the public school bus fleet in California is to repower or convert the engine and drivetrain of an old combustion bus to zero-emission or other cleaner engine. While staff recognize the benefits of repowers, they are not allowed in all programs since some programs are focused on the replacement of the oldest school buses within the fleet. Generally, upfitters repower school buses that are between 5 and 7 years old. On average, publicly owned school buses operating in California are approximately 14 years old and it is usually not cost effective or technologically feasible to repower buses that old. Additionally, for the oldest school buses in the state, scrapping and replacing with a new

The State recognizes that a school district may need to expand their fleet and offers incentives to ensure that those school districts receive funds to support a zero-emission bus purchase. For example, HVIP offers funding to cover the incremental cost of purchasing a zero-emission bus compared to a conventional diesel. The incentive offered for fleet expansion projects is generally lower than for incentives that require scrappage.

Prioritizing Overburdened Communities

Many communities across California experience disproportionately high levels of air pollution and the resulting adverse health effects. In order to address these inequities, the State has adopted approaches to ensure that funding programs, including many of the school bus funding programs, prioritize overburdened communities for funding opportunities. Programs like the Clean Mobility in Schools Pilot Project are only open to projects that benefit disadvantaged communities as defined in SB 535 (De León, Chapter 830, Statutes of 2012).¹⁴ Other programs such as the Zero-Emission School Bus and Infrastructure Project (ZESBI) prioritize funding for disadvantaged and low-income communities. Finally, some programs such as HVIP offer higher incentive amounts for school districts with buses domiciled in disadvantaged communities. Of the ongoing incentive programs, roughly 68% of zero-emission public school bus projects have supported projects located in or directly serving disadvantaged communities.¹⁵



Focus on Publicly Owned School Buses

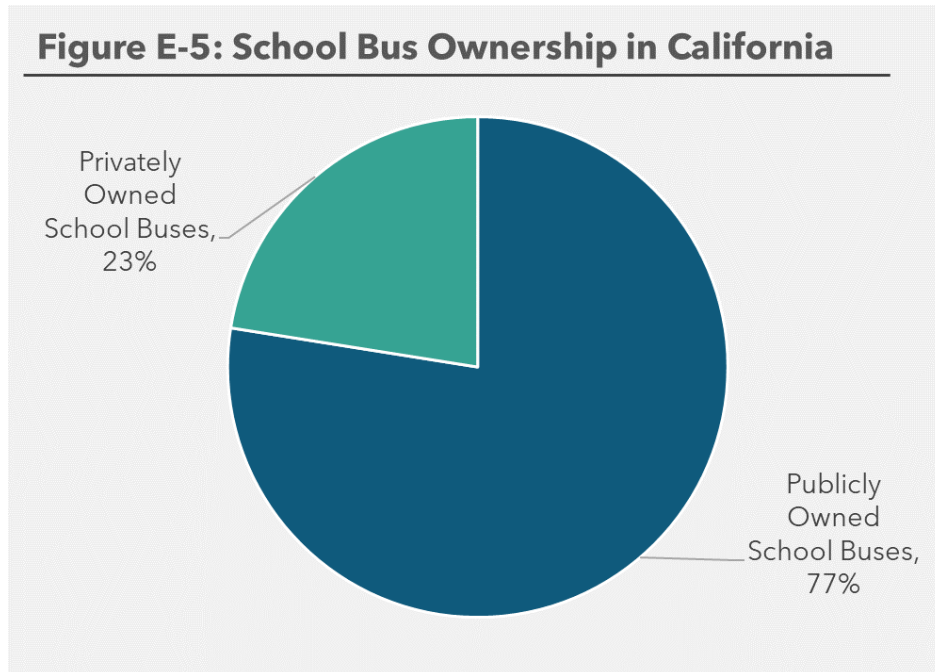
For some public school districts, the use of a third-party school transportation provider that owns and operates the school buses provides a cost-effective method of providing transportation services. New third-party school transportation providers with “zero-emission bus-as-a-service” models have entered the market in recent years. These school transportation providers often bring technical expertise and can provide full-service pricing or an all-inclusive lease that incorporates the cost of the bus, infrastructure and energy. Many third-party school transportation providers and bus-as-a-service models can take

¹⁴ Additional information on the designation of disadvantaged communities is available at <https://calepa.ca.gov/envjustice/ghginvest/>

¹⁵ Statistic includes zero-emission buses funded by HVIP Standard, HVIP Public School Bus Set-Aside Clean Mobility in Schools, Moyer, Community Air Protection Incentives, Volkswagen Mitigation Trust, CEC’s School Bus Replacement Program, and Rural School Bus Pilot Project

advantage of better pricing through bulk purchases and in some cases are able to install infrastructure that serves multiple school districts at a single charging hub.

While utilizing third-party school transportation providers is a popular choice among some school districts, the majority of public school districts own their school buses. As mentioned previously, of the 20,000 school buses operated in the state, roughly 15,500 are owned by public school districts. Approximately 63% of school districts operate at least 1 school bus. The remaining school districts may partner with local transit authorities or contract with third-party school transportation providers to provide transportation services. Third-party



school transportation providers generally operate newer bus fleets. According to staff's analysis of the California school bus fleet, the average bus in the publicly owned school bus fleet is model year 2010, compared to a model year 2014 for privately owned school buses. Additionally, publicly owned buses make up nearly 93% of the diesel buses that are model year 2007 or older, making them a priority for replacement. To ensure sufficient incentives are available to those public school districts operating the oldest buses in the state, some funding programs are exclusively available to public school districts.

While third-party operators are excluded from some funding programs, there is still a significant amount of funding available to third-party school transportation providers. For example, third-party transportation providers serving public school districts may request vouchers of up to \$198,000 per bus from HVIP, which, as of August 2024, had over \$100 million of available funding. Third-party transportation providers have frequently utilized these programs. To date, third-party transportation providers have received over \$22 million to support the purchase of over 160 zero-emission school buses.

Table E-5: Comparison of On-Going Public School Bus Incentive Funding Programs*

Program Requirements	HVIP Standard	ZESBI	Moyer & Community Air Protection incentives**	Clean Mobility in Schools	U.S. EPA Clean School Bus Program
Zero-emission school bus incentive amount range	\$99k-\$198k	\$280k-\$375k	Up to \$400k	Up to the full cost of the bus	\$145k-\$345k
Eligible fuel types	ZE	ZE	ZE, Hybrids, Alt. Fuels, Diesel	ZE	ZE, CNG, Propane
Requires scrappage of an existing bus		√	√		√
Gross vehicle weight rating requirement for bus to be scrapped		≥10,001 lbs	≥14,001 lbs		≥10,001 lbs
Model year/age requirement for bus to be scrapped		2010 or older	Any		2010 or older for CNG and Propane, Any for ZE
Repowers of old buses are eligible	√		√		√
Program includes or can include infrastructure funding		√	√	√	√
3 rd party transportation providers that contract with public schools are eligible	√		√		√
Funding can support driver and mechanic training		√		√	√
Funding available for other medium- and heavy-duty vehicles (white fleet)	√		√	√	

Acronym Key: Zero-Emission (ZE), Compressed Natural Gas (CNG), Alternative (Alt.)

*Comparison of program requirements as of July 2024. Individual program requirements are subject to change. Refer to the program website for the current version of requirements.

**Requirements depicted align with the Moyer and AB 617 Incentive Guidelines developed by CARB. Local Air Districts implementing the program may implement additional requirements or focus funding toward other community priorities.

Zero-Emission by 2045

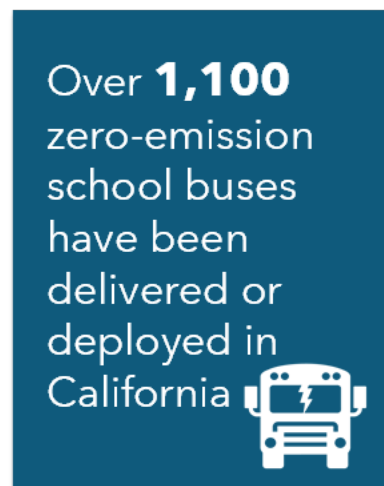
Recognizing the need to take decisive action to combat the threat of climate change, California has set multiple aggressive mandates to reduce greenhouse gas emissions that will simultaneously reduce air pollutants to protect public health. This includes a mandate to reduce greenhouse gas emissions by at least 85% by 2045.¹⁶ The *2022 Scoping Plan* also reflects California’s goal to achieve carbon neutrality by 2045. Governor Newsom’s Executive Order N-79-20 states that all operations of medium- and heavy-duty vehicles shall be zero-emission by 2045 where feasible, with all drayage trucks zero-emission by 2035.¹⁷

To support these goals, multiple requirements have also been enacted that would require public school districts and other local educational agencies to phase out the purchase of combustion school buses. In 2023, the Legislature recognized the benefits of zero-emission school buses with the passage of AB 579 (Ting, Chapter 445, Statutes of 2023). This new law requires that beginning in 2035, 100% of all newly purchased or contracted school buses of a local educational agency be zero-emission where feasible. In addition, the Advanced Clean Fleets Regulation requires all new medium- and heavy-duty vehicles sold in California be zero-emission beginning with the 2036 model year.¹⁸

Zero-Emission School Bus Deployments in California

Zero-emission school buses are available and being deployed throughout California and the country. Battery electric school buses are the only zero-emission school bus technology commercially available today. Approximately 300 school districts and public charter schools in California have ordered or deployed at least 1 battery electric school bus. Since 2023 the number of zero-emission school buses that have been delivered or deployed has increased by over 80% with more than 1,100 battery electric school buses now operating in the state.¹⁹

Most battery electric school buses can drive between 100-155 miles per trip when fully charged, which is enough for most school bus routes. Some models are reported to have even longer ranges of up to 200 to 300 miles per trip when fully charged. Increased battery storage capacity continues to



¹⁶ AB 1279 (Muratsuchi, Chapter 337, Statutes of 2022)

¹⁷ Executive Order N-79-20: <https://www.gov.ca.gov/wp-content/uploads/2020/09/9.23.20-EO-N-79-20-Climate.pdf>

¹⁸ California Air Resources Board (2023). "Advanced Clean Fleets". <https://ww2.arb.ca.gov/our-work/programs/advanced-clean-fleets>

¹⁹ "California Zero-Emission Vehicle Population Dashboard" (2023). <https://californiahvip.org/cavevdashboard> and "CEC School Bus Delivery Tracker" (2023). <https://www.energy.ca.gov/data-reports/energy-almanac/zero-emission-vehicle-and-infrastructure-statistics/cec-funded-school>

expand and develop. At least 1 battery electric school bus is available in all the same types and classes as conventional school buses. These can be viewed in the [Zero-Emission Technology Inventory \(ZETI\)](#) tool, an interactive online resource developed by CALSTART that shows all commercially available offerings of zero-emission medium- and heavy-duty vehicles. According to ZETI, there were 12 manufacturers with 25 available school bus models as of July 2024.²⁰

Zero-Emission School Bus Infrastructure

Successful and cost-efficient charging or fueling infrastructure results from extensive planning that takes into account both immediate and future infrastructure needs. There is no standard approach to infrastructure planning as each California local educational agency's fleet and site are unique. Therefore, assessing long-term zero-emission transportation goals and involving the service utility early in the process is critical.

Local educational agencies often do not have the dedicated staff or financial resources necessary for specialized and future-proofed zero-emission infrastructure planning. To help reduce this capacity gap, organizations have developed a landscape of free and online technical assistance tools to help local educational agencies approach infrastructure planning. CALSTART has developed the [School Bus Fleet Infrastructure Planning Tool](#) that provides local educational agencies a systematic installation timeline and an infrastructure-planning checklist. [CalFleetAdvisor](#), implemented by CALSTART, also offers technical assistance services such as vendor and peer referrals and fleet transition planning. The World Resources Institute has established the [Electric School Bus Initiative](#) that provides an [Electric School Bus Toolkit](#) with templates for Request for Proposals and Requests for Information, an "All About Series" on a number of school bus electrification topics, and a [Technical Assistance Menu](#) where support on infrastructure planning and upgrades, utility coordination, and more is offered. The Joint Office of Energy and Transportation's [Clean Bus Planning Awards](#) offers technical assistance tools such as an Electric School Bus Route Analysis to determine charge power needs, a Charging Station Planning Form to inform coordination with utilities, and fleet electrification transition plans that includes components such as an infrastructure assessment and optimization strategy.

In its role as the State's primary energy policy and planning agency, CEC is leading funding opportunities and knowledge building efforts to ensure local educational agencies have the infrastructure needed to support their zero-emission school bus fleets. As described in earlier sections, CEC has developed several incentive programs for zero-emission school bus infrastructure such as EnergIIZE, and closely coordinated with CARB to develop streamlined infrastructure incentives that complement the zero-emission school bus incentives through the Public School Bus Set-Aside and Zero-Emission School Bus and Infrastructure (ZESBI) projects. Additionally, in November 2020, the CEC released

²⁰ CALSTART (2022). Drive to Zero's Zero-Emission Technology Inventory Data Explorer. Version 1.0. Available online at: <https://globaldrivetozero.org/zeti-data-explorer/>

GFO-20-601 entitled *Blueprints for Medium- and Heavy-Duty Zero-Emission Vehicle Infrastructure* to accelerate the deployment of medium- and heavy-duty zero-emission vehicles and infrastructure with a holistic and futuristic view.

Two school transportation electrification projects were completed in September 2023, one with Twin Rivers Unified School District (Twin Rivers USD) and one with Berkeley Unified School District (Berkeley USD). Results from the blueprint analyses show that local educational agencies experience challenges related to technical issues, site constraints, workforce development, and staff and financial capacity. While Berkeley USD decided to hold off on fleet electrification due to site and capacity constraints, Twin Rivers USD's leadership and supportive stakeholders leaned into these challenges and shortly after completion of the blueprints raised enough funds to successfully deploy 47 electric school buses with supporting infrastructure. Since the blueprint, Twin Rivers USD has expanded its zero-emission fleet even further and is making progress towards its goal to secure 75 more electric school buses with supporting infrastructure over a 10-year period.

Additional State entities are supporting California educational agencies' fleet electrification. The Clean Energy and Pollution Reduction Act requires the California Public Utilities Commission to direct the investor-owned electric utilities to invest in infrastructure for transportation electrification. The California Public Utilities Commission has approved projects that support infrastructure development for school buses. *Southern California Edison, Pacific Gas and Electric, and San Diego Gas and Electric* have no-cost, make-ready infrastructure programs. Many of California's publicly-owned utilities (such as Sacramento Municipal Utility District, Los Angeles Department of Water and Power and other municipal utilities) also have programs to provide low- or no-cost infrastructure and favorable electric vehicle rates. Others can provide infrastructure and support services on an ad hoc basis.

Vehicle-to-Grid

Battery electric school buses that have vehicle-to-grid (V2G) capability can improve community electrical grid resilience, by providing a back-up energy resource. V2G capability is the bidirectional flow of energy between an EV's on-board battery and the grid. Battery electric school buses have been determined to be a good application for V2G because of their large batteries, predictable duty-cycles, and long down times throughout the day when energy demand is greatest. This capability allows the battery electric school bus to export power stored in its battery packs to any islanded load and to the grid if an interconnection agreement is in place with the local utility. Benefits of V2G include on-site resiliency in the case of an emergency power shut-off by the utility or catastrophic event, as well as financial benefits through either on-site power offset using vehicle-to-building (V2B) or enrollment in export compensation programs. Schools using this technology have the potential to accelerate zero-emission adoption by adding an additional revenue stream to lower the total cost of ownership.

Multiple pilot projects studying both V2B and V2G are underway in California and throughout the country. CEC's Electric Program Investment Charge (EPIC) program has

invested in technology demonstrations focused on advancing and validating the performance of bidirectional charging technologies, including with battery electric school buses. For example, one project with eQ Mobility, a NextEra Energy Resources company, will be demonstrating managed and bidirectional charging software with 20 battery electric school buses operated by First Student at a site in Richmond, CA. The bidirectional chargers were energized in April 2024. V2G operations are pending a Rule 21 interconnection with Pacific Gas & Electric.

As a result of GFO-22-612 Electric School Bus Bi-Directional Infrastructure solicitation, a total of approximately \$10 million in funding was conditionally awarded to four projects in September 2023. The recipients, including Nuvve Holding Corp., The Mobility House LLC, Storer Transportation, and BorgWarner, will collectively install a total of 78 bi-directional charging ports to support 10 local educational agencies or school agencies across the state and enable battery electric school buses to connect to the grid. Each project will utilize V2G technology for grid interconnection, with two projects also incorporating a V2B application into their microgrid design. As of April 2024, all four projects have been executed. This solicitation is a two-phase approach, with the initial phase intending to assist local educational agencies by developing V2G charging infrastructure demonstrations. The second phase of this solicitation is anticipated to be released in 2025, which will allow for larger scale deployments utilizing blueprints from phase one demonstrations. Additionally, San Diego Gas & Electric has continued partnership with Cajon Valley Union School District for the V2G pilot program with battery electric school buses. The buses' onboard batteries have been utilized as a renewable energy resource for discharging energy back to the grid during high demand or peak hours, and this specific pilot has enabled Cajon Valley Union School District to earn revenue through the Emergency Load Reduction Program.²¹ Although V2G adds additional upfront cost to the price of the vehicle and infrastructure, it has the potential to be an attractive option to help local educational agencies build a stronger business case for zero-emission battery electric school bus adoption while supporting grid resiliency and security. In 2018, CEC required awarded battery electric school buses to have V2G capabilities in their School Bus Replacement Program. This was required to assist in standardizing vehicle charging as well as providing added resiliency and emergency capabilities for school bus recipients. Following CEC's lead, CARB also began to phase in V2G requirements for school buses in HVIP starting with the Public School Bus Set-Aside. As of January 1, 2024, the V2G requirement has been expanded to encompass all school buses funded by HVIP.

²¹ San Diego Gas and Electric (2022). "SDG&E and Cajon Valley Union School District Flip the Switch on Region's First Vehicle-to-Grid Project Featuring Local Electric School Buses Capable of Sending Power to the Grid". <https://www.sdgetoday.com/news/sdge-and-cajon-valley-union-school-district-flip-switch-regions-first-vehicle-grid-project>

Low Carbon Fuel Standard Credits

The Low Carbon Fuel Standard (LCFS) credits can also reduce operational costs for both public and privately owned electric fleets. The LCFS regulation is designed to reduce the carbon intensity (CI) associated with the lifecycle of transportation fuels in California and provide an increasing range of low-carbon and renewable alternatives, which reduce petroleum dependency and achieve air quality benefits. For example, a fleet operating a battery-electric or hydrogen fueled school bus may generate credits for the quantity of electricity charged or hydrogen consumed on the buses. For battery-electric buses, additional credits are generated by charging with renewable or low-CI electricity.

The number of credits generated is tied to total fuel consumption; therefore, the more the vehicles or school buses operate on low carbon fuels, the greater the credit generation and cost savings potential. The average credit price from June 2023 to May 2024 is about \$70 per credit.²² LCFS credit value depends on a few variables, including the LCFS credit price, the annual CI target, the CI of the fuel dispensed, and the vehicle type. For 2024, LCFS credit revenue may be worth approximately 9 cents/kilowatt hour (kW-h) when charging school buses with California average grid electricity²³ and 11 cents/kW-h with zero-CI electricity, assuming a credit price of \$70. LCFS staff has developed a [credit value calculator](#)²⁴ that is available on the [LCFS dashboard](#)²⁵ which can help estimate the LCFS value for different fuels. The fleet has the option to sell the credits directly to LCFS regulated parties or opt-in entities, or sell them using a broker. Additional regulatory flexibility took effect in 2019 to allow fleets to delegate fuel transaction reporting, credit generation, and trading of credits to a third-party aggregator. While the credits cannot be used to generate revenue, the fleet can use the money toward electric vehicle purchases, infrastructure, operating costs, or associated LCFS program administration costs.²⁶

While some fuels generate credits in the LCFS program and are optional for reporting, others (typically fossil fuels) generate “deficits” in the program and may need to be reported to CARB. The reporting requirements are based on the date of school bus purchase, station

²² California Air Resources Board (2023, 2024). LCFS Credit Transfer Activity Reports.

<https://ww2.arb.ca.gov/resources/documents/lcfs-credit-transfer-activity-reports>

²³ California Air Resources Board (January 23, 2024). “2024 Carbon Intensity Values for California Average Grid Electricity Used as a Transportation Fuel in California and Electricity Supplied Under the Smart Charging or Smart Electrolysis Provision.” Page 2.

https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/comments/2024_elec_update.pdf?_ga=2.28854524.1167423694.1713987895-2120305604.1689864641

²⁴ California Air Resources Board (2019). Credit Value Calculator

<http://ww3.arb.ca.gov/fuels/lcfs/dashboard/creditvaluecalculator.xlsx>

²⁵ California Air Resources Board (2023). LCFS dashboard: <https://ww2.arb.ca.gov/resources/documents/lcfs-data-dashboard>

²⁶ California Air Resources Board (2021). “Guidance 20-03: Electricity Credit Proceeds Spending Requirements, for more details on eligible uses for electricity credit proceeds”

https://ww3.arb.ca.gov/fuels/lcfs/guidance/lcfsguidance_20-03_ADA.pdf

owner through which fuel is dispensed for transportation use, and the fuel type used, such as propane or CNG, by school bus fleets.

As of January 1, 2021, the school districts that operate fossil propane school buses purchased after January 1, 2020, or other propane-operated vehicles, are required to report fuel transaction quantities to LCFS and purchase credits to balance the deficits they incur from use of these fuels. The school districts operating CNG buses purchased after January 1, 2020, are also subject to reporting requirements under the regulation. However, buses purchased prior to January 1, 2020, are exempt from reporting requirements under the regulation, for both propane and CNG. A LCFS Frequently Asked Questions document titled *Reporting Requirements for School Buses*²⁷ describes these requirements in detail, as well as opportunities for credit generation for using low-carbon fuels to power school buses.

Lastly, unlike the requirement for propane and natural gas, school districts are not required to report consumption of gasoline or diesel, as liquid fuel reporting is conducted by the producer or importer of the fuel, rather than the owner of the dispensing equipment.

Federal Tax Credits

Federal tax credits may also benefit local educational agencies and third-party student transportation providers that purchase zero-emission school buses. The Inflation Reduction Act introduced the *Qualified Commercial Clean Vehicle Credit* that can provide up to \$40,000 for each eligible delivered zero-emission school bus. *The Alternative Fuel Vehicle Refueling Property Credit* provides up to 30% of electric vehicle infrastructure project costs, with a maximum of \$100,000 for electric vehicle infrastructure installed in low-income or non-urban communities.

Traditionally, it has been challenging for most local educational agencies to take advantage of tax credits due to their tax-exempt status. However, the Inflation Reduction Act also introduced a new mechanism known as elective pay, or direct pay, that enables school districts and other qualified tax exempt and governmental entities to benefit from the tax credits by treating the amount of the credit as a payment of tax and issuing a refund to the school district.

The United States Internal Revenue Service has developed a *fact sheet* about the direct payment mechanism for state and local governments. As this is a new mechanism, it is not yet known how many school districts will benefit from this tax credit.

California Department of General Services Statewide Procurement Contract

In accordance with SB 114 and to provide a resource for the purchase of zero-emission school buses, CARB coordinated with the Department of General Services (DGS) to establish statewide procurement contracts for the purchase of zero-emission school buses. CARB

²⁷ California Air Resources Board (2021). "Frequently Asked Questions: Reporting Requirements for School Buses." <https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/guidance/schoolbus exemptions.pdf>

provided guidance on technical specifications for the zero-emission school bus contracts which were informed by previous CARB zero-emission school bus funding programs, including the HVIP Public School Bus Set-Aside. DGS opened the low-cost, competitive request for proposals in June 2023 and established contracts for school bus Types A, C, and D with various original equipment manufacturers based on the lowest-cost vehicle meeting minimum required specifications as outlined in the request for proposals. The original equipment manufacturers selected for the statewide procurement contracts executed their two-year agreement with DGS in October 2023, with up to three optional one-year extensions. Statewide procurement contracts are currently available for use by any public local educational agency or California State government, regardless of funding source. As of June 2024, the statewide procurement contracts have been used to purchase two zero-emission school buses, both by the California Department of Transportation. Additional information, including original equipment manufacturers' contracts, minimum zero-emission school bus specifications, and pricing information can be found on the [DGS website](#).

Workforce Training

Workforce training is critical to successfully incorporate zero-emission school buses into fleets, support a positive user experience, and prepare school fleet technicians and bus operators for transportation electrification. The need to expand training commensurate with bus deployments is growing and will continue to grow. As advanced technologies for buses and infrastructure come to market, local educational agencies must make operational adjustments and develop essential skills to account for the differences between the operation and maintenance of zero-emission school buses and conventional-fueled school buses. For example, battery electric school buses have fewer moving parts, do not have an exhaust system, or require oil changes, and their braking systems last longer because regenerative braking results in less wear on the brake pads.

Currently, there are several resources and training options available for mechanics, school bus drivers, and fleet managers. All major zero-emission vehicle manufacturers provide some level of fleet technician and driver training to new zero-emission school bus owners. Training is offered to support customers throughout the purchase and initial deployment of zero-emission school buses as well as training programs for both technicians and drivers. Trainings are offered both on-site at school district locations and via online training platforms.

On October 26, 2023, the Department of General Services, Procurement Division released the latest statewide procurement contract for zero-emission school buses, requiring manufacturers and dealers to provide adequate training to local educational agencies that purchase zero-emission buses through the contract. Additionally, the California Department of Education has also developed a supplemental module to their Behind-The-Wheel curriculum that state-certified instructional personnel may use in the training of bus drivers on battery electric school bus operations. The World Resources Institute also offers free

one-on-one technical support and peer learning sessions for local educational agencies in all stages of procuring and deploying zero-emission school buses.²⁸

In 2019, CEC approved a contract for \$1 million with Cerritos College to develop and deliver the “Electric School Bus Training Project.”²⁹ The project developed curriculum and training modules with bus manufacturers, industry, and college automotive faculty that provides training and skills development needed to operate and maintain the battery electric school buses funded through CEC’s School Bus Replacement Program. The training is free for both school district maintenance technicians and school bus operators. A total of five online courses are available including Introduction to Electric Vehicles, High Voltage Vehicle Safety, Electrical Principles, Advanced Diagnostics and Communication Systems, and Electric Vehicle Supply Equipment and Charging Systems. In addition to the online courses, regional in-person trainings are held at schools or community college campuses for fleet operators and technicians looking to test their skills and gain more hands-on experience in the classroom. The project is designed this way to help school transportation staff feel more confident in the operation and maintenance of their new electric school buses and charging infrastructure. In 2023, the CEC added an additional \$1 million to the contract with Cerritos College to expand the training to all California local educational agencies that receive public funding for zero-emission school buses. As of June 2024, a total of 576 courses have been completed by 339 school fleet technicians and community college faculty.

To ensure safety and compliance with newly installed public charging infrastructure, AB 841 (Ting, Chapter 372, Statutes 2020) was passed by the legislature in 2020. This bill added Section 740.20 to the Public Utilities Code, which requires electrical infrastructure contractors installing electric vehicle charging infrastructure and equipment on the customer side of the electrical meter to hold an Electric Vehicle Infrastructure Training Program (EVITP) certification if the project is funded or authorized by CARB, CEC, or the California Public Utilities Commission. The certification includes training on site assessment, load calculations, National Electric Code, jobsite safety, personal protection equipment, and other installation and maintenance best practices.

On March 13, 2024, CEC approved a \$3 million dollar contract with the Employment Training Panel (ETP) to increase the number of EVITP-certified electricians within California. ETP is a department under the California Labor and Workforce Development Agency, which oversees the State’s comprehensive workforce investment system. The project with ETP will contract with electrical apprenticeship programs, electrical employees, electric vehicle charger companies, community colleges, and other interested parties to provide reimbursement for EVITP training and certification. The goal of this project is to train and

²⁸ World Resources Institute (2023). “Talk to an Expert”. <https://electricschoolbusinitiative.org/talk-expert>

²⁹ Advanced Transportation and Logistics (2023). “The Electric School Bus Training Project”. <https://atleducation.org/cec/the-electric-school-bus-training-project/>

certify a minimum of 3,000 EVITP electricians, with 50% of the funds being invested in employers located in low-income and disadvantaged communities.

Additionally, the CEC is in the process of developing a workforce training and development strategy that defines the CEC's vision for zero-emission vehicle workforce development goals and objectives through 2030. It is intended to clarify the CEC's role in zero-emission vehicle workforce development, recognize existing opportunities, identify workforce program objectives, and serve as a roadmap to building the career pathways necessary to support the adoption of zero-emission vehicles and infrastructure. On June 25, 2024, the CEC held a workshop to introduce the draft zero-emission vehicle workforce training and development strategy objectives and solicit feedback from the public.

Conclusion

Zero-emission school buses provide a clear pathway to support the State's climate and air quality goals, and provide important health and safety benefits for children, who are particularly vulnerable to pollution. In 2023 there were approximately 20,000 school buses operating in California, more than half of which are diesel buses that are model year 2010 or older. Replacing the oldest diesel school buses remains a priority for the State, and since last year's SB 1403 update, the State has spent an additional \$73 million on school bus incentives, bringing the total to date to \$1.98 billion, \$1.3 million of which has been allocated or spent on zero-emission school buses. This funding has supported the purchase of over 2,300 zero-emission school buses across over 300 public school districts and charter schools, and of these approximately 1,100 are already on the road. While historic federal and State investments in zero-emission school buses over the last three years have significantly expanded deployments of zero-emission school buses, continued investments and coordination at the State, federal, and local levels are needed to replace the aging California school bus fleet.