



California Energy Commission Clean Transportation Program **FINAL PROJECT REPORT** 

# Advanced Transportation and Logistics Initiative at San Diego Community College District

# Part I: Light-Duty I Part II: Medium- and Heavy-Duty

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# **California Energy Commission**

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# PREFACE

Assembly Bill 118 (Núñez, Chapter 750, Statutes of 2007) created the Clean Transportation Program. The statute authorizes the California Energy Commission (CEC) to develop and deploy alternative and renewable fuels and advanced transportation technologies to help attain the state's climate change policies. Assembly Bill 8 (Perea, Chapter 401, Statutes of 2013) reauthorizes the Clean Transportation Program through January 1, 2024, and specifies that the CEC allocate up to \$20 million per year (or up to 20 percent of each fiscal year's funds) in funding for hydrogen station development until at least 100 stations are operational.

The Clean Transportation Program has an annual budget of about \$100 million and provides financial support for projects that:

- 1. Reduce California's use and dependence on petroleum transportation fuels and increase the use of alternative and renewable fuels and advanced vehicle technologies.
- 2. Produce sustainable alternative and renewable low-carbon fuels in California.
- 3. Expand alternative fueling infrastructure and fueling stations.
- 4. Improve the efficiency, performance and market viability of alternative light-, medium-, and heavy-duty vehicle technologies.
- 5. Expand the alternative fueling infrastructure available to existing fleets, public transit, and transportation corridors.
- 6. Establish workforce-training programs and conduct public outreach on the benefits of alternative transportation fuels and vehicle technologies.

To be eligible for funding under the Clean Transportation Program, a project must be consistent with the CEC's annual Clean Transportation Program Investment Plan Update. The CEC issued 600-18-005 to support specialized training programs in advanced vehicle technologies through faculty training, curriculum development and equipment purchases throughout the California Community College system. The agreement was executed April 10, 2019.

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## ABSTRACT

This is the final report for the California Energy Commission (CEC) Contract 600-18-005. This project sought to develop and fund zero-emission and advanced vehicle technology workforce training programs through the California Community Colleges automotive technologies system to increase the number of technicians able to repair and maintain alternative fueled and zero-emission vehicles (ZEVs) for California's growing clean vehicle market.

Under Part I of the agreement, the contractor, in concert with the CEC, approved seven community colleges to develop light-duty vehicle training programs based on the conclusion of a competitive grant solicitation. The project was later augmented to provide funding to develop medium- and heavy-duty zero-emission vehicle and infrastructure program capacity at an additional six community colleges. As a result of the overall work, alternative fuel and zero-emission technical training courses and certificate programs were added to the California Community College system curriculum.

**Keywords**: Zero-emission vehicle (ZEV), alternative fuels, community college, technical training, workforce training, curriculum

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## **EXECUTIVE SUMMARY**

The project sought to develop and fund zero-emission and advanced vehicle technology workforce training programs to increase the number of technicians able to repair and maintain alternative-fueled vehicles for California's growing zero-emission vehicle market. This is the final report for the California Energy Commission (CEC) Contract 600-18-005. It summarizes all activities conducted by the Advanced Transportation and Logistics Sector at San Diego Community College District (contractor).

Table ES-1 identifies the awarded funding by contract (in aggregate), the respective funding amounts, and the total amount spent for each.

PROJECT	AWARDED	EXPENDED	
Part I: Light-Duty College Funding	\$1,209,998	\$1,125,344	
Part II: Medium- and Heavy-Duty College Funding	\$1,560,000	\$1,439,390	

#### **Table ES-1: Major Equipment Purchases**

Source: San Diego Community College District

Under this agreement, the CEC also funded workforce technical training through the California Transit Training Consortium. This organization provided alternative fuel vehicle technical training sessions to the transit workforce including employees of public transportation agencies and academic instructors across California. Through a combination of in-person and online training, more than 100 workers were trained on the newest systems and diagnostic applications in their field, as well as safety awareness of new battery-electric technology.

# CHAPTER 1: Review of the Contract Requirements

### **Background/Problem Statement**

The use of alternative-fueled vehicles, such as electric and hybrid electric vehicles (HEVs), in California continues to grow. This growth is due in part to Governor Gavin Newsom's executive order directing, and regulations by the California Air Resources Board requiring, that by 2035 all new cars and passenger trucks sold in California be zero emission, and medium- and heavy-duty vehicles sales must be zero emission by 2045. As this growth continues, there is an increased need for technicians to service these vehicles. While the availability for training in clean fuel vehicle technology is increasing, specialized training in alternative fueled and advanced vehicle technology is offered primarily by manufacturers making it less accessible to technicians and trainers.

### The Advanced Transportation and Logistics Sector

The Advanced Transportation and Logistics Sector (ATL) of the California Community Colleges is responsible for providing direction and resources on future trends to its network of community colleges through its connections with industry leaders and the ATL statewide director. San Diego Community College District is part of the ATL initiative and offers advanced transportation programs at its colleges.

### **Goal of the Contract**

This contract sought develop and fund alternative fuel and zero-emission vehicle (ZEV) workforce training through the California Community Colleges transportation technologies sector. ATL through the San Diego Community College District published a request for proposals (RFP) to fund alternative fuel and advanced vehicle technology/ZEV proposals across the California Community College system and issued awards keeping with each community college's process for receiving and using awarded funding. To the extent possible, the contractor focused on the participation of colleges that serve primarily underserved and disadvantaged communities.

### **Objective of the Agreement**

The agreement objective was to develop and fund zero-emission and advanced vehicle technology workforce training programs to increase the number of individuals able to repair and maintain alternative-fueled vehicles for California's growing ZEV market.

# CHAPTER 2: Part I: Light-Duty Vehicle Program Activities

### **Funding Plan Development**

The first task completed was the development of a funding plan for how ATL would deliver training funds to California Community Colleges automotive programs. This funding plan was based in part on the successful execution of the contractor's previous project to establish alternative fuels training programs in community colleges under the California Energy Commission (CEC) Agreement Number 600-15-008.<sup>1</sup> The need for California's community colleges to provide advanced transportation training throughout the state was central to the development of the funding plan.

The funding plan was designed to improve regional capacity to deliver alternative fuel and ZEV technical training through the California Community College system. The plan also included about \$50,000 for direct workforce training. The CEC and contractor identified the California Transit Training Consortium, which has members throughout California, to conduct this training. The California Transit Training Consortium provided alternative fuel vehicles and ZEV technical training sessions to the transit workforce that included employees of public transportation agencies and academic instructors.

### **Implementation of Approved Funding Plan**

This task sought to implement the approved funding plan. The contractor implemented and administered the approved funding plan, including:

- 1. Purchasing equipment for training.
- 2. Developing and delivering training for trainers.
- 3. Providing information on developing the curriculum.
- 4. Providing training to underserved communities and veterans, when applicable.
- 5. Providing information in progress reports on the operation and oversight of the approved funding plan, including:
- 6. Activities related to monitoring the program.
- 7. Challenges in program implementation.
- 8. Proposed solutions to challenges related to program implementation.
- 9. Information the contractor deemed essential to the success of the program.

Implementing this phase of the project included developing and implementing an RFP process approved by the CEC. The process was designed to solicit applications from and improve automotive programs in community colleges in many areas of California. Under Part I of the

<sup>1</sup> Newhouse, Greg. 2019. "<u>Alternative and Renewable Fuel and Vehicle Technology Program Final Project Report."</u> California Energy Commission. Accessed March 17, 2025. Available at

https://www.energy.ca.gov/sites/default/files/2021-05/CEC-600-2019-054.pdf.

agreement (awarded \$1,395,110), the contractor, in concert with the CEC, approved seven community colleges for light-duty program development. Subcontracts with each of the colleges were implemented according to the overall requirements of the CEC contract. The funding amounts awarded and expended by each college are shown in Table 1.

Table 1: Community College Funding for the Light-Duty vehicle Program			
COLLEGE	AWARDED	EXPENDED	
Fresno City College	\$180,547	\$143,038	
Golden West College	\$136,283	\$126,839	
Los Medanos College	\$174,432	\$173,633	
Mt San Jacinto College	\$163,179	\$163,179	
San Bernardino Valley College	\$188,239	\$167,475	
Santa Ana College	\$180,500	\$164,683	
Southwestern College	\$186,818	\$186,496	

#### Community College Funding for the Light Duty Vehicle Due and

Source: San Diego Community College District

### **Overview of Major Equipment Purchases**

Participating community colleges were encouraged to address alternative fuel/ZEV technical training needs specific to their respective regions and the use of that technology in their regions. As a result, there were a variety of high-voltage battery training systems purchased, light-duty electric and hybrid vehicles, and specialty electric vehicle kits, which include curriculum. Table 2 summarizes the overall major purchases, some of which are shown in Figure 1.

EQUIPMENT	NUMBER PURCHASED
Training Systems – High Voltage Battery, Advanced Driver-Assistance Systems	7
Light-Duty Electric Vehicles	3
Light-Duty Hybrid Vehicles	1
Electric Vehicle Kit & Curriculum Packages	3

Source: San Diego Community College District





(Clockwise from top-left) High-voltage training system. Hyundai Kona EV. Honda CR-V Hybrid Touring. Switch Electric Vehicle Kit.

Source: Mt. San Jacinto College, Santa Ana College, Fresno City College, Los Medanos College

### **Curriculum Development**

Community college faculty used contract funding to update existing or create new courses and certificates/degrees or both that advance alternative fuel-related technical training in their respective regions. Key courses and/or certificates/degrees modified or created by participating colleges are shown in Table 3.

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COLLEGE	COURSES MODIFIED OR CREATED		
Golden West College	New Electric and Hybrid Certificate and Associate of Science		
	AUTOT 170A: Introduction to HEVs		
	AUTOT 170B: Service and Maintenance of HEVs		
Fresno City College	AUTOT 170C: Diagnosis and Repair to HEVs		
	AUTOT 171A: Introduction to Alternative Fuel Vehicles (AFVs)		
	AUTOT 171B: Service and Maintenance of AFVs		

#### Table 3: Curriculum Development – Courses, Certificates/Degrees

COLLEGE	COURSES MODIFIED OR CREATED	
	AUTOT 171C: Diagnosis and Repair to AFVs	
Los Medanos College	Auto-124: Electric Vehicles	
Mt San Jacinto College	AUME 800: Introduction to Hybrid and Electric Vehicle Technology	
Santa Ana College	AUTO-260: Introduction to Electric Vehicles AUTO-284: Hybrid Vehicles AUTO-116: Electrical Fundamentals AUTO-287: Alternative Fuels	
San Bernardino Valley College	HMDT 042: Zero Emission Heavy Duty Trucks HMDT 034: Heavy Duty Truck Alternative Fuels	
Southwestern College	NC-350 and NC-351: Hybrid and Alternative Fuels I & II	

Source: San Diego Community College District

### **Faculty Professional Development**

Faculty must continually update their skills and knowledge to teach new technologies to technicians desiring to enter the workforce. An important component of this contract was the provision of technical training for faculty, enabling them to bring new alternative fuel/ZEV technology into the classroom and automotive labs on their campuses.

With this funding, 33 faculty members participated in professional development technical training. Most instructors participated in electrical and hybrid vehicle training courses. Hydrogen fuel instructor training was also provided. Table 4 provides training details.

COVID-19 restrictions, particularly related to travel and onsite campus events, delayed faculty training or forced campuses to identify online options or both. While this was not ideal for many instructors who prefer hands-on training, online delivery offered flexibility, as it could be completed anytime. Mt. San Jacinto College used the "Unlimited Educator Pass" purchased to also offer access to hybrid and electrical training to about 30 students.

COLLEGE	TRAINING	FACULTY TRAINED
Golden West College	L3 National Institute for Automotive Service Excellence (ASE) Certification	4
Fresno City College	HEV/battery-electric vehicle (BEV)/plug-in hybrid electric vehicle/fuel cell electric vehicle online training modules	11
Los Medanos College	Switch Lab Instructor Training	1
Mt San Jacinto College	Electrical & Hybrid Courses – Automotive Video Innovations (AVI) OnDemand Electrical live training – AVI	6 6
Santa Ana College	Manufacturer training – online	1
San Bernardino Valley College	Hydrogen Fuel and Electronic AC/DC Motors Instructor Training	3

#### **Table 4: Faculty Professional Development**

COLLEGE	TRAINING	FACULTY TRAINED
Southwestern College	High Voltage Safety Training Hybrid and Electric Vehicle Systems Hybrid and Electric Vehicle Bootcamp	1

Source: San Diego Community College District

While the workforce training provision was a small component of the overall contract, it is a highly effective faculty professional development tool. Trained community college faculty can deliver workforce training to technicians in need of new knowledge of alternative fuels and associated technologies. Eleven community college faculty members were also trained through the California Transit Training Consortium's workforce technical training funded by this contract.

# CHAPTER 3: Part II: Medium- and Heavy-Duty Vehicle Program Activities

Under Part I of the agreement, the contractor approved seven community colleges for lightduty program development based on the conclusion of a competitive grant solicitation process. The project was later augmented with an additional \$1,800,000 for Part II to provide funding to develop medium- and heavy-duty zero-emission vehicle and infrastructure program capacity at six community colleges.

### **Funding Plan Development**

The contractor collaborated with the CEC to develop a funding plan that differed from previous years and from the light-duty vehicle program. The revised plan and scope of work were highly structured, limiting the ability of colleges to submit unique proposals or allowing for significant differentiation between colleges. To maximize the effectiveness of the funding, the project team and the CEC chose to focus on colleges that were best positioned to promptly use the equipment and achieve significant impact. Efforts were made to solicit interest from institutions across the state to expand training and access to resources as widely as possible.

### **Analysis of Project Funding Gaps**

In coordination with the statewide director for ATL, the contractor analyzed medium- and heavy-duty transportation programs in California to identify candidates for ZEV seed investments. While the initial goal was to encourage participation from underrepresented community colleges, discussions with stakeholders and leadership at the CEC led to a strategic decision to prioritize colleges in regions that were either modernizing or well-positioned to modernize their programs with ZEV curriculum. These colleges were identified as having the ability to deploy ZEV technology more efficiently.

The team's research highlighted two significant barriers to transitioning medium- and heavyduty transportation programs to ZEV platforms: cost and lack of early advisory committee support. Initially, few industry advisors believed that ZEV platforms would play a major role in the heavy-duty transportation sector. However, with the introduction of supportive legislation, high-profile demonstration projects (such as Volvo Lights), port mandates, and increasing adoption, advisory committees gradually became more supportive across more colleges. The high cost of ZEV equipment — ranging from low six figures to more than \$300,000 — posed another major challenge for college adoption. One lesson learned from the light-duty ZEV programs is that if colleges do not invest early in new technology transitions, it can be much more difficult and cost-prohibitive over time.

Given these financial challenges, the project adopted a phased approach, providing colleges with funding to acquire three training units each. This approach allowed colleges to integrate ZEV technology into their curricula while continuing to build capacity over time, enabling technicians to gain systems familiarity with ZEV technology and safety standards.

### **Outreach Efforts**

With the funding plan finalized and target regions and colleges identified, the contractor, alongside the statewide director for ATL, conducted interviews with potential colleges. These interviews covered key aspects of each college's curriculum, program history, partnerships, student enrollment, and plans to modernize or transition to zero-emission programs.

The contractor compiled a list of eligible colleges, which was then submitted to the CEC for final approval.

### **Implementation of Approved Funding Plan**

This task focused on developing a comprehensive funding plan to submit to the CEC for approval. The primary objective was to accelerate the engagement and modernization of California Community Colleges' heavy-duty transportation programs, enabling them to build the training capacity necessary to serve the emerging ZEV market.

The funding plan was intentionally structured to be prescriptive. During the planning phase, the contractor, stakeholders, and CEC preapproved specific training systems that colleges would be able to acquire as part of the initial investment. The focus was on identifying "shovel-ready" programs that could quickly deploy equipment and resources to begin modernization. As the heavy-duty ZEV segment was still in the early stages, this stepped approach was designed to allow colleges to integrate initial ZEV training while building more comprehensive programs over time, which also reduced investment risk for early adopters.

Under the \$1.8 million contract augmentation, the contractor, in collaboration with the CEC, approved six community colleges for program development. Subcontracts with these colleges were executed in alignment with the overarching requirements of the CEC contract. Table 5 shows the colleges selected and the funding spent for each.

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COLLEGE	AWARDED	EXPENDED	
College of Alameda	\$260,000	\$228,065	
Fresno City College	\$260,000	\$244,613	
San Bernardino Valley College	\$260,000	\$228,356	
San Diego Miramar College	\$260,000	\$237,860	
Santa Rosa Junior College	\$260,000	\$250,839	
Shasta College	\$260,000	\$249,657	

# Table 5: Community College Funding for the Medium- and Heavy-Duty VehicleProgram

Source: San Diego Community College District

### **Overview of Major Equipment Purchases**

Equipment funding for Part II of this project was intentionally structured to be prescriptive to maximize funding and reach. There was only one company offering training for this segment at the time funds were deployed, which was the TruckTrain systems by Lucas-Nuelle, which includes the hybrid & electric heavy-duty vehicle specialist, diagnosis & maintenance of a high-voltage battery, and the first responder trainer for advanced electric drive vehicles. Each

participating college received all three tabletop training units as part of this project. The major purchases for this program are shown in Table 6.

# Table 6: Major Equipment Purchases for the Medium- and Heavy-Duty VehicleProgram

EQUIPMENT	NUMBER PURCHASED
Hybrid & Electric Heavy-Duty Vehicle Specialist	12 (2 per college)
Diagnosis & Maintenance of a High-Voltage Battery	6
First Responder Trainer for Advanced Electric Drive Vehicles	6

Source: San Diego Community College District

The hybrid & electric heavy duty vehicle specialist system, shown in Figure 2, enables students to work directly on a real high-voltage system, which does not require any prior qualification due to the design and protection. This training system thus creates a safe working environment and enables focused work. This system comes with curriculum, various accessories, and related personal protective equipment. All module contents are based on the Institute of Motor Industry qualification Electric Vehicle 2.2 and Electric Vehicle 3, as well as the U.S. qualification ASE L3, Light Duty Hybrid Electric Vehicle Specialist.

#### Figure 2: Hybrid and Electric Heavy-Duty Vehicle Specialist



Source: San Diego Miramar College

Advances in the development of ZEVs continue to pose new challenges for the automotive sector. The high-voltage battery has long been considered to be a "black box." But now, more manufacturers are also venturing into repairing high-voltage batteries. The diagnosis and maintenance of a high-voltage battery system, shown in Figure 3, focuses on the digitally networked controller area network-bus battery management system in a traction battery and on the corresponding components. This system comes with curriculum, various accessories, and related personal protective equipment.



Figure 3: Diagnosis and Maintenance of a High-Voltage Battery

Source: San Diego Miramar College

The first responder trainer for advanced electric drive vehicles system offers students a safe but practical training solution consisting of training hardware and a special e-learning coursework. In this way, students are prepared for the various accident scenarios with highvoltage vehicles and can practice the correct procedures through the various practical exercises, as well as the interactively prepared theory until this has become second nature. The system is shown in Figure 4.

#### **Figure 4: First Responder Trainer for Advanced Electric Drive Vehicles**



Source: San Diego Miramar College

# CHAPTER 4: Additional Activities and Information

### **Student Impacts**

Courses developed or modified through CEC funding will affect an estimated 2,500 students each year. Faculty members were asked how students have been or will be positively impacted by the implementation of the new curriculum and equipment, and reported the following:

Travis Ebersole, a student at Mt. San Jacinto College, was one of the first to take the new AUME 800 class as soon as it was offered. He quickly became familiar with hybrid/electric vehicle technology and got comfortable working around it. He was recently able to secure a job at the local Toyota dealership. This position came at a good time because he had been hard-hit by the economic impact of the COVID-19 situation.

Scott Sheffield and Isaiah Knight successfully completed the Toyota Technical Education College Support program at Fresno City College. The program is designed to help fill the pipeline for well-trained, certified technicians with hands-on automotive diagnosis and repair education. Both students attained employment to start their careers as certified Toyota technicians and completed the "Introduction to BEV/HEV Vehicles" course at Fresno City College to enhance their on-the-job performance and practice industry standard safety procedures when working on high-voltage vehicles.

Anthony Przybylek completed the alternative fuels certificate, which includes zero-emission technology at San Bernardino Valley College. Upon completion, he was hired by a TEC Equipment dealership as a lead technician in the shop and is now moving toward a promotion to shop foreman. TEC in Fontana is the first dealership recognized as a Volvo EV certified dealer.

### **Addressing Equity Impacts**

An important objective under this contract was addressing equity within the college automotive programs. The student population at funded colleges is diverse, and the majority of students are economically disadvantaged. Faculty expressed several ways in which their projects impacted equity issues on their campuses.

All funded colleges noted that their students gained an introduction and access to high-tech training equipment that they would not otherwise encounter in their local communities. These students now have the opportunity to learn about emerging automotive markets with equipment and vehicles usually reserved for colleges in affluent areas or research universities. Los Medanos College reported that there has been a higher-than-normal level of interest in its new electric vehicles course by groups that do not typically look for career options within the automotive industry.

Online training offered to Mt. San Jacinto College automotive students made it possible for many nontraditional students, for whom the expense and time spent commuting is significant, to gain access to training not otherwise available to them. This online training made the subsequent hands-on training safer for students without an automotive technology background and provided an introduction to a technology that was unfamiliar to most students living in the immediate vicinity of the campus.

San Bernardino Valley College leveraged the project to deepen its strategic partnerships with its advisory committee and broader community. Conversations around connecting isolated communities with racially and economically diverse populations to the college are continuing.

### **Faculty Feedback**

Community college faculty appreciate the opportunities the CEC funding has created for them and their students. The purchase of equipment has allowed Golden West College faculty to teach hybrid and electric classes that had not been able to be offered previously. Southwestern College will be implementing its new hybrid and alternative fuels courses soon as well.

Los Medanos College also offered its new electric vehicles course for the first time during the fall 2021 semester, with 23 students participating. "Each is receiving training in EV safety procedures, battery replacement, battery management system programming and diagnosis, EV component operation, maintenance, and more," said Jason Dearman, auto instructor.

Mt. San Jacinto College has already seen an increase in enrollment in its "Introduction to Hybrid and Electric Vehicle Technology" course. "The department chair reports that this course is among the most requested when it comes to courses included on the schedule and the one that has generated the greatest interest in a more advanced course," said auto instructor Robert Pensiero. "It introduces students to an emerging technology that many of them didn't think they had an interest in, or they were intimidated by the perceived dangers of." The purchased Consulab Drivetrain simulator and CarTrain high-voltage battery trainer allow students to diagnose and test these systems thoroughly and safely.

Although Santa Ana College's "Introduction to Electric Vehicles" course was canceled in spring 2021 because of COVID-19, it was offered in spring 2022. "Manufacturer support has increased this semester with the addition of the Ford ACE program to the department," said auto instructor David Roper. "They have expressed interest in the EV courses and offered support in the form of vehicle donations and EV demonstrations with the new Ford Lightning. The department continues to work with high schools to create dual enrollment options, using EVs as focal points of the department."

Classes in San Bernardino Valley College's Clean Vehicle Technology and Zero Emission program started spring 2021 with 10 students focused on receiving the certificate. "The equipment that was purchased with the help of this grant armed the students with a strong understanding of the technician portions of the BEV vehicles with safe and proper diagnosis of electrical motors," said Kenny Melancon, auto instructor. "Students with this knowledge have made themselves more competitive candidates for employment. Employers are desperately in need of filling positions and are looking toward the community colleges for support."

Fresno City College deepened its existing industry partnerships and created new ones. "The Fresno City College Automotive/Diesel/Advanced Technology Department was able to partner with Valley CAN (Clean Air Now) and the City of Fresno Light Maintenance Fleet Operations to provide BEV/HEV industry training," said Marty Kamimoto, auto instructor. "Several other educational partnerships are in development with Tesla, Inc., and American Honda at our new Fresno City College West Fresno Campus/Advanced Transportation Center."

### **Workforce Training Summary**

The CEC also funded workforce technical training through the California Transit Training Consortium. The California Transit Training Consortium provided alternative-fuel vehicles and ZEV technical training sessions to the transit workforce that included employees of public transportation agencies and academic instructors. Through in-person and online training, more than 100 workers were trained on the newest systems and diagnostic applications in their field, as well as safety awareness of new battery-electric technology.

### **Program Challenges**

The most significant program challenges stemmed from COVID-19 restrictions placed on campuses throughout the contract period. Many planned in-person faculty professional development training were canceled either because of training facility closures or lack of adequate space, or faculty were unable to attend because of campus travel restrictions or a combination. Most colleges were able to identify online training for their faculty, and three were able to offer limited in-person training during the contract period.

COVID-19 restrictions also hampered the ability for many campuses to offer in-person classes during the contract period. The launch of newly created or updated classes was delayed by as much as a full year for some colleges. Some faculty also noted that the overall move to online classes led to decreased enrollment.

Another observable challenge with these projects was the complexity of purchasing equipment. Colleges reported difficulties in completing purchases promptly because of local purchasing regulations, acquisition protocols, and sole-source restrictions. Furthermore, delays in equipment delivery presented obstacles, with some colleges still experiencing supply chain issues stemming from the COVID-19 pandemic. All medium- and heavy-duty electrical trainers, for instance, were made to order, with lead times ranging from three to six months.

When considering the challenges in subcontracting and local delays at individual colleges, such as board approvals and project ramp-ups, these lead times can present significant challenges. This issue persists, posing a substantial hurdle for programs reliant on grant funding. Many manufacturers of training equipment have lead times of six to eight months, which often conflict with grant requirements, as colleges need to receive the equipment before the grant performance period concludes.

### **Future Program Opportunities**

This program addressed major challenges faced by community college technical training programs by enabling colleges to acquire new technology and train their faculty on that technology. Colleges were also able to strengthen partnerships with industry and increase student interest in automotive/ZEV training through their new or enhanced curriculum.

The automotive industry faces the challenge of continuous technological advances, which necessitate ongoing workforce training and the need for technicians trained on the latest technology to enter the workforce. State policy that addresses energy or environmental issues or both also drives advancements in automotive, trucking, transit, and related transportation technology.

Technical training remains a critical component of California's alternative fuel/ZEV policies, and the CEC, California Community Colleges Chancellor's Office, and ATL could continue to work together to strengthen the state's technical training programs in the following ways:

- 1. The CEC and ATL could assess how well regional or statewide alternative fuel vehicle technical training is meeting industry and consumer needs and how these needs could be addressed.
- 2. The CEC could invite organizations such as the South Coast Air Quality Management District, California Air Resources Board, California Public Utilities Commission, and electricity and natural gas utilities to address alternative-fuel vehicle technical training needs.
- 3. The CEC could work with the California Transit Training Consortium, the Municipal Equipment Maintenance Association, and other transit organizations to address workforce technical training needs.
- 4. The CEC could leverage its relationships to provide colleges with obsolete ZEV equipment. Through various stakeholder discussions, the team was made aware of first-and second-generation ZEV equipment funded by the commission that is no longer being used by various organizations. These vehicles could be distributed to college programs that could not afford them otherwise, giving these vehicles a second life and affording students critical hands-on experience with industry equipment.

# GLOSSARY

ALTERNATIVE FUEL VEHICLE (AFV) — motor vehicles that run on fuels other than petroleumbased fuels. As defined by the National Energy Policy Act (EPAct), this excludes reformulated gasoline as an alternative fuel.

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

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

- 1. Advancing state energy policy.
- 2. Achieving energy efficiency.
- 3. Investing in energy innovation
- 4. Developing renewable energy.
- 5. Transforming transportation.
- 6. Overseeing Energy infrastructure.
- 7. Preparing for energy emergencies.

CALIFORNIA TRANSIT TRAINING CONSORTIUM — A non-profit corporation comprised of community colleges, universities, transit agencies, and public and private partners to develop transit workforce technical training.

CONTROLLER AREA NETWORK (CAN) — A serial network technology that was originally designed for the automotive industry, especially for European cars, but has also become a popular bus in industrial automation as well as other applications. The CAN bus is primarily used in embedded systems, and as its name implies, is a network technology that provides fast communication among microcontrollers up to real-time requirements.

ELECTRIC VEHICLES (EV) — A broad category that includes all vehicles that are fully powered by electricity or an electric motor.

HEAVY-DUTY VEHICLE (HDV) — Any motor vehicle with a gross vehicle weight rating (GVWR) of more than 26,000 pounds.

HYBRID ELECTRIC VEHICLE (HEV) — A vehicle that combines an internal combustion engine with a battery-electric motor. This combination offers the range and refueling capabilities of a conventional vehicle, while providing improved fuel economy and lower emissions.

HYDROGEN (H2) — A colorless, odorless, highly flammable gas, the chemical element of atomic number 1.

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

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

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

ZERO-EMISSION VEHICLE (ZEV) — Vehicles that produce no emissions from the on-board source of power (for example, an electric vehicle