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# ZERO-EMISSION DRAYAGE TRUCKS WORKFORCE ASSESSMENT

Long Beach City College

WTA Workforce Training Associates

Rocket One Group

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ZERO EMISSION

## Port of Long Beach
## The Green Port
## August 2023

A 2023 Report By

Long Beach City College

Workforce Training Associates

Rocket 1 Group

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# EXECUTIVE SUMMARY

The Port of Long Beach, in collaboration with Long Beach City College, conducted a targeted workforce gap analysis to assess the region's readiness to support the maintenance and operation of heavy-duty zero-emission drayage vehicles (ZEVs) and related infrastructure. Funded by the California Energy Commission's EV Blueprint Phase II initiative, this project addresses a critical industry need: preparing a skilled workforce capable of supporting the rapid deployment of advanced vehicle technologies.

**Advancing Operational Readiness Through Workforce Development:** As ZEV adoption accelerates in port logistics and drayage operations, the demand for qualified technicians is outpacing supply. Industry interviews and surveys revealed 17 essential competencies—ranging from high-voltage safety and software diagnostics to battery management systems—that are not yet widely embedded in traditional diesel training pipelines. This gap presents both a challenge and an opportunity for fleets, OEMs, and service providers seeking to build internal capacity or partner with regional training institutions.

**Workforce Assets & Training Capacity:**
The region is home to seven community colleges with heavy-duty/diesel programs and six with electrical programs applicable to EV infrastructure. Select colleges—such as Rio Hondo and San Bernardino Valley—have begun integrating ZEV-focused content, including technician training aligned with OEM platforms. However, broader program alignment and upskilling are needed to meet industry time lines and technology rollouts.

**Partnering for Scalable Solutions:**
The International Brotherhood of Electrical Workers (IBEW) Local 11 offers the nationally recognized Electric Vehicle Infrastructure Training Program (EVITP), providing immediate training options for electricians involved in depot buildouts. Industry engagement is essential to shaping program design, advising curriculum development, and supporting instructor training—especially as ZEV platforms evolve and diversify.

**Recommendations for Industry Engagement**:
To meet 2035 ZEV drayage goals, employers should actively partner with local training providers to:

- Co-develop curricula aligned with evolving technology
- Support incumbent worker training through ETP and fee-based programs.
- Participate in advisory committees to guide program direction.
- Provide training equipment, internship sites, or instructional support.
- Collaborate on early-phase skill development in high-voltage systems and diagnostics.

## A CALL TO ACTION

The transition to zero-emission logistics is well underway. By investing in workforce partnerships now, industry leaders can help ensure a stable pipeline of job-ready technicians, reduce long-term maintenance costs, and maintain compliance with regulatory targets. The Port of Long Beach and its regional partners are committed to supporting these efforts and invite industry stakeholders to co-invest in the talent that will power the next generation of clean transportation.

# PROJECT BACKGROUND

In support of a zero-emissions future, the Port of Long Beach (Port), California Energy Commission (CEC), Long Beach City College (LBCC), Workforce Training Associates (WTA), Rocket 1 Group, and industry partnered together to assess needed skills of current and future workers, identify skills gaps, evaluate regional training programs, and make recommendations to strengthen the heavy-duty zero-emission vehicle (ZEV) workforce.

# The Port is actively testing and implementing zero-emission vehicles and technology

The Port, an award-winning Green Port, is actively testing and implementing zero emission vehicles and technology to achieve zero-emission cargo-handling equipment and on-road trucks for drayage operations by 2035. Through the CEC grant "EV Blueprint Phase II", the project's objectives are to develop and deploy alternative and renewable fuels and advanced transportation technologies to help attain the Port's and the state's climate change, clean air, and alternative energy goals.

Outlined in this report, readers will find environmental justice information, new skills/competencies needed, existing regional education and training programs at the community college level, training offered through the International Brotherhood of Electrical Workers (IBEW), and recommendations for all stakeholders, including funding partners, on how best to prepare a zero-emissions drayage workforce.

# 3 HEAVY-DUTY VEHICLE INFORMATION AND COMMON JARGON

## Common Acronyms

Zero-Emission Truck **(ZET)**
Zero-Emission Vehicle **(ZEV)**
Heavy-Duty **(HD)**
Battery Electric Vehicle **(BEV)**
Fuel-Cell Electric Truck **(FCET)**
Electric Vehicle **(EV)**
Gross Vehicle Weight Rating **(GVWR)**

## Definitions

- **Weight Class:** The Federal Highway Administration classifies vehicles by their gross vehicle weight rating (GVWR). GVWR is the vehicle manufacturer's specification of the vehicle's loaded weight. Vehicle weight class ranges from 1 - 8. See below for more information on vehicle weight class.
- **GVWR:** Gross vehicle weight rating – the maximum operating weight of the vehicle set by the manufacturer. This includes the empty vehicle weight, fuel, passengers, and cargo combined.
- **Heavy-Duty:** Vehicles with a GVWR greater than 26,000 pounds. Includes weight classes 7 and 8.
- **Drayage Truck:** These trucks are generally diesel-fueled (Class 7 & 8) trucks that transport containers and freight between the port and intermodal rail facilities, distribution centers, and near-port locations.

# 4 ENVIRONMENTAL JUSTICE

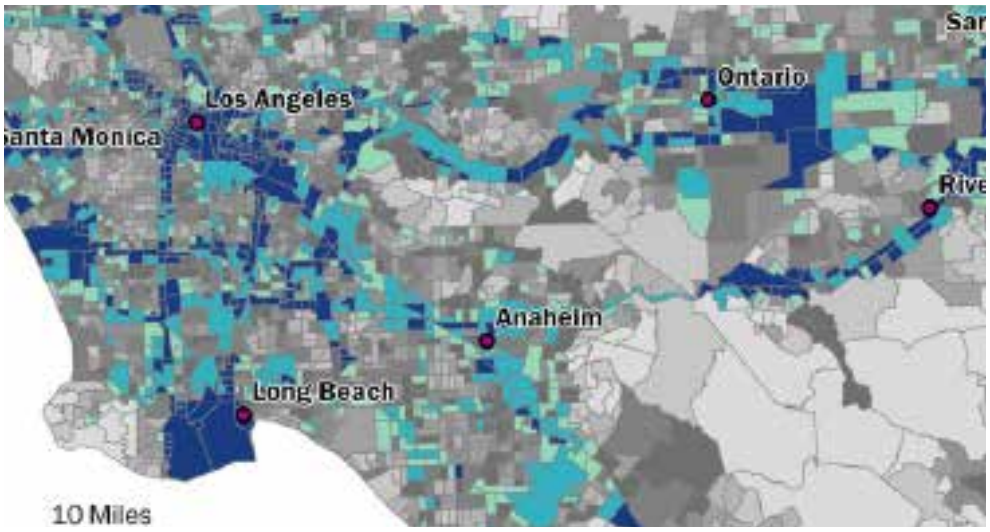
**The Port has reduced heavy-duty vehicle DPM by 97% since 2005.**

Port-adjacent communities—predominantly composed of low-income residents and communities of color—have long borne a disproportionate share of the environmental and public health burdens associated with freight movement, industrial superblocks, and high-volume transportation corridors. These neighborhoods are among the most heavily impacted by diesel particulate matter (DPM) in California, with census tracts consistently ranking in the top 10th percentile for pollution exposure according to CalEnviroScreen 4.0 **(1)**.

Over the past two decades, the Port of Long Beach has taken aggressive steps to mitigate these impacts. Since its 2005 baseline, the Port has achieved a 97% reduction in DPM emissions from heavy-duty vehicles. Despite ongoing operational demands, emissions from this sector have remained flat at six tons annually since 2020—an achievement that reflects both technological investment and operational innovation **(2).**

## 4.1 Diesel Particulate Matter Mapping

Diesel Particulate Matter (PM) is the particle phase of diesel exhaust emitted from diesel engines. This phase consists of a mixture of compounds, including sulfates, nitrates, metals, and carbon particulate. The diesel PM indicator differs from other air pollution indicators in CalEnviroScreens because it includes known carcinogens, such as benzene and formaldehyde (Krivoshto et al., 2008) and 50% or more of the particles are in the ultrafine range (US EPA, 2002)**(3)**. Drayage trucks, which utilize diesel engines, are significant emitters of particulate matter (PM) and oxides of nitrogen (NOx). Diesel PM emissions have significant adverse health impacts and are responsible for 70 percent of cancer risk from airborne toxins in California **(4).**




**Diesel Particulate Matter Mapping Emissions from on-road and non-road sources, tons/year (2021 CalEnviroScreen Report using 2016 DPM data)**
Diesel PM Images sourced from CalEnviroScreen 4.0 **(5)**

Diesel Particulate Matter (PM) is the particle phase of diesel exhaust emitted from diesel engines

**FOR DECADES, low-income communities and communities of color located near freight hubs, bus depots, and trucking corridors have been directly and disproportionately affected by the cumulative impacts of air pollution and GHGs from transportation and other emissions sources.**

Many communities also lack access to clean and reliable transportation options. These historically marginalized front lines, overburdened, and underserved communities should be the first to benefit from transportation electrification. The ZEV Task Force has endeavored to develop an Action Plan that centers equity and prioritizes the delivery of the environmental, public health, and economic benefits of MHD vehicle electrification where they are needed most." ZEV Task Force Report **(6)**.

*The ZEV Task Force is comprised of seventeen U.S. states (including California), the District of Columbia, and Quebec who worked together to produce a bold Action Plan for accelerating a transition to zero-emission trucks and buses. The plan identifies barriers and opportunities for rapid and equitable truck and bus electrification and actionable policy and program recommendations for state policymakers, utilities, and utility regulators.*

**The Port's commitment to environmental stewardship is further demonstrated through:**

- **Joint Clean Air Action Plans (CAAP)** with the Port of Los Angeles to align on emissions reduction strategies.
- **The Clean Truck Fund Rate**, generating financial resources for the adoption of zero-emission vehicles.
- **Over $150 million committed** to fund and scale zero-and near-zero-emission demonstration projects, with $70 million secured in competitive grant funding to date

While progress has been substantial, the broader transition to a zero-emission freight system is not only an environmental imperative—it is an equity imperative. Statewide guidance, including from the Multi-State ZEV Task Force, calls for centering historically marginalized communities in the deployment of zero-emission transportation infrastructure and workforce strategies.

To that end, workforce development is a core element of environmental justice. Preparing local residents—particularly from frontline communities—for high-quality careers in the zero-emission vehicle (ZEV) and infrastructure sectors will ensure that those most impacted by pollution can also benefit economically from the transition. Equity-centered strategies must include access to training, industry-aligned curriculum, and regional job placement pipelines to ensure inclusive economic opportunity.

To learn more about the Port initiatives and projects related to advancing zero emissions and reducing air pollution.

visit **www.polb.com/zeroemissions**

## 4.2 Clean Air Action Plan

The Clean Air Action Plan (CAAP) is a landmark air quality plan that sets a comprehensive strategy for dramatically reducing port-related air pollution from cargo movement in and around the ports. Additionally, the plan supports port development, job creation, and related economic activity. This action plan is a collaboration between the Ports of Long Beach and Los Angeles, which have been developing and deploying strategies that include multiple vessel pollution reduction incentive programs, the Clean Trucks Program, and advanced new technology, among others. These action plans have been in place since 2006 and were updated in 2010 and 2017.

The latest plan update aims to align with the California Sustainable Freight Action Plan **(7)**.

**This alignment includes:**

- Clean Vehicles & Equipment Technology and Fuels.
- Terminal Operators Purchase Requirements: Requiring terminal operators to purchase ZEV cargo handling equipment if feasible.
- On-dock Rail Expansion: Expanding rail operations to shift more cargo leaving the ports by rail, improving Port efficiency.

Additionally, the Ports, as part of the CAAP, and its goal to achieve a 100-percent ZE drayage fleet by 2035, are committed to publishing a Drayage Truck Feasibility Assessment every three years to evaluate the status of technology and supporting infrastructure that will be required to achieve CAAP strategies. The assessment is intended to evaluate the current state of zero-emission (ZE) and low-emission (LE) fuel-technology platforms appropriate for drayage-capable trucks.

# 5 ASSESSMENT CHALLENGES

The Port of Long Beach is at the forefront of advancing zero-emission technologies in freight and logistics, yet the broader deployment of heavy-duty electric vehicles (HDEVs) across the drayage sector remains in its early stages. As a result, assessing workforce readiness requires navigating a dynamic and rapidly evolving landscape.

A central challenge in this assessment was the limited number of Licensed Motor Carriers (LMCs) currently operating HDEVs. Adoption remains low due to production delays, infrastructure gaps, and operational uncertainties. Consequently, this analysis expanded its scope to include adjacent sectors—such as transit, utility fleets, and other medium- and heavy-duty operators—where early adoption of similar technologies offers transferable insights. These industries face many of the same maintenance, training, and safety considerations as the drayage sector.

**Industry feedback revealed several key issues:**

**OEM Uncertainty:** Original Equipment Manufacturers are still refining training protocols, with some only allowing internal engineers to service vehicles. This has limited external technician access and delayed the development of standardized maintenance curricula.

**Technician Training Gaps:** Many service providers, including dealers and fleet operators, lack formal training resources for ZEV platforms. Internal training teams report difficulty in preparing technicians due to limited guidance from manufacturers.

**Maintenance Complexity:** Technicians are currently engaged in "trial-and-error" maintenance, as OEM documentation and troubleshooting guides are still being developed.

**Service Models:** LMCs report relying heavily on OEM service contracts due to warranty coverage and the complexity of the technology, reducing demand for in-house technicians during the early adoption phase.

**Cost Barriers for Small Fleets:** Micro fleets—typically immigrant- and family-owned operations with one to five trucks—face the greatest obstacles. Many may pre-purchase diesel vehicles ahead of regulatory deadlines to delay ZEV adoption, citing capital constraints and lack of access to qualified service providers.

Despite these challenges, the industry consensus is clear: workforce development must begin now to ensure a pipeline of qualified technicians, infrastructure specialists, and safety professionals capable of supporting large-scale ZEV deployment. While early adoption has created fragmentation in service models and training access, this transitional period offers a strategic opportunity to standardize programs and align regional education systems with emerging industry needs.

> Technician training for zero-emission trucks is still in its infancy. OEMs are just beginning to release guidance, and much of the current maintenance is trial-and-error. The time to invest in workforce readiness is now—before the curve becomes a cliff.

# 6 GENERAL SKILLSET: HEAVY-DUTY ELECTRIC VEHICLE MAINTENANCE TECHNICIAN

**The following represents the general skillset for Heavy-Duty Electric Vehicle Maintenance Technicians. The top specialized, soft, and technical skills listed below were sourced from surveys, interviews, and job postings.**

## 6.1 TOP SKILLS FOR CURRENT AND ZEV TRANSITIONING DIESEL MECHANICS

### Specialized Skills

- Hybrid Systems
- HVAC
- Electric Motors, Wiring & Modules
- High-Voltage Batteries
- High-Voltage Safety
- Software Diagnosis & Uploading
- Advanced Driver-Assistance Systems
- Technical Documentation
- Thermal Management & Cooling
- Battery Management Systems
- Quality Assurance
- Charging Fundamentals
- PPE & General Safety
- Telematics
- Fuel Cells
- Emergency Response
- Advanced Diagnostics Tools

### Foundational Skills

- Tires
- Batteries
- Suspension
- Brakes
- Computer Systems
- ASE
- Preventative Maintenance
- Electrical Systems
- Hydraulics
- Diagnosis
- Air Brakes
- Occupational Health & Safety
- Pneumatics

### Soft Skills

- Problem-Solving
- Customer Service
- Sales
- Management
- Communications
- Operations
- Driving
- Trust
- Leadership
- Troubleshooting

# 7 GENERAL SKILLSET: HEAVY-DUTY VEHICLE MAINTENANCE TECHNICIAN

The following represents the general skillset for traditional HD Vehicle Maintenance Technicians. The top specialized, common, and software skills listed below were sourced from recent online job postings and profiles and were collected from Lightcast (formally EMSI), an economic modeling software. The following table pulled the data from all the current job postings, resumes, and profiles to help illustrate today's desired skills.

## 7.1 TOP SKILLS FOR DIESEL MECHANIC OCCUPATIONS IN LOS ANGELES COUNTY(8)

### Foundational Skills

- Diesel Engines
- Preventative Maintenance
- Electrical Systems
- Mechanics
- Hand Tools
- Forklift Operation
- Vehicle Maintenance
- Oil & Gas
- Breaks
- Cooling Systems
- Hydraulics
- DOT Inspections

### Soft Skills

- Self-motivation
- Valid Driver's License
- Customer Service
- Energetic
- Enthusiasm
- Goal-oriented
- Communication
- Troubleshooting
- Computer Literacy
- Mechanical Aptitude

### Software Skills

- Fleet Maintenance Software
- Microsoft Excel
- Apple IOS
- Microsoft Office
- Dell PowerEdge
- Microsoft Outlook
- SAP Applications
- Solid Works (CAD)
- Microsoft Office 365

# 8 SKILLS AND TRAINING GAP ANALYSIS

The Port, through the 2017 Clean Air Action Plan Update, has proposed ambitious zero-emissions goals, including a complete transition to zero-emissions drayage trucks by 2035 and zero-emissions terminal equipment by 2030. Adopting this new technology will have implications for the workforce, and the readiness of labor to support this transition is intimately tied to the Port's ability to achieve its zero-emission goals.

In addition, the California Energy Commission (CEC) has a continued interest in understanding the impact the adoption and scaling of ZEV technology has on the workforce and, through this grant, has included funding for a workforce needs assessment and skills gap analysis. This part of the analysis serves to map out educational and training programs in the Los Angeles region, identify the existing assets, and develop recommendations for augmenting these programs. The goal is to support the electrification of heavy-duty vehicles and produce an area workforce capable of operating and maintaining zero-emission drayage trucks.

The following table highlights the specialized skills required for Heavy-Duty Electric Vehicle Maintenance Technicians. These skills have been identified through directed interviews, surveys, fleets, dealerships (maintenance), and job postings. They represent the skills gap between many current training programs and industry needs.

## ZEV SPECIFIC KNOWLEDGE SKILLS & ABILITIES (IDENTIFIED GAP)

- Hybrid Systems
- HVAC
- Electric Motors, Wiring & Modules
- High-Voltage Batteries
- High-Voltage Safety
- Software Diagnosis & Uploading
- Advanced Driver-Assistance Systems (ADAS)
- Technical Documentation
- Thermal Management & Cooling
- Battery Management Systems
- Quality Assurance
- Charging Fundamentals
- PPE & General Safety
- Telematics
- Fuel Cells
- Emergency Response
- Advanced Diagnostics Tools

**Want to learn more about Volvo Lights? www.lightsproject.com**

The wide-scale electrification of the transportation system will require a highly skilled and specialized workforce to support, maintain, & repair advanced electric drivetrains and their increasingly sophisticated technology.

**Volvo Lights Project**

# 8.1 INDUSTRY OUTREACH

## 8.1.1 INTERVIEW INSIGHT

The project team interviewed heavy-duty vehicle dealerships that are selling ZEV platforms utilized by drayage operators. They also engaged with Licensed Motor Carriers (LMC) who are actively planning to utilize this technology. The dealers are proactively strategizing and gearing up for the maintenance of these vehicles as they will be part of their routine maintenance and repair planning due to vehicle warranties. Dealerships report significant fleet adoptions of heavy-duty trucks in California in 2023. They are heavily investing in facility upgrades to manage the future maintenance of these heavy-duty trucks.

### ELECTRICAL UNION

- International Brotherhood of Electrical Workers

### DRAYAGE DEALER

- TEC Equipment
- Velocity Truck Centers

### OEM

- Nikola Motors
- Volvo North America

### LMC

- Prologis

## LICENSED MOTOR CARRIER (LMC) INSIGHT

In addition to identifying competencies, the team interviewed LMCs and dealers to discuss the adoption and implementation environment and how that might impact their workforce. One common theme among the LMCs interviewed is that they currently utilize service contracts and warranties to cover the vehicles, limiting and even eliminating the need for internal technicians.

Some of the barriers to adoption reported by LMCs are manufacturing lag times exceeding 1.5 years. Additionally, the LMCs are anticipating parts and service issues similar to the previous transition to compressed natural gas (CNG). Furthermore, some LMCs indicated that they will purchase diesel vehicles before the deadline in order to operate 10+ years under the exception rather than navigate the shift.

It is anticipated that the transition will be the most difficult for the LMCs who never transitioned from diesel to CNG as this group often utilized private vendors for maintenance and repairs. The hardest hit, however, is expected to be micro fleets, typically 1-5 trucks, as the transition will be costlier to switch. These fleets are usually immigrant-owned and tend to utilize vendors for maintenance who are part of a larger affinity group. An early transition to ZEV, rather than diesel, could be a considerable disruption.

## TRAINING

The dealerships surveyed reported some frustration among their internal training staff due to the uncertainty about how and what to prepare. This is a common theme the team heard as the technology is new, and the Original Equipment Manufacturers (OEMs) are just starting to address the training and maintenance aspects associated with this emerging technology. Additionally, some OEMs only allow internal engineers to work on vehicles at this point in the adoption curve.

All the employers agreed that safety training should be a priority in program development. General high-voltage safety familiarization training is a good place to start, but colleges should work with OEMs on specific needs as vehicle systems differ between manufacturers. The employers also recommended that programs should incorporate training in:

- Commissioning & Decommissioning
- Troubleshooting
- Understanding Schematics
- Electrical Circuits

## TECHNICIANS

Employers reported they are seeking technicians who are excited about this technology, demonstrate proficiency in electrical skills, and are willing to travel to maintain vehicles. Some report sourcing technicians from nontraditional channels or other sectors like Heating, Ventilation, & Air Conditioning (HVAC) Technicians.

Currently, the internal training of these technicians is focused on safety. Dealers report that maintenance at the moment is "trial and error maintenance" as troubleshooting documents have not yet been developed or disseminated by manufacturers.

## INFRASTRUCTURE

Employers report that the most significant barrier to adoption is infrastructure. The logistics surrounding charging infrastructure are consistently described as uncertain or unclear.

One recommendation for infrastructure-related safety is to incorporate NFPA 70E (Standard for Electrical Safety in the Workplace). This standard aims to protect personnel by reducing exposure to major electrical hazards. NFPA 70E helps companies and employees avoid workplace injuries and fatalities due to shock, electrocution, arc flash, and arc blast.

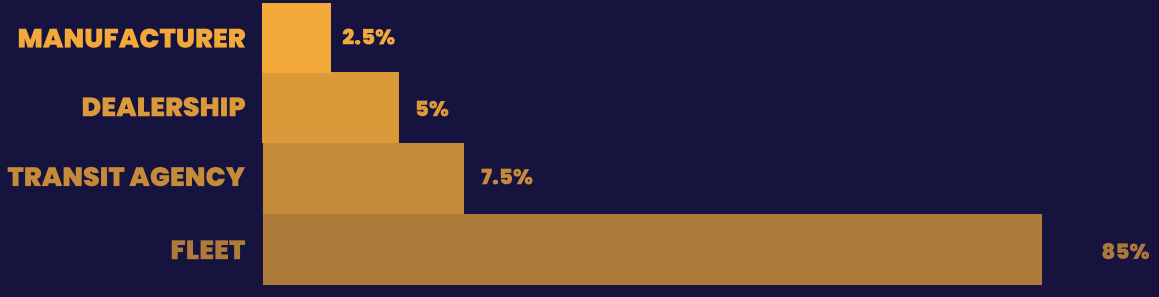
# 8.1.2 EMPLOYER SURVEY

**This project surveyed 50 industry professionals across 33 organizations consisting of fleets, OEMs, transit agencies, and dealerships that currently utilize or have plans to deploy HD zero-emission vehicles. Non-drayage fleets were included due to low HD drayage deployments. These fleet transitions set precedents with aspects that we anticipate will carry over to ZEV drayage due to the universal nature of the technology. Additionally, many of these vehicles do not yet require maintenance as they are all new and still under warranty. This factor played a role in expanding the survey list to include a broader range of participants.**

# SURVEYED INDUSTRY ORGANIZATIONS

- A.P. Express
- Ability Tri-Modal
- All Cartage Transportation
- All Ports Logistics
- Alto Systems
- Alvarez Trucking
- American Heavy Moving & Rigging
- Andry Specialty Vehicles
- BDR Transport
- Best Overnight
- C&C Transportation
- CA Intermodal
- CA Specialized Eq. Systems
- Cargomatic
- Concept Freight & Logistics
- Contractors Cargo
- Custom Freight Systems
- Custom Air Trucking
- Municipal Equip. Maintenance Assoc.
- National Assoc, of Fleet Admin.
- Nikola Motors
- Penske Truck Leasing
- Price Intermodal
- Price Transfer
- Pride Intermodal
- Prime Global Solutions
- Prologis
- Quick Pick Express
- R & L Carriers
- TEC Equipment
- Ted Levine Drum Co.
- Velocity Truck Centers
- Volvo North America

## SURVEY DEMOGRAPHIC



**65%** of respondents see an increased need for more formal education such as an associate's or bachelor's degree.

**THE IMPORTANCE OFAUTOMOTIVE SERVICE EXCELLENCE (ASE) CERTIFICATIONS WHEN CHOOSING A TECHNICIAN CANDIDATE.**

- **15%** — **Extremly Important**
- **52%** — **Very Important**
- **29%** — **Somewhat Important**
- **4%** — **Not so Important**
- **0%** — **Not at all Important**

## 8.2.3 TOP CERTIFICATIONS FOR DIESEL MECHANIC OCCUPATIONS IN LOS ANGELES COUNTY

**Top Certifications |** Online Job Posting

1. Automotive Service Excellence (ASE) Certification
2. Air Brake Certified
3. CDL Class A
4. Security Clearance
5. Diesel Mechanic Certification
6. CDL Class B
7. Brake Inspector Certification
8. CDL Class C
9. CDL Class D
10. OSHA Forklift Certification
11. Project Management Certification
12. Adjuster License
13. Air Conditioning (AC) Certification
14. EPA 609
15. Hazardous Materials Certification

**81%** of respondents indicated they are experiencing a shortage of technicians.

**96%** of respondents indicated they expect the demand for technicians servicing HD zero-emission vehicles to increase in the next five years.

**4%** of respondents think the demand will largely remain the same.

## 8.2.4 TOP SKILLS RELATED TO EV INFRASTRUCTURE MAINTENANCE & INSTALLATION

### Soft Skills

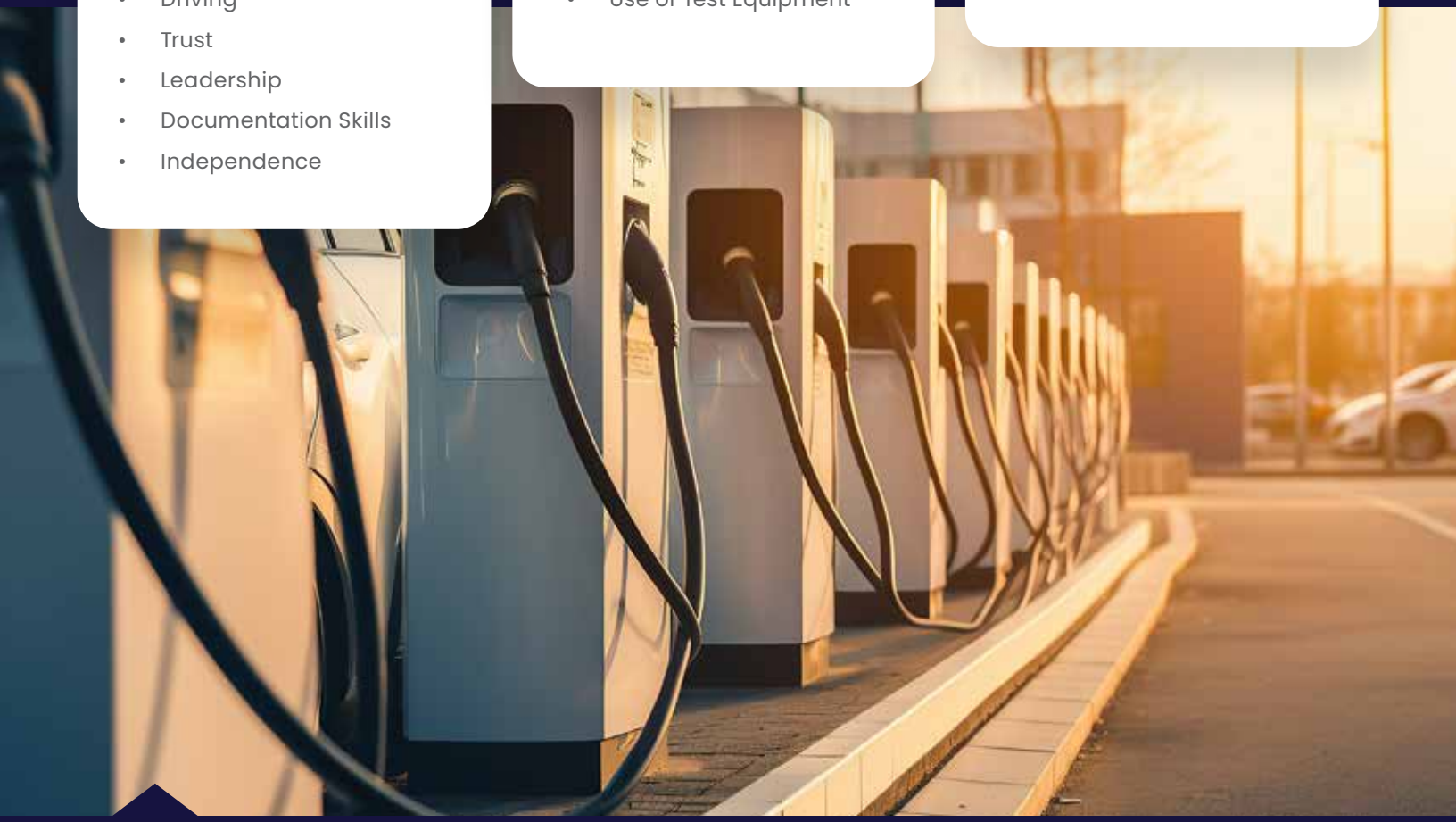
- Problem-Solving
- Customer Service
- Troubleshooting
- Communications
- Operations
- Driving
- Trust
- Leadership
- Documentation Skills
- Independence

### Foundational Skills

- Computer Skills
- Blueprint Reading
- Electrical Code - NEC
- Basic Electricity
- Basic Electrconics
- Use of Test Equipment

### Specialized Skills

- Lock Out/Tag Out
- OSHA 10
- First Aid/CPR
- Job Hazard Analysis
- Safety Training



## CALIFORNIA'S EQUITY FOCUSED WORKFORCE DEVELOPMENT EFFORTS

Through California state law (AB398) and grant funding (High Roads Initiative), California calls for various workforce interventions to help ensure that the state's transition to a carbon-neutral economy creates high-quality jobs; broadens career opportunities for disadvantaged communities; supports at-risk workers; and prepares workers to adapt and master new technologies related to low- and zero-emissions **(11)**.

# 9 ADDRESSING WORKFORCE GAPS

The Port of Long Beach continues to champion ambitious zero-emission goals, including a complete transition to zero-emission drayage trucks by 2035. The adoption of new transportation technology requires that stakeholders consider and plan for the impacts on both the existing and future workforce.

In addition, the California Energy Commission has a continued interest in understanding the impact that the adoption and scaling of ZEV technology has on the workforce and has included funding for a workforce needs assessment and skills gap analysis. This part of the analysis serves to map educational and training programs in the Los Angeles region, identify the existing education assets, and develop recommendations on how to address this new market and any possible skills gaps.

## 9.1 COMMUNITY COLLEGE PROGRAM MAPPING

The California Community College system is the largest higher education system in the nation, with 1.8 million students attending 116 colleges. Community colleges do not have admission requirements beyond a high school diploma or equivalent and low per-unit fees, making them the most accessible college education available. This system of colleges continues to serve as an affordable and accessible education and workforce training resource for students in underserved and underrepresented communities.

Community colleges provide the hands-on training and education needed for occupations in the trades and technical industries, where students can obtain certificates, degrees, and short-term training for Port-related careers. Accordingly, the gap analysis focused on assessing community college programs and their readiness to prepare future and incumbent workers to support zero-emission heavy-duty vehicles.

The team reviewed 23 colleges in the Los Angeles and Orange County area, looking for those that, at minimum, offered an electrical and/or heavy-duty program or courses. Please note that most programs in the community college system are currently named “Heavy-Duty” or “Diesel,” encompassing medium-duty as well. These programs are only now beginning to consider updating their names to reflect technology shifts.

# COLLEGE PROGRAM MAPPING

## COMMUNITY COLLEGE PROGRAMS REVIEWED FOR RELEVANT CURRICULUM

- Cerritos College
- Citrus College
- Coastline Community College
- Cypress College
- East Los Angeles College
- El Camino College
- Fullerton College
- Glendale College
- Golden West College
- Los Angeles City College
- Los Angeles Pierce College
- Los Angeles Southwest College
- Los Angeles Trade-Tech College
- Los Angeles Valley College
- Long Beach City College
- Mt. San Antonio College
- Orange Coast College
- Pasadena City College
- Rio Hondo College
- Saddleback College
- Santa Ana College
- Santa Monica College
- Santiago Canyon College

*Data about the college programs were collected through interviews, team knowledge, and an assessment of curriculum and program information available online and through the California Community College's Chancellor's Office.*

The below represent colleges offering heavy-duty/diesel programs, including short-term certificates and degrees. Heavy-duty programs are designed to train students to service heavy-duty and off-road equipment platforms. This may include some liquefied natural gas (LNG), Compressed Natural Gas (CNG), and/or electrical and hybrid curricula.

## COMMUNITY COLLEGES OFFERING HEAVY-DUTY/DIESEL PROGRAMS

### Rio Hondo College

**Program Page**

www.riohondo.edu/career-and-technical-education/heavy-equipment-technology

### Santa Ana College

**Program Page**

www.sac.edu/AcademicProgs/OccupationalPrograms/CTE/Pages/CareerEd/diesel.aspx

### LA Trade Tech

**Program Page**

www.lattc.edu/academics/aos/heavy-duty-truck-transit-and-equipment

### Citrus College

**Program Page**

www.citruscollege.edu/courseofstudy/Pages/MTRK.aspx

### San Bernardino Valley College

**Program Page**

www.sac.edu/AcademicProgs/OccupationalPrograms/CTE/Pages/CareerEd/diesel.aspx

## OTHER TRAINING PROVIDERS OFFERING HEAVY-DUTY/DIESEL PROGRAMS

### Universal Technical Institute

### CALIFORNIA ZERO-EMISSION VEHICLE MARKET DEVELOPMENT STRATEGY & COMMUNITY COLLEGES

In September 2020, Governor Newsom signed Executive Order N-79-20, which set some ambitious zero-emission vehicle targets for California.

To meet these targets, the Governor tasked the Office of Business and Economic Development (GO-Biz) to collaborate with multiple agencies and partners to lead the administration's Zero Emission Vehicle Market Development Strategy. This strategy is the first part of the ongoing and evolving effort to help ensure California's 100 percent ZEV transition goals. This strategy includes some high-level approaches involving community colleges.

Community colleges are key in California's Zero-Emission Vehicle Market Development Strategy. This role includes training California's workforce, exposing students to eclectic vehicle technology, and establishing partnerships with ZEV companies **(11)**.

Highlighted and high-level objectives for colleges include:

- Establish robust training programs that build transferable skills and are connected to both current and future workforce needs.
- Create & maintain close connections with industry partners/advisors.
- Pilot programs such as ZEV carsharing, e-bike sharing, and EV charging.

## 9.2 INCUMBENT WORKER TRAINING

Community colleges can offer education and training in a variety of modalities – for-credit courses, non-credit workforce, fee-based professional development/training courses, or, where available, ETP-funded training (CA Employment Training Panel Funding). While the process for creating and adopting new credit-bearing certificates and degrees can take six months to more than a year, the region already has many training assets in this area. Existing workers or returning students can choose from various credit courses throughout the region to receive continued training and professional development. Additionally, community colleges can utilize not-for-credit training as a short-term solution while the credit-bearing curriculum is in process.

In addition, there are several regional colleges offering fee-based training that is typically short-term, as short as eight hours or as many as 150, with flexible schedules and tied to specific occupations or careers. Long Beach City College (LBCC) offers these types of courses in advanced transportation. ETP is also a valuable tool for incumbent workers and employers to leverage for upskilling. As described earlier, IBEW offers EVITP training and certification for the installation of electric vehicle infrastructure. This is a tremendous regional asset for existing electricians who want to begin working with electric vehicles and infrastructure.

# 10 OTHER TRAINING CONSIDERATIONS

## 10.1 EV INFRASTRUCTURE AND MAINTENANCE TRAINING

Basic maintenance and familiarization with electric vehicle charging infrastructure will continue to be important factors for companies considering the adoption of heavy-duty EV platforms. While the installation of electric vehicle charging systems is performed by a state-licensed or certified electrician, there are opportunities to augment college electrical and construction programs to assist with these installations and maintain the infrastructure.

Only six colleges offer an electrical degree or certificate, and within those electrical programs, four have integrated zero-emission concepts. This suggests that colleges are not confining the study of zero-emissions technology and vehicles to electrical programs alone but are integrating it into advanced transportation programs to a great extent.

### COLLEGES OFFERING ELECTRICAL DEGREES AND/OR CERTIFICATES

#### East LA College

**Program Page**

www.elac.edu/academics/pathways/stem/engineering-dept/apply

#### Long Beach City College

**Program Page**

www.lbcc.edu/program-electrical-technology

#### LA Pierce College

**Program Page**

www.programmapper.piercecollege.edu/academics/interest-clusters/5e92e3cc-64bf-4852-8e1b-d4678d80c8c9/programs/a10d41bd-fb4d-7b6d-3a97-73281135572d

#### Orange Coast College

**Program Page**

www.orangecoastcollege.edu/academics/career-advantage/program-areas/electronics-technology.html

#### LA Trade Tech

**Program Page**

www.lattc.edu/academics/aos/electrical-construction-and-maintenance

#### Rio Hondo College

**Program Page**

www.careertraining.ed2go.com/rio-hondo/training-programs/electrical-

### 10.1.1 INTERNATIONAL BROTHERHOOD OF ELECTRICAL WORKERS (IBEW) APPRENTICESHIPS AND TRAINING

The IBEW has been a leader in providing training to support electric vehicles and infrastructure for years. Local 11, which covers the greater Los Angeles area, currently represents 11,700 members. They continue to train new apprentices and retrain and upskill existing members to work in the growing field of zero-emissions technology and are an important partner in the Port's zero-emissions goals. IBEW apprentices are utilized at Port terminals, but these apprentices also work with contractors outside of the Port, via the National Electrical Contractors Association (NECA), and they will likely have involvement in charging infrastructure for drayage trucks.

In addition to the traditional apprenticeship path, IBEW offers the Electric Vehicle Infrastructure Training Program (EVITP) — the highest standard in training and certification for the installation of electric vehicle infrastructure. EVITP is a partnership of stakeholders from the electric vehicle industry with over 3,000 certified electricians. EVITP partners include vehicle and battery storage manufacturers, utilities, and research centers. The training is available to all California state-certified general electricians and prepares them to support residential, commercial, public, and fleet vehicles and infrastructure. EVITP was offered in the past at a few community colleges until they were dropped due to low attendance, potentially because of low EV sales. It is now only offered occasionally at the Electrical Training Institute in Commerce.

The Electric Vehicle Infrastructure Training Program (EVITP) has moved completely online. To be eligible for EVITP, a participant must be a state-licensed or certified electrician.

### OTHER TRAINING PROVIDERS OFFERING ELECTRIC VEHICLE INFRASTRUCTURE TRAINING PROVIDERS (EVITP)

#### EVITP & The IBEW

**Program Page**

www.evitp.org/training

#### IBEW Apprenticeship Program

**Program Page**

www.ibew.org/Join-the-IBEW#
www.electricianapprenticehq.com/how-to-join-ibew-apprenticeship
www.necanet.org

# 11 ADDITIONAL CONSIDERATIONS

Preparing for a zero-emission drayage future requires more than updated training programs—it demands strategic coordination between education providers, employers, and technology developers. The following considerations outline actionable steps stakeholders can take to support a scalable and sustainable ZEV workforce pipeline.

## 11.1 STRENGTHEN INDUSTRY ADVISORY COMMITTEES

Career Education programs at California community colleges are required to engage industry advisory committees to align curriculum with labor market needs. As ZEV technology evolves, it is critical that these committees expand to include:

- ZEV fleet managers
- OEM and EV component manufacturers
- Port and municipal transit agencies
- Charging infrastructure specialists
- First responders with EV protocols

Programs should also consider forming regional Communities of Practice (CoPs) to jointly approach ZEV employers, pool resources, and share curriculum innovation. These collaborations will ensure programs remain responsive to real-time industry developments and funding opportunities.

## 11.2 PRIORITIZE FACULTY PROFESSIONAL DEVELOPMENT

Instructor expertise is essential to delivering high-quality ZEV training. However, many faculty members are unfamiliar with current EV systems, safety protocols, or diagnostic platforms. Colleges should:

- Invest in OEM-led train-the-trainer sessions
- Support faculty attendance at key ZEV and transportation technology conferences (e.g., ACT Expo, GTSE, Mobilize Summit)
- Leverage public-private partnerships to facilitate professional learning exchanges

Keeping instructors current will ensure that programs remain relevant, competitive, and aligned with employer expectations.

### HEAVY-DUTY ZERO EMISSION VEHICLE CONFERENCES

**Advanced Clean Transportation (ACT) Expo**

Website: www.actexpo.com

**Green Transportation Summit & Expo (GTSE)**

Website: www.gtsummitexpo.com

## 11.3 INTEGRATE EV CHARGING INFRASTRUCTURE INTO TRAINING PLANS

Electric vehicle charging infrastructure (EVCI) is a core component of port electrification—and training programs must plan accordingly. Colleges should:

- Coordinate with facilities departments to install on-campus charging systems for instructional use
- Include EVSE maintenance and safety in both electrical and transportation curricula
- Incorporate National Electrical Code (NEC) standards and NFPA 70E electrical safety training

Planning for capital improvements early will ensure colleges are equipped to deliver hands-on training at scale.

## 11.4 LEVERAGE APPRENTICESHIPS & PRE-APPRENTICESHIPS

State-supported earn-and-learn models are key to creating career pathways in ZEV industries. Programs should:

- Apply for California Apprenticeship Initiative (CAI) funding to pilot innovative new pathways
- Collaborate with labor partners and employers to build registered apprenticeships for EV maintenance, charging infrastructure, and clean fleet logistics
- Embed pre-apprenticeship models into noncredit and adult education pathways to expand access for underserved populations

These approaches provide scalable, inclusive strategies to develop the next generation of ZEV technicians and installers.

## 11.5 FIRST RESPONDER PARTNERSHIP AND TRAINING

As electric trucks become more common in urban and port environments, first responders must be trained to manage high-voltage vehicles safely. Colleges and local agencies should:

- Develop partnerships between public safety training programs and ZEV instructors
- Offer joint workshops and simulations for emergency vehicle response
- Integrate vehicle safety protocols into relevant fire, EMS, and law enforcement academies

Cross-sector preparedness is essential to protect both workers and the public.

## 11.6 TEACH ELECTRIC VEHICLE DRIVING CHARACTERISTICS & BEHAVIOR

Electric vehicles have unique operating characteristics—such as regenerative braking, torque distribution, and energy management—that impact safety, range, and wear. Programs should incorporate:

- Simulations and hands-on modules focused on ZEV operation
- Diagnostics for drivability issues unique to electric platforms
- Operator training to support efficient driving and reduced maintenance risk

These competencies are critical for both technicians and drivers supporting ZEV deployments.

## 11.7 CURRICULUM DEVELOPMENT: PHASED ZEV INTEGRATION

The following curriculum recommendations are only suggestions and should be vetted by local advisory committees, curriculum committees, and any relevant partnerships or associations.

These recommendations are based on interviews with heavy-duty vehicle industry advisors. Much like the light-duty ZEV market, training strategies are still in their infancy. Most advisors recommend a phased-in approach that aligns with adoptions and deployment strategies.

Please note: Curriculum recommendations are subject to change as the industry segment matures, and we need to better understand the maintenance requirements and needs for these platforms.

### 11.7.1 HEAVY-DUTY ELECECTIC VEHICLE CURRICULUM

**Phase One** - This phase is intended as a recommendation for programs looking to enhance and adjust heavy-duty programs to keep pace with industry adoption.

***Priority Topics:***

- Introduction to ZEVs (EVs & Hydrogen Vehicle Platforms)
- High-Voltage Electrical Safety & High-Voltage Vehicle Safety Systems
- Basic ZEV Maintenance

**Phase Two** - This phase is intended as a recommendation for programs creating a standalone degree or certificate program.

**Recommended Curriculum Topics:**

- Introduction to ZEVs (EVs & Hydrogen Vehicle Platforms)
- High-Voltage Electrical Safety & High-Voltage Vehicle Safety Systems
- Basic ZEV Maintenance
- Advanced Electrical Courses
- Battery Management Systems
- Hybrid Vehicles Regenerative Braking Systems
- Converter Systems
- Permanent Magnet Electrical Machines
- AC Induction Electrical Machines
- Energy Management Systems
- Transaxles, Gears, & Cooling Systems

# CHARGING
INFRASTRUCTURE
MAINTENANCE
# TRAINING

### 11.7.2 CHARGING INFRASTRUCTURE MAINTENANCE TRAINING OPPORTUNITIES

The following maintenance curriculum recommendations are developed for the California Energy Commission's Inclusive, Diverse, Equitable, Accessible, and Local (IDEAL) Workforce Pilot for LA colleges and the California Conservation Corps.

## EVSE MAINTENANCE CURRICULUM

- Hardware/equipment repair
- Wireless connectivity
- How equipment communicates
- Max distance of communications
- Load management control systems
- Radio signals
- Mesh network-ways that it might fail
- Troubleshooting

## Training Needs Specific to Entry-Level Workers

RECOMMENDATIONS

**Job Tools Familiarization**

- Lineman pliers
- Adjustable pliers
- Crescent wrench
- Different types of screwdrivers & nut drivers
- Difference between Romex striper and wire striper & determine which you need for the wire
- How to separate & organize tools
- How to read a tape measure

**Material Familiarization**

- Conduit
- Conduit bodies
- Underground rigid conduit
- What is glued and what isn't
- What gets wrapped
- Connector
- Difference between connector and coupling
- Difference between LB and LL conduit body
- Panelboard
- Transformer
- Circuit breaker

**Basics of Construction and Electrical Work**

- Experience running conduit (including challenging runs where they need to know how to use pipe bending equipment to properly bend pipe) and pulling wire
- Why a dig alert needs to be done and how to prepare for it
- How to dig a trench
- How to saw cut and break up asphalt
- Soil types

**Contextualized Calculations**

- Load calculations
- Voltage drops

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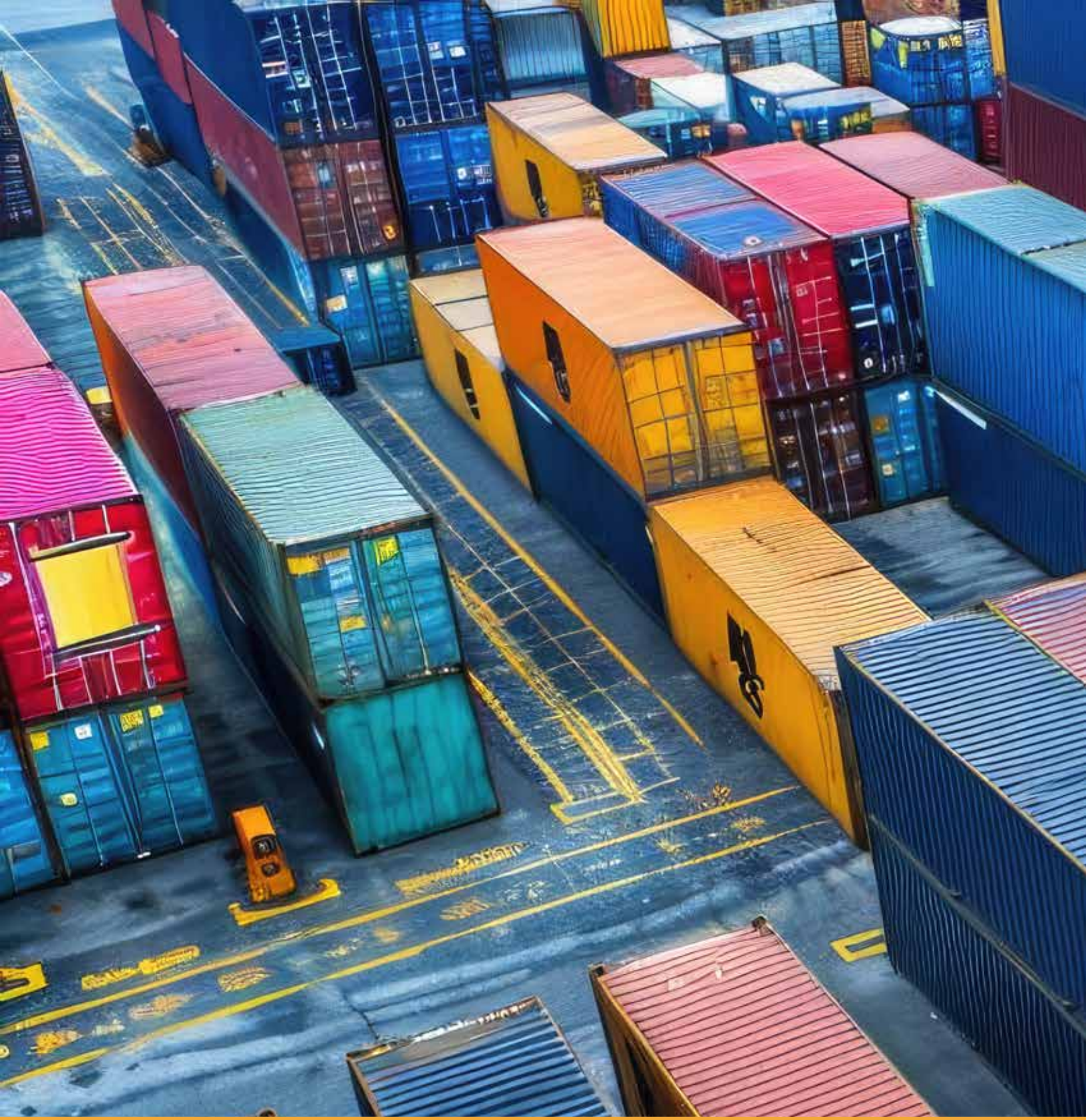
# APPENDIX A

**Survey Questions**

- Which of the below best describes your company? (Manufacturer, Licensed Motor Carrier/Independent, Dealership, Fleet, or Transit)
- Do you see an increase in the requirement for more formal education such as an associate's or bachelor's degree?
- How important is an ASE certification when choosing to hire a technician?
- Are there other industry certifications you look for when hiring an entry-level technician?
- What are you expecting incoming technicians to know specifically about new technologies and electric vehicles?
- Are you experiencing a shortage of technicians?
- What do you expect the demand for technicians servicing MHD zero-emission and other zero-emission vehicles in the next 5 years to be?
- Are there any skills gaps/training that you would like your current technicians to be trained on to be prepared for ZEV technology?
- Any course topic recommendations we should explore? Examples: General Safety, High-Voltage Safety, Introduction to MHD BEV, etc.
- Please review the below Knowledge, Skills, and Abilities (KSAs) below. Do the following KSAs look appropriate for incoming techs considering the shift in technology? Would you add or remove any? (Hybrid Systems, HVAC, Electric Motors, Wiring & Modules, High-Voltage Batteries, High-Voltage Safety, Software Diagnosis & Uploading, CNG, Technical Documentation, Thermal Management & Cooling- Battery Management Systems, Quality Assurance Technical, Batteries, Suspension, Brakes/Air Brakes, Computer Systems, ASE, Preventative Maintenance, Electrical Systems, Hydraulics, Diagnosis, Occupational Health & Safety, Pneumatics)



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