C·O·E CENTERS OF EXCELLENCE FOR LABOR MARKET RESEARCH

Advanced Vehicle Technology
Electric Vehicle & Autonomous Vehicle Workers

California

Introduction

The automotive industry is undergoing significant changes as it transitions to advance vehicle technologies, specifically in alternative fuels and autonomous driving. President Joe Biden's plan to reach net-zero emissions by 2050 includes a call to electrify the federal government's 645,000 fleet vehicles (Kaplan, 2021). Additionally, California's Governor, Gavin Newsom, signed an executive order that requires that, by 2035, all new cars and passenger trucks sold in California will be zero-emission vehicles (ZEV) (Office of Governor, 2020). The governor recently affirmed his commitment to 100% ZEV sales by 2035 by announcing a $10 billion investment to accelerate the transition (Office of Governor 2, 2022). Government mandates and growing consumer demand have led to the electric vehicle market expansion. The national share of electric vehicles is projected to increase from 1.8% of the automotive market in 2020 to 9% in 2025. By 2030, the percentage is expected to increase to 15% (Priddle, 2021). Traditional automotive manufacturers have bolstered this transition, with companies, like Ford pledging that 40% of its vehicles sold will be electric by 2030 (Isidore, 2021). The workforce demand for electric vehicle service technicians will likely increase as the share of electric vehicles increases.

This report captures the demand for advanced vehicle technology workers, including electric and autonomous vehicles, by examining online job advertisements. Automotive service technicians and mechanics service advanced technology vehicles, but traditional labor market data does not capture the number of workers currently maintaining these vehicles or how many will be needed in the future.

The first section of this report utilizes real-time job advertisement information to analyze the demand for workers servicing and maintaining electric vehicles; the second section of this report details real-time demand for autonomous vehicle workers; the third section of this report details student completion and outcome data for regional alternative fuels and advanced transportation technology programs (TOP 0948.40), presented on page 10.

Quantifying the relationship between electric vehicle demand and the demand for associated workers is challenging due to the specificity of the work and the historically limited number of job advertisements seeking workers in this field. The limited number of job advertisements may result from employers self-training new workers or upskilling their existing workforce to service advanced technology vehicles. State-

level demand for electric vehicle workers was analyzed for this report because too few job ads were posted for these workers in the local region.

Electric Vehicle/Zero Emission Workers Online Job Advertisements

An online job advertisements (ad) search for electric vehicle technology worker jobs was conducted to reveal the employers seeking these workers, including the time it takes to fill positions, earnings information, and in-demand skills. Using a combination of keyword and employer filters, job ads for automotive workers have been limited to positions that service and maintain electric vehicles. The job ad search parameters and keywords are available in the Appendix section of this report.

Over the last 12 months, eight job ads (8) were posted for electric vehicle technology workers in the region. Job ad information from electric vehicle worker job ads posted across California is included in this report to ensure that the information is reliable and generalizable.

Exhibit 1 shows the number of job ads posted during the last 12 months, October 2021 through September 2022, and the statewide average time to fill these jobs. On average, employers in California spend 35 days filling online job ads for electric vehicle workers.

Exhibit 1. Job ads and time to fill, California, October 2021 through September 2022

Occupations	Job Ads	Statewide Average Time to Fill (Days)
Automotive Service Technicians and Mechanics	302	35

Source: Burning Glass – Labor Insights

Advertised Salary from Online Job Ads

Exhibit 2 displays online job ad salary data for electric vehicle technology workers over the last 12 months. Online job ad salary information reveals employers are willing to pay these workers an average annual salary of $54,000, above the region's $45,386 annual ($21.82 hourly) MIT living wage standard. Consider the salary information with caution since only 16% (49 out of 302) of online job ads for this occupation provided salary information. The salary figures are prorated to reflect full-time, annual earnings status.

Exhibit 2. Advertised salary information, California, October 2021 through September 2022

Source: Burning Glass – Labor Insights

Job Titles, Employers, Skills, Education, and Work Experience

Exhibit 3 displays the job titles most frequently used in job ads for electric vehicle workers. Displaying advertised job titles may provide insight into the positions sought by employers posting ads. The most frequently requested job title for electric vehicle workers over the last 12 months was service technician.

Exhibit 3. Job titles most frequently used in job ads, California, October 2021 through September 2022

Job Titles	Job Ads
Service Technician	98
Mobile Glass Technician	44
Mid-Level Automotive Service Technician	32
Mobile Service Technician	24
Automotive Service Technician	10
All other job titles	*94*
Total	**302**

Source: Burning Glass – Labor Insights

Exhibit 4 displays the employers that posted five or more job ads for electric vehicle workers during the last 12 months. Showing employer names provides insight into where students may find employment after completing a program. Tesla posted the most job ads for electric vehicle workers in California over the last 12 months.

Exhibit 4. Employers posting the most job ads, California, October 2021 through September 2022

Top Employers	Job Ads
Tesla	89
Lucid Motors	80
AutoNation	38

Top Employers	Job Ads
Rivian Automotive	21
Honda	13
Toyota	9
Volvo	8
Chevrolet	7
Nissan	6
All other employers	*31*
Total	**302**

Source: Burning Glass – Labor Insights

Exhibit 5 lists a sample of specialized and employability skills employers seek when seeking workers to fill electric vehicle positions. Specialized skills are occupation-specific skills that employers request for industry or job competency. Employability skills are foundational skills that transcend industries and occupations; this category is often referred to as "soft skills." The skills requested in job ads may be utilized to guide curriculum development.

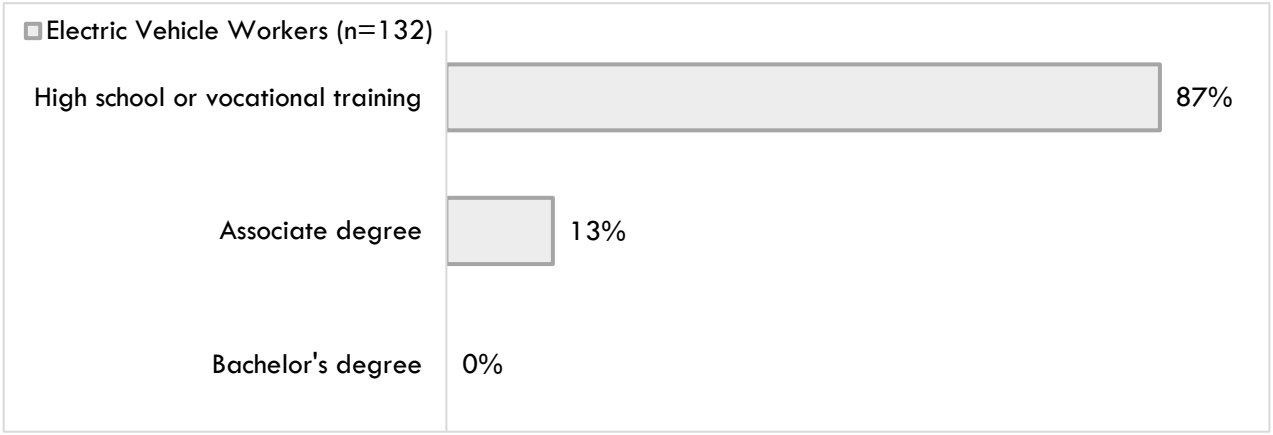
Exhibit 5. Sample of in-demand skills from employer job ads, California, October 2021 through September 2022

Specialized skills *(n=297)*	Employability skills
Auto Repair	Communication Skills
Customer Service	Problem Solving
Record Keeping	Detail-Oriented
Calibration	Teamwork/Collaboration
Quality Assurance and Control	Building Effective Relationships
Electric Vehicle Knowledge	Computer Literacy

Source: Burning Glass – Labor Insights

Exhibit 6 displays the minimum advertised education requirements for electric vehicle workers. Approximately 87% of employers sought electric vehicle workers with a high school diploma or equivalent.

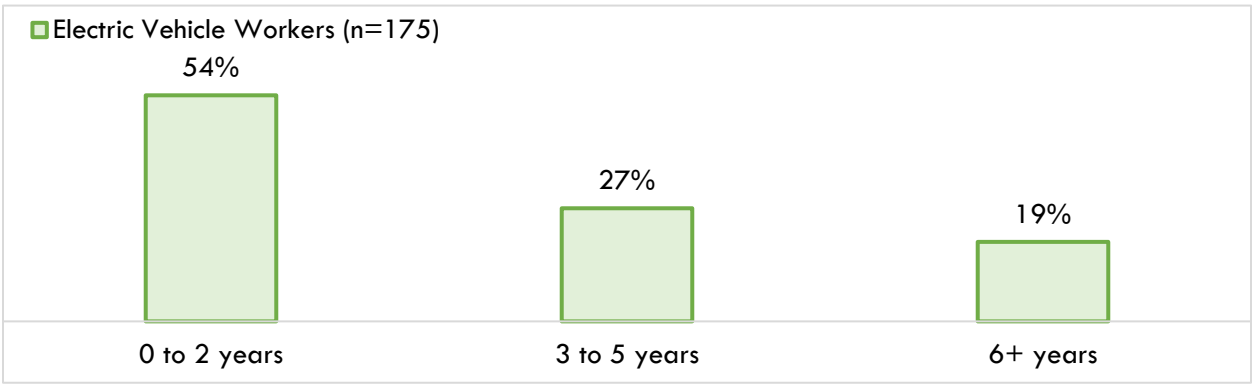
Exhibit 6. Minimum advertised education requirements, California, October 2021 through September 2022



Source: Burning Glass – Labor Insights

Exhibit 7 displays the real-time work experience requirements from employer job ads. More than half of employers (54%) posting job ads for electric vehicle workers sought candidates with zero to two years of previous work experience.

Exhibit 7. Real-time work experience requirements, California, October 2021 through September 2022



Source: Burning Glass – Labor Insights

Nearly 14% of job ads (42 ads) for electric vehicle workers sought candidates with a National Institute for Automotive Service Excellence (ASE) certification. Approximately 10% of job ads (31 ads) sought candidates with an ASE Master Technician certification. For more information regarding ASE certifications, visit the ASE website (ASE, 2022).

Autonomous Vehicles Workers Online Job Advertisements

The link between manually operated vehicles and fully autonomous vehicles can be found in Advanced Driver Assistance Systems (ADAS). ADAS are technological features currently available on vehicles that are designed to increase the safety of vehicle driving (Car and Driver, 2020). The technologies that assist drivers include adaptive cruise control, anti-lock brakes, forward collision warning, land departure warning, traffic signal recognition, and traction control. The workforce that will be prepared to service and maintain the fully autonomous vehicles of the future is currently servicing vehicle ADAS. The market for ADAS is likely to grow above a compound annual growth rate of 10.2% between 2022 and 2028 (Global News Wire, 2022).

ADAS calibration (and recalibration) is the precise physical alignment, testing, and electronic aiming of sensors that collect data to inform your vehicle's ADAS, like forward collision warning (FCW), lane departure warning (LDW), automatic emergency braking (AEB), and several others (Car ADAS, 2021). The National Institute for Automotive Service Excellence (ASE) provides a certification for ADAS specialists that ensures technicians are prepared to diagnose, repair, and calibrate advanced driver assistance systems in modern automobiles and light trucks (ASE, 2022).

Given the emergent nature of this technology, traditional labor market information does not capture demand for ADAS workers. A job ad search was conducted to determine the regional demand for the ADAS workforce, further referred to as advanced vehicle technology workers.

Job Advertisements

An online job ad search for advanced vehicle technology worker jobs was conducted to reveal the employers seeking these workers, including the time it takes to fill positions, earnings information, and in-demand skills. Job ads for automotive workers were limited to positions that work on advanced vehicle technologies. The search parameters and keywords are available in the Appendix section of this report.

Over the last 12 months, there were 11 job ads posted for advanced vehicle technology workers in the local region. Job ad information from advanced vehicle technology worker job ads posted across California is included in this report to ensure that the information is reliable. The ASE ADAS specialist certification was not found in job ads for advanced vehicle technology workers, indicating that this certification may not be essential to employment.

Exhibit 8 shows the number of job ads posted during the last 12 months, October 2021 through September 2022, and the statewide average time to fill these jobs. On average, employers in California spend 37 days filling online job ads for advanced vehicle technology workers.

Exhibit 8. Job ads and time to fill, California, October 2021 through September 2022

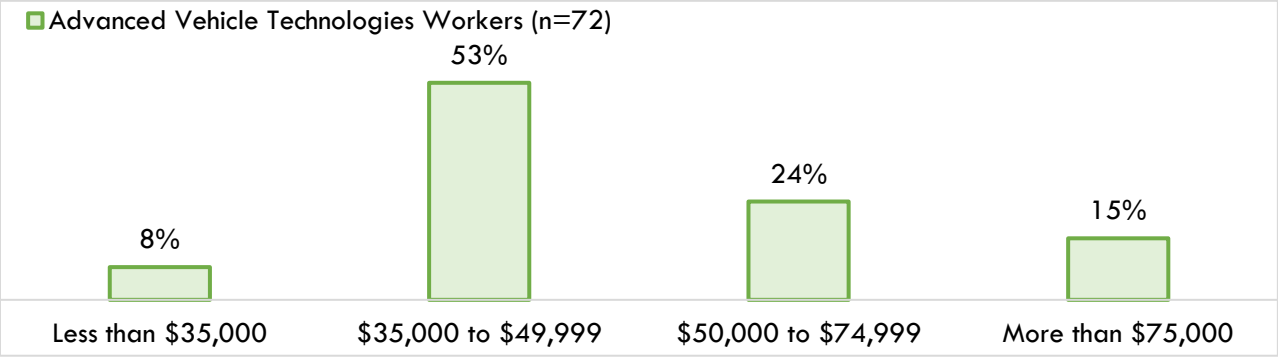
Occupations	Job Ads	Statewide Average Time to Fill (Days)
Automotive Service Technicians and Mechanics	118	35
Automotive Glass Installers and Repairers	12	52
Automotive Body and Related Repairers	1	38
Total	**131**	**37**

Source: Burning Glass – Labor Insights

Advertised Salary from Online Job Ads

Exhibit 9 displays online job ad salary data for advanced vehicle technology workers over the last 12 months. Online job ad salary information reveals employers are willing to pay these workers an average annual salary of $52,000, above the region's $45,386 annual ($21.82 hourly) MIT living wage standard. Consider the salary information with caution since only 55% (72 out of 131) of online job ads for this occupation provided salary information. The salary figures are prorated to reflect full-time, annual earnings status.

Exhibit 9. Advertised salary information, California, October 2021 through September 2022



Source: Burning Glass – Labor Insights

Job Titles, Employers, Skills, Education, and Work Experience

Exhibit 10 displays the job titles most frequently used for advanced vehicle technology workers in job ads. Displaying advertised job titles may provide insight into the positions sought by employers posting ads. The most commonly requested job title for advanced technology workers over the last 12 months was automotive mobile glass technician.

Exhibit 10. Job titles most frequently used in job ads, California, October 2021 through September 2022

Job Titles	Job Ads
Automotive Mobile Glass Technician	23
Automotive Diagnostic & Recalibration Technician	8
ADAS Scan/Diagnostic Technician	8
Lead Auto Glass Technician	5
Mobile Install Technician	4
Automotive Glass Technician	4
All other job titles	*79*
Total	**131**

Source: Burning Glass – Labor Insights

Exhibit 11 displays the employers that posted five or more job ads for advanced vehicle technology workers during the last 12 months. Showing employer names provides insight into where students may find employment after completing a program. Safelite AutoGlass, a windshield repair and ADAS calibration company, posted the most job ads for advanced technology vehicle workers in California.

Exhibit 11. Employers posting the most job ads, California, October 2021 through September 2022

Top Employers	Job Ads
Safelite AutoGlass	14
AirPro Diagnostics	14
Caliber Auto Glass Repair Services	10
Ultimate Auto Glass & Electronics	8
Zoox, Inc.	7
Technical Professionals Group	5
Glass Doctor of Turlock	5
All other employers	*68*
Total	**131**

Source: Burning Glass – Labor Insights

Exhibit 12 lists a sample of specialized and employability skills employers seek when seeking workers to fill advanced vehicle technology positions. Specialized skills are occupation-specific skills that employers request for industry or job competency. Employability skills are foundational skills that transcend industries and occupations; this category is often referred to as "soft skills." The skills requested in job ads may be utilized to guide curriculum development.

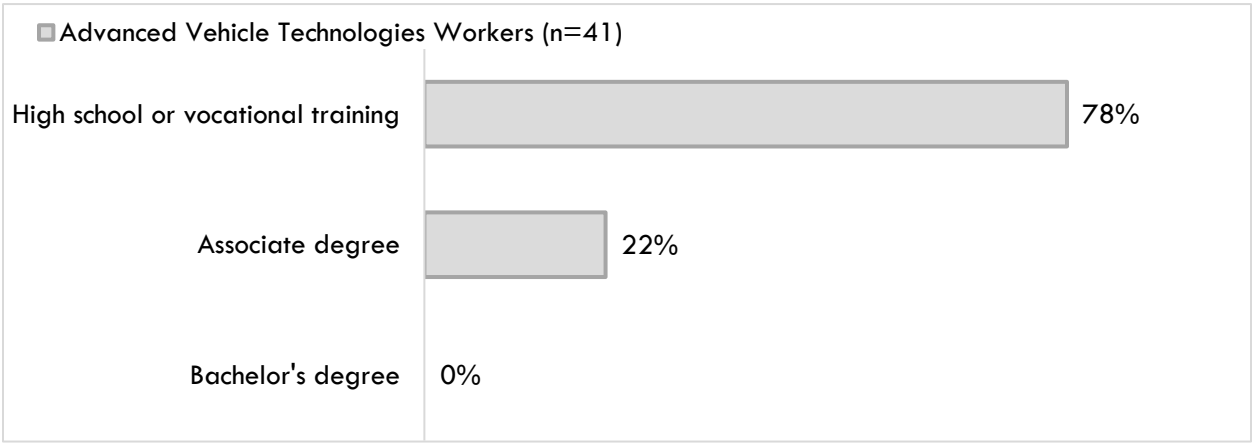
Exhibit 12. Sample of in-demand skills from employer job ads, California, October 2021 through September 2022

Specialized skills *(n=125)*	**Employability skills**
Automotive Repair	Communication Skills
Calibration	Physical Abilities
Wiring	Computer Literacy
Customer Service	Teamwork/Collaboration
Mechanical Knowledge	Energetic
Hand Tools	Writing
Test Equipment	Organizational Skills
Soldering	Problem Solving

Source: Burning Glass – Labor Insights

Exhibit 13 displays the minimum advertised education requirements for advanced vehicle technology workers. Only 31% of employer job ads (41 ads) included minimum education requirements. Of the employers posting job ads for advanced vehicle technology workers, 78% sought workers with a high school diploma or vocational training, and 22% sought workers with an associate degree.

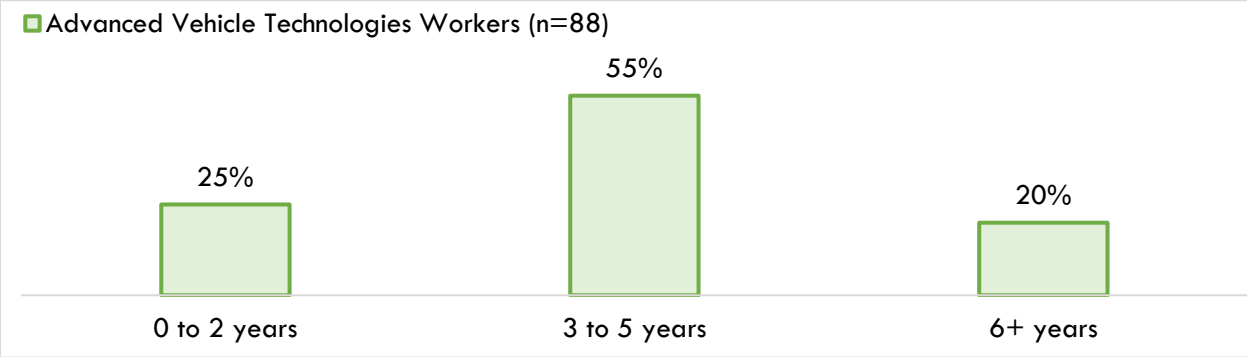
Exhibit 13. Minimum advertised education requirements, California, October 2021 through September 2022



Source: Burning Glass – Labor Insights

Exhibit 14 displays the real-time work experience requirements from employer job ads. More than half of employers (55%) posting job ads for advanced vehicle technology workers sought candidates with three to five years of previous work experience.

Exhibit 14. Real-time work experience requirements, California, October 2021 through September 2022



Source: Burning Glass – Labor Insights

Student Completions and Program Outcomes

California Community College alternative fuels and advanced transportation technology programs (0948.40) prepare students for employment through instruction related to the conversion to, installation of, and maintenance of electric vehicles, liquified petroleum gas, compressed natural gas, hybrid fuel technologies, and related systems (Taxonomy of Programs, 2012).

Exhibit 15 displays student completions for alternative fuels and advanced transportation technology programs (TOP 0948.40) over the last three academic years (2019-22). Regional community colleges have issued three awards annually in alternative fuels and advanced transportation technology programs in the previous three academic years. Program completion and student outcome methodologies are found in the appendix.

Exhibit 15. Annual average community college awards for alternative fuels and advanced transportation technology programs, Inland Empire/Desert Region, Academic Years 2019-2022

TOP 0948.40 – Alternative Fuels and Advanced Transportation Technology (Local Program Title)	**Academic Year 2019-20**	**Academic Year 2020-21**	**Academic Year 2021-22**	**Total CC Annual Average Awards, Academic Years 2019-22**
Copper Mountain (Alternative Fuel Vehicles)				**1**
Certificate 16 < 30 semester units	0	0	2	1
College of the Desert (Advanced Transportation Technologies/ Automotive Alternative Fuels/Compressed Natural Gas Essentials-Inspection-Installation Essentials/Hybrid, Fuel-Cell & Electric Vehicle)				**1**
Associate Degree	2	0	0	1
San Bernardino Valley (Automotive Clean Vehicle Technology/ Heavy/Medium Duty Clean Vehicle Technology)				**1**
Certificate 6 < 18 semester units	0	1	3	1
Total	**2**	**1**	**5**	**3**

Source: MIS Data Mart, COCI

California program outcome data may provide useful insight into the likelihood of success for the proposed program. Community college student outcome information based on the selected TOP code and region is provided in Exhibit 16. State metrics show that 78% of students exiting alternative fuels and advanced transportation technology community college programs find work in their field of study. Regionally, 54% of students exiting these programs attained a living wage.

Exhibit 16. 0948.40 – Alternative fuels and advanced transportation technology strong workforce program outcomes, Inland Empire/Desert Region, Academic Year 2019-2020 (Unless Noted)

Strong Workforce Program Metrics: 0948.40 – Alternative Fuels and Advanced Transportation Technology	**Inland Empire/Desert Region**	**California**
Unduplicated count of enrolled students (2020-21)	98	490
Completed 9+ career education units in one year (2020-21)	41%	41%
Perkins Economically disadvantaged students	92%	77%
Students who earned a degree, certificate, or attained apprenticeship (2020-21	-	33
Job closely related to the field of study (2018-19)	-	78%
Median annual earnings (all exiters)	$30,798	$33,374

Strong Workforce Program Metrics: 0948.40 – Alternative Fuels and Advanced Transportation Technology	Inland Empire/Desert Region	California
Median change in earnings (all exiters)	3%	46%
Attained a living wage (completers and skills-builders)	54%	43%

Sources: LaunchBoard Community College Pipeline and Strong Workforce Program Metrics

It should be noted that Riverside City College offers Automotive Hybrid and Electrical Vehicle programs that utilize the automotive technology program code (TOP 0948.00). Over the last three academic years, Riverside City College has conferred 47 awards annually in automotive technology programs. However, Riverside City College offers 13 programs that utilize the automotive technology program code, making it difficult to disaggregate award data and determine the number of awards conferred in the automotive hybrid and electrical vehicle programs.

Other regional postsecondary education providers may utilize the alternative fuel vehicle technology/technician Classification of Instructional Program (CIP) program code (CIP 47.0614). Over the last three academic years, other postsecondary educational institutions in the region have not issued awards in alternative fuel vehicle technology/technician programs.

Summary of Findings

The increasing availability of electric vehicles and government mandates will likely increase the demand for electric vehicle workers. Eight job ads were posted for electric vehicle workers in the Inland Empire/Desert Region. In California, 336 job postings were identified for community college-level workers that build and maintain electric vehicles over the last 12 months. Approximately 88% of California employer job ads sought candidates with a high school diploma or vocational training, and 12% sought candidates with an associate degree. Job advertisements reveal employers are willing to pay electric vehicle workers $54,000 annually, above the MIT living wage estimate of $45,386 annually ($21.82 hourly).

The demand for Advanced Driver Assistance Systems (ADAS) service workers will likely increase as the market grows. Over the last 12 months, there were 11 job ads posted for advanced vehicle technology workers in the region and 131 job ads posted in California. Approximately 78% of California employer job ads sought candidates with a high school diploma or vocational training, and 22% sought candidates with an associate degree. The ASE ADAS specialist certification was not found in job ads for advanced vehicle technology workers, indicating that this certification may not be essential to employment. Job advertisements reveal employers are willing to pay advanced vehicle technology workers $52,000

annually, above the MIT living wage estimate of $45,386 annually ($21.82 hourly). Limitations of job ad analysis suggest that internal training programs are upskilling the existing workforce or that relevant employers are finding workers by methods other than online job ads.

Regional community college alternative fuels and advanced transportation technology programs (0948.40) have issued three awards annually over the last three academic years. State metrics show that 78% of students exiting alternative fuels and advanced transportation technology community college programs find work in their field of study. Regionally, 54% of students exiting these programs attained a living wage.

The COE recommends that colleges considering an electric vehicle and advanced vehicle technology program partner with relevant employers to understand their need for more workers and the necessary skills that will lead to a living wage for students.

Contact

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October 2022

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Student Completions and Program Outcome Methodology

Exhibit 15 displays the average annual California Community College (CCC) awards conferred during the three academic years between 2019 and 2022 from the California Community Colleges Chancellor's Office Management Information Systems (MIS) Data Mart. Awards are the combined total of associate degrees and certificates issued during the timeframe, divided by three in this case to calculate an annual average. This is done to minimize the effect of atypical variations that might be present in a single year.

Community college student outcome information is from LaunchBoard and based on the selected TOP code and region. These metrics are based on records submitted to the California Community Colleges Chancellor's Office Management Information Systems (MIS) by community colleges, which come from self-reported student information from CCC Apply and the National Student Clearinghouse. Employment and earnings metrics are sourced from California's Employment Development Department's Unemployment Insurance database records. When available, outcomes for completers are reported to demonstrate the impact that earning a degree or certificate can have on employment and earnings. For more information on the types of students included for each metric, please see the web link for LaunchBoard's Strong Workforce Program Metrics Data Element Dictionary in the References section (LaunchBoard, 2022a). Finally, employment in a job closely related to the field of study comes from self-reported student responses on the CTE Employment Outcomes Survey (CTEOS), administered by Santa Rosa Junior College (LaunchBoard, 2022a).

Job ad data is limited to the information provided by employers and the ability of artificial intelligence search engines to identify this information. Additionally, preliminary calculations by Georgetown Center on Education and the Workforce found that "just 30 to 40 percent of openings for candidates with some college or an associate degree, and only 40 to 60 percent of openings for high school diploma holders appear online" (Carnevale et al., 2014). Online job ads often do not reveal employers' hiring intentions; it is unknown if employers plan to hire one or multiple workers from a single online job ad or collecting resumes for future hiring needs. A closed job ad may not be the result of a hired worker.

Appendix: Job Advertisement Search Parameters and Keywords

Electric Vehicle Search Parameters

Keywords:

- Electric
- Electric Vehicle
- Electric Motors
- Electrical
- EV
- Fuel Cell
- Hybrid
- Hybrid Vehicle
- Unmanned Vehicle Systems

Employers:

- Tesla
- Toyota Motors
- Meritor Automotive
- Chevrolet
- Chrysler
- Carvana, LLC
- Daimler
- AutoNation
- Honda
- Lucid Motors
- Rivian Automotive
- Canoo
- Nikola Motor Company
- BYD Motors
- Volvo
- Linamar
- General Motors
- Fountain Group
- Ford Motor Company
- Nissan North America Incorporated
- Mitsubishi
- New Flyer
- Orange EV
- Cummins Incorporated
- EV Connect
- Complete Coach Works
- First Transit
- Ampere Motors USA
- Karma Automotive

Autonomous Vehicles Search Parameters

Keywords:

- Advanced Driver Assistance Systems
- ADAS
- Actuator
- Automatic Braking
- Camera
- Cruise Control
- Lane Departure
- Lane Assist
- Lane Keep
- Lidar
- Mechatronics
- Radar
- Robotic
- Robotics
- Ultrasonic