AUGUST 2018

LABOR MARKET ANALYSIS

Industrial Maintenance Technicians

CALIFORNIA COMMUNITY COLLEGES
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FOR JOBS AND THE ECONOMY

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Prepared by the Central Valley/Mother Lode Center of Excellence

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SUMMARY

This study conducted by the Central Valley/Mother Lode Center of Excellence examined labor market demand, wages, skills and community college supply for occupations related to industrial maintenance technicians for Fresno City College. Nine occupational groups, containing 21 distinct occupations, were identified and analyzed for this study.

KEY FINDINGS:

- **Occupational demand —** The largest occupational group is maintenance and repair workers with 9,188 workers in 2017 and 1,050 annual openings, followed by industrial machinery mechanics with 3,458 workers and 345 annual openings.

- **Wages —** The highest paid occupational group is engineering technicians (except drafters, all other), followed by electrical and electronics engineering technicians. All nine occupational groups exceed the region's self-sufficiency wage, and eight occupations exceed living wages at entry-level.

- **Employers —** Top employers in the region include the U.S. Air Force, Saalex Solutions Incorporated, and the U.S. Navy.

- **Job titles —** The most common occupational title in job postings was maintenance and repair workers (general). The most common job titles were maintenance technician, maintenance mechanic, and maintenance worker.

- **Skills and certifications —** The top baseline skill requirement is troubleshooting, and the top specialized skill is repair. The top certification is a driver's license.

- **Education —** The typical education required for four of the nine occupational groups is an associate degree. A high school diploma is required for three occupational groups. A postsecondary non-degree award is required for electrical and electronics repairers (commercial and industrial equipment). A bachelor's degree is required for occupational health and safety specialists.

- **Supply —** Analysis of community college completions in the region shows that there are 215 certificates and 53 degrees conferred each year in the region related to the nine occupations analyzed in this study.

Based on a comparison of occupational demand and community college supply, there is an undersupply of 1,502 trained workers in the subregion and 2,540 trained workers in the region. As a result, the Center of Excellence recommends that Fresno City College work with the region's advanced manufacturing deputy sector navigator, the college's advisory board and local industry in the expansion its industrial maintenance technician program

INTRODUCTION

The Central Valley/Mother Lode Center of Excellence was asked by Fresno City College to provide labor market information for industrial maintenance technicians.

This analysis focuses on the South Central Valley/Southern Mother Lode (SCV/SML) subregion; however, occupational demand, supply and wage data for the region are also included for broader applicability and use. Analysis of the program and occupational data related to industrial maintenance technicians resulted in the identification of 21 applicable occupations within 9 occupational groups (Exhibit 1).

The occupational groups and their Standard Occupational Classification (SOC) System codes are:

- 17-3023 Electrical and Electronics Engineering Technicians;
- 17-3026 Industrial Engineering Technicians;
- 17-3027 Mechanical Engineering Technicians;
- 17-3029 Engineering Technicians, Except Drafters, All Other;
- 29-9011 Occupational Health and Safety Specialists;
- 49-2094 Electrical and Electronics Repairers, Commercial and Industrial Equipment;
- 49-9041 Industrial Machinery Mechanics;
- 49-9043 Maintenance Workers, Machinery; and
- 49-9071 Maintenance and Repair Workers, General.

The SOC codes, occupational titles, job descriptions, sample job titles, and knowledge and skills from the Bureau of Labor Statistics and O*NET OnLine are shown in Exhibit 1. Note that there is no O*NET data for 51-4199 Metal Workers and Plastic Workers, All Other.

EXHIBIT 1. SOC titles, job descriptions, sample job titles, and knowledge and skills related to industrial maintenance technicians

SOC CODE & TITLE	DESCRIPTION	SAMPLE JOB TITLES	KNOWLEDGE & SKILLS
Electrical & Electronics Engineering Technicians			
17-3023.01 Electronics Engineering Technicians	Lay out, build, test, troubleshoot, repair, and modify developmental and production electronic components, parts, equipment, and systems, such as computer equipment, missile control instrumentation, electron tubes, test equipment, and machine tool numerical	Digital Tech (Digital Technician), Electrical Technician, Electronics Engineering Technician, Electronics Technician, Engineering Technician (Engineering Tech), Failure Analysis Technician (FA Technician), Refurbish Technician (Refurb Tech), Senior Electronics Technician, Technician, Test Technician	**Knowledge** • Engineering and technology • Computers and electronics • Design • Customer and personal service • Mechanical **Skills** • Reading comprehension

SOC CODE & TITLE	DESCRIPTION	SAMPLE JOB TITLES	KNOWLEDGE & SKILLS
	controls, applying principles and theories of electronics, electrical circuitry, engineering mathematics, electronic and electrical testing, and physics. Usually work under direction of engineering staff.		• Complex problem solving • Critical thinking • Active listening • Monitoring
17-3023.03 Electrical Engineering Technicians	Test or modify developmental or operational electrical machinery or electrical control equipment and circuitry in industrial or commercial plants or laboratories. Usually work under direction of engineers or technologists.	Electrical Engineering Technician, Electrical Technician, Engineering Assistant, Engineering Technician, Generation Technician, Instrument and Controls Technician (I & C Technician), Relay Tester, Results Technician, Test Specialist, Test Technician	**Knowledge** • Computers and electronics • Engineering and technology • English language • Mathematics • Production and processing **Skills** • Critical thinking • Reading comprehension • Active listening • Complex problem solving • Monitoring
Industrial Engineering Technicians			
17-3026 Industrial Engineering Technicians	Apply engineering theory and principles to problems of industrial layout or manufacturing production, usually under the direction of engineering staff. May perform time and motion studies on worker operations in a variety of industries for purposes such as establishing standard production rates or improving efficiency.	Engineering Technician, Industrial Engineering Analyst, Industrial Engineering Technician, Manufacturing Technician, Methods Engineer, Process Documentation and Methods Analyst, Process Engineer, Process Technician, Production Staff Worker, Quality Control Engineering Technician (QC Engineering Technician)	**Knowledge** • Mechanical • Engineering and technology • Production and processing • Mathematics • Design **Skills** • Reading comprehension • Active listening • Critical thinking • Complex problem solving • Monitoring

SOC CODE & TITLE	DESCRIPTION	SAMPLE JOB TITLES	KNOWLEDGE & SKILLS
Mechanical Engineering Technicians			
17-3027.00 Mechanical Engineering Technicians	Apply theory and principles of mechanical engineering to modify, develop, test, or calibrate machinery and equipment under direction of engineering staff or physical scientists.	Design Engineer, Designer, Engineering Lab Technician, Engineering Technical Analyst, Engineering Technician, Equipment Engineer, Lab Technician, Mechanical Designer, Process Technician, Research and Development Technician	**Knowledge** • Mechanical • Engineering and technology • Design • Mathematics • Production and processing **Skills** • Active listening • Reading comprehension • Critical thinking • Operation monitoring • Speaking
17-3027.01 Automotive Engineering Technicians	Assist engineers in determining the practicality of proposed product design changes and plan and carry out tests on experimental test devices or equipment for performance, durability, or efficiency.	Emissions Engineer, Engineering Team Supervisor, Laboratory Technician (Lab Technician), Research Technician, Test Engineer	**Knowledge** • Engineering and technology • Mechanical • Computers and electronics • Mathematics • English language **Skills** • Reading comprehension • Critical thinking • Speaking • Active listening • Complex problem solving
Engineering Technicians, Except Drafters, All Other			
17-3029.01 Non-destructive Testing Specialists	Test the safety of structures, vehicles, or vessels using x-ray, ultrasound, fiber optic or related equipment.	Industrial Radiographer, Inspector, Non-Destructive Evaluation Manager, Non-Destructive Evaluation Technician, Non-Destructive Testing Services Director, Non-Destructive Testing	**Knowledge** • Education and training • Mathematics • Production and processing • Engineering and technology

SOC CODE & TITLE	DESCRIPTION	SAMPLE JOB TITLES	KNOWLEDGE & SKILLS
		Specialist, Non-Destructive Testing Supervisor, Non-Destructive Testing Technician, Quality Engineer, Quality Manager	• Customer and personal service **Skills** • Quality control analysis • Active listening • Critical thinking • Reading comprehension • Active listening
17-3029.02 Electrical Engineering Technologists	Assist electrical engineers in such activities as process control, electrical power distribution, or instrumentation design. May prepare layouts of electrical transmission or distribution systems, supervise the flow of work, estimate project costs, or participate in research studies.	Design Tech; Electrical Tech/Project Manager; Engineering Tech; Engineering Technologist; Senior Analysis Specialist; Senior Engineering Tech; Senior Process Control Tech; Technologist; Technologist Electronic Design or Technical Director; Technologist, Development	**Knowledge** • Engineering and technology • Computers and electronics • Design • English language • Mathematics **Skills** • Critical thinking • Complex problem solving • Mathematics • Reading comprehension • Active listening
17-3029.03 Electromechanical Engineering Technologists	Assist electromechanical engineers in such activities as computer-based process control, instrumentation, or machine design. May prepare layouts of machinery or equipment, plan the flow of work, conduct statistical studies, or analyze production costs.	Designer, Engineering Specialist, Engineering Tech, Instrumentation and Electrical Preventive Maintenance Inspector IE PM Inspector, Process Control Tech, R&D Lab Technician, Senior Design Engineering Specialist, Senior Designer, Senior Mechanical Designer, Senior Tech Manufacturing Engineering	**Knowledge** • Engineering and technology • Mechanical • Computers and electronics • Physics • Mathematics **Skills** • Active listening • Critical thinking • Reading comprehension • Active listening • Complex problem solving
17-3029.04	Assist electronics engineers in such	Communications Technologist, Electronics	**Knowledge**

SOC CODE & TITLE	DESCRIPTION	SAMPLE JOB TITLES	KNOWLEDGE & SKILLS
Electronics Engineering Technologists	activities as electronics systems and instrumentation design or digital signal processing.	Department Manager, Electronics Technology Department Chair, Electronics Technology Instructor, Field Service Technician, Field Technical Specialist, System Technologist, Systems Technician, Systems Technologist	• Computers and electronics • Mathematics • Engineering and technology • Telecommunications • Physics **Skills** • Active listening • Critical thinking • Complex problem solving • Reading comprehension • Speaking
17-3029.05 Industrial Engineering Technologists	Assist industrial engineers in such activities as quality control, inventory control, or material flow methods. May conduct statistical studies or analyze production costs.	Associate Product Integrity Engineer; Head of Operation and Logistics; Liaison Engineer; Manager, Asset Management; Materials Planner/Production Planner; Planner/Scheduler; Production Control Supervisor; Quality Management Coordinator; Quality Tech; Senior Quality Methods Specialist	**Knowledge** • Engineering and technology • Production and processing • Mathematics • English language • Administration and management **Skills** • Critical thinking • Reading comprehension • Speaking • Active listening • Complex problem solving
17-3029.06 Manufacturing Engineering Technologists	Develop tools, implement designs, or integrate machinery, equipment, or computer technologies to ensure effective manufacturing processes.	Business Process Analyst, Manufacturing Coordinator, Manufacturing Technology Analyst, Product Manager, Scientist	**Knowledge** • Engineering and technology • Production and processing • Mechanical • Mathematics • Design **Skills** • Critical thinking • Mathematics

SOC CODE & TITLE	DESCRIPTION	SAMPLE JOB TITLES	KNOWLEDGE & SKILLS
			• Judgment and decision making • Systems analysis • Active listening
17-3029.07 Mechanical Engineering Technologists	Assist mechanical engineers in such activities as generation, transmission, or use of mechanical or fluid energy. Prepare layouts of machinery or equipment or plan the flow of work. May conduct statistical studies or analyze production costs.	CAD Designer, Engineer Technical Staff, Engineering Tech, Engineering Technologist, Mechanical Designer, Mechanical Designer/Wind-Chill Administrator, Senior Designer, Senior Process Analyst, Technical Staff Engineer, Tooling Engineering Tech	**Knowledge** • Engineering and technology • Mechanical • Production and processing • Design • Mathematics **Skills** • Active listening • Operation monitoring • Critical thinking • Quality control analysis • Reading comprehension
17-3029.08 Photonics Technicians	Build, install, test, or maintain optical or fiber optic equipment, such as lasers, lenses, or mirrors, using spectrometers, interferometers, or related equipment.	Coating Manager, Engineering Technician (Engineering Tech), Engineering Technologist, Fiber Optics Technician, Laser Technician, Lead Technician, Optomechanical Technician, Photonic Laboratory Technician (Photonic Lab Tech), Photonics Technician, Ruling Technician	**Knowledge** • Engineering and technology • Computers and electronics • Mathematics • Mechanical • English language **Skills** • Reading comprehension • Operation monitoring • Active listening • Quality control analysis • Active learning
17-3029.09 Manufacturing Production Technicians	Set up, test, and adjust manufacturing machinery or equipment, using any combination of electrical, electronic, mechanical, hydraulic,	Engineering Technician, Experimental Machining Lab Manager, Final Operations Technician, Metallurgical Lab Technician, Quality Assurance Technician,	**Knowledge** • Mechanical • Engineering and technology • Production and processing • Design • Mathematics

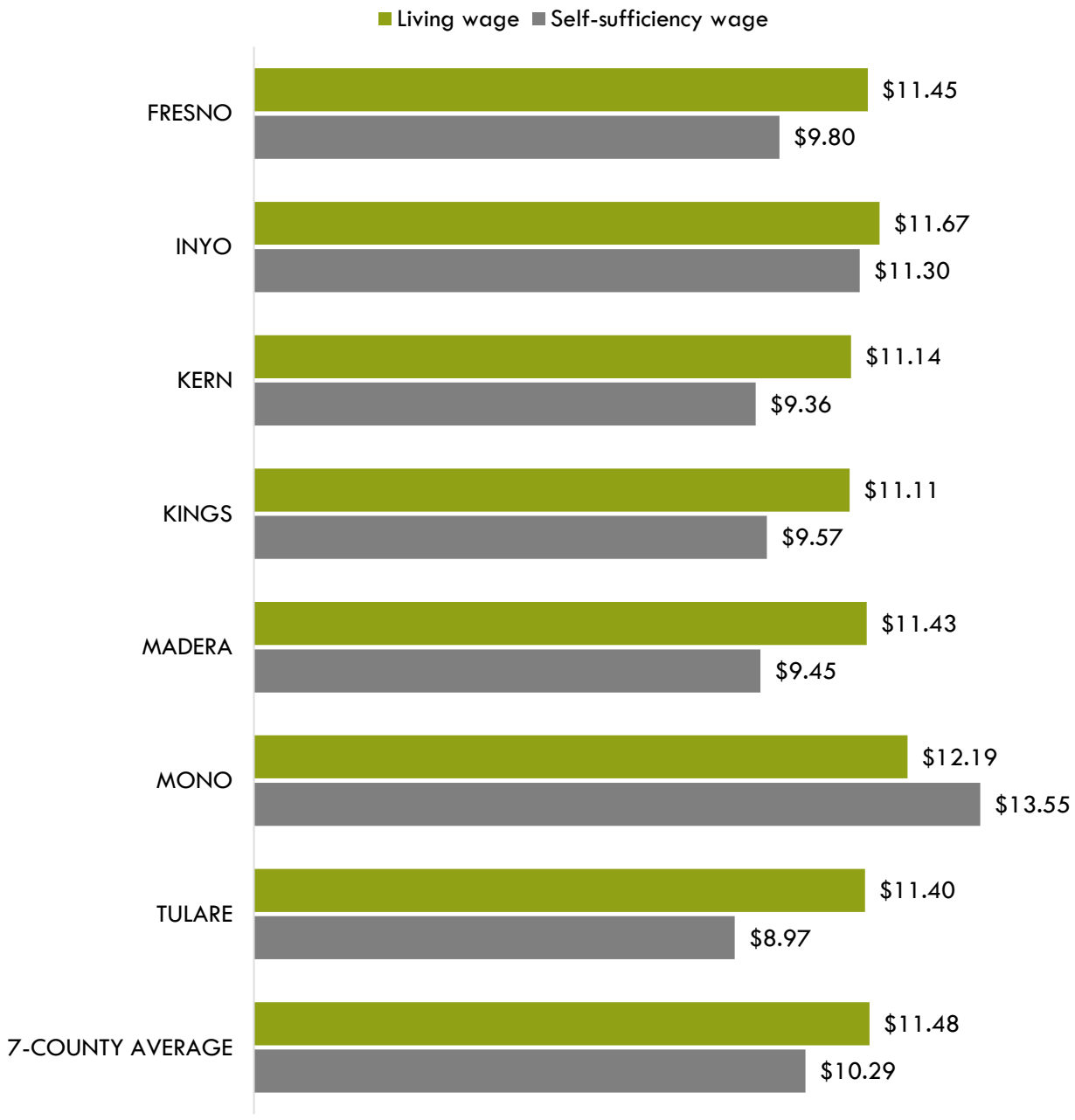
SOC CODE & TITLE	DESCRIPTION	SAMPLE JOB TITLES	KNOWLEDGE & SKILLS
	pneumatic, or computer technologies.	Quality Technician, Service Technician, Support Technician, Tool Room Supervisor, Value Stream Manager	**Skills** • Operation monitoring • Critical thinking • Monitoring • Active listening • Equipment maintenance
17-3029.11 Nanotechnology Engineering Technologists	Implement production processes for nanoscale designs to produce or modify materials, devices, or systems of unique molecular or macromolecular composition. Operate advanced microscopy equipment to manipulate nanoscale objects. Work under the supervision of nanoengineering staff.	Research Associate, Research Scientist, Research Specialist, Research Staff Member, Scientific Research Associate, Scientist, Staff Scientist, Technical Research Scientist	**Knowledge** • Chemistry • Engineering and technology • Physics • Mathematics • English language **Skills** • Critical thinking • Reading comprehension • Active listening • Mathematics • Monitoring
17-3029.12 Nanotechnology Engineering Technicians	Operate commercial-scale production equipment to produce, test, or modify materials, devices, or systems of molecular or macromolecular composition. Work under the supervision of engineering staff.	Engineering Technician, Laboratory Manager (Lab Manager), Laboratory Technician (Lab Technician), Microfabrication Engineer Manager, Nanofabrication Specialist, Process Engineering Technician, Research Scientist, Research Support Specialist, Research Technician, Technical Associate	**Knowledge** • Engineering and technology • Computers and electronics • Mechanical • Chemistry • English language **Skills** • Monitoring • Operation monitoring • Quality control analysis • Reading comprehension • Active listening
	Occupational Health & Safety Specialists		
29-9011 Occupational Health and Safety Specialists	Review, evaluate, and analyze work environments and design programs and procedures to control,	Certified Industrial Hygienist; Chief Safety Officer; Corporate Safety Director; Director Employee	**Knowledge** • English language • Law and government • Education and training

SOC CODE & TITLE	DESCRIPTION	SAMPLE JOB TITLES	KNOWLEDGE & SKILLS
	eliminate, and prevent disease or injury caused by chemical, physical, and biological agents or ergonomic factors. May conduct inspections and enforce adherence to laws and regulations governing the health and safety of individuals. May be employed in the public or private sector. Includes environmental protection officers.	Safety and Health; Environmental Health and Safety Manager; Environmental, Health, and Safety EHS Officer; Health and Safety Manager; Risk Control Consultant; Safety Consultant; Safety Specialist	• Public safety and security • Customer and personal service **Skills** • Active listening • Complex problem solving • Critical thinking • Speaking • Judgement and decision making
Electrical & Electronics Repairers, Commercial & Industrial Equipment			
49-2094 Electrical and Electronics Repairers, Commercial and Industrial Equipment	Repair, test, adjust, or install electronic equipment, such as industrial controls, transmitters, and antennas.	Control Technician, Electrical and Instrument Mechanic, Electrical and Instrument Technician, Electrical Maintenance Technician, Electrical Technician, I&C Tech, Instrument and Electrical Technician, Repair Technician, Service Technician, Technical Support Specialist	**Knowledge** • Computers and electronics • Engineering and technology • Mechanical • English language • Mathematics **Skills** • Operation monitoring • Quality control analysis • Repairing • Troubleshooting • Critical thinking
Industrial Machinery Mechanics			
49-9041 Industrial Machinery Mechanics	Repair, install, adjust, or maintain industrial production and processing machinery or refinery and pipeline distribution systems.	Fixer, Industrial Machinery Mechanic, Industrial Mechanic, Loom Fixer, Machine Adjuster, Maintenance Mechanic, Maintenance Technician, Master Mechanic, Mechanic, Overhauler	**Knowledge** • Mechanical • Engineering and technology • Production and processing • English language • Mathematics **Skills** • Equipment maintenance

SOC CODE & TITLE	DESCRIPTION	SAMPLE JOB TITLES	KNOWLEDGE & SKILLS
			• Repairing • Operation monitoring • Troubleshooting • Operation and control
Maintenance Workers, Machinery			
49-9043 Maintenance workers, machinery	Lubricate machinery, change parts, or perform other routine machinery maintenance.	Lubricator, Machine Repairer, Maintainer, Maintenance Electrician, Maintenance Man, Maintenance Mechanic, Maintenance Technician, Maintenance Worker, Oiler, Overhauler	**Knowledge** • Mechanical • Mathematics • Design • English language • Engineering and technology **Skills** • Equipment maintenance • Operation monitoring • Repairing • Troubleshooting • Operation and control
Maintenance & Repair Workers, General			
49-9071 Maintenance and repair workers, general	Perform work involving the skills of two or more maintenance or craft occupations to keep machines, mechanical equipment, or the structure of an establishment in repair. Duties may involve pipe fitting; boiler making; insulating; welding; machining; carpentry; repairing electrical or mechanical equipment; installing, aligning, and balancing new equipment; and repairing buildings, floors, or stairs.	Building Maintenance Mechanic, Building Mechanic, Equipment Engineering Technician, Facilities Manager, Maintenance Engineer, Maintenance Man, Maintenance Mechanic, Maintenance Supervisor, Maintenance Technician, Maintenance Worker	**Knowledge** • Mechanical • Building and construction • Customer and personal service • Public safety and security • English language **Skills** • Equipment maintenance • Repairing • Troubleshooting • Critical thinking • Equipment selection

The 2014 average self-sufficiency wage for a single adult in the South Central Valley/Southern Mother Lode (SCV/SML) subregion is $10.29/hour, and the current average living wage for a single adult is $11.48/hour. Self-sufficiency and living wage data by county and the overall eight-county average are shown in Exhibit 2. In the wages sections of this report, Pct.10 hourly denotes entry-level wages, and median represents experienced wages.

EXHIBIT 2. Self-sufficiency and living wages in the SCV/SML subregion



OCCUPATIONAL DEMAND

In 2017, 16,192 workers were employed in occupational groups related to industrial maintenance technicians in the South Central Valley/Southern Mother Lode subregion (Exhibit 3). The largest occupation is maintenance and repair workers (general) with 9,188 workers in 2017. This occupation is expected to increase by 7% over the next five years and has the greatest number of projected annual openings, 1,050. The next largest occupation is industrial machinery mechanics. This occupation is smaller with 3,458 jobs in 2017 and a moderate growth projection, 6%, offering 345 job openings each year.

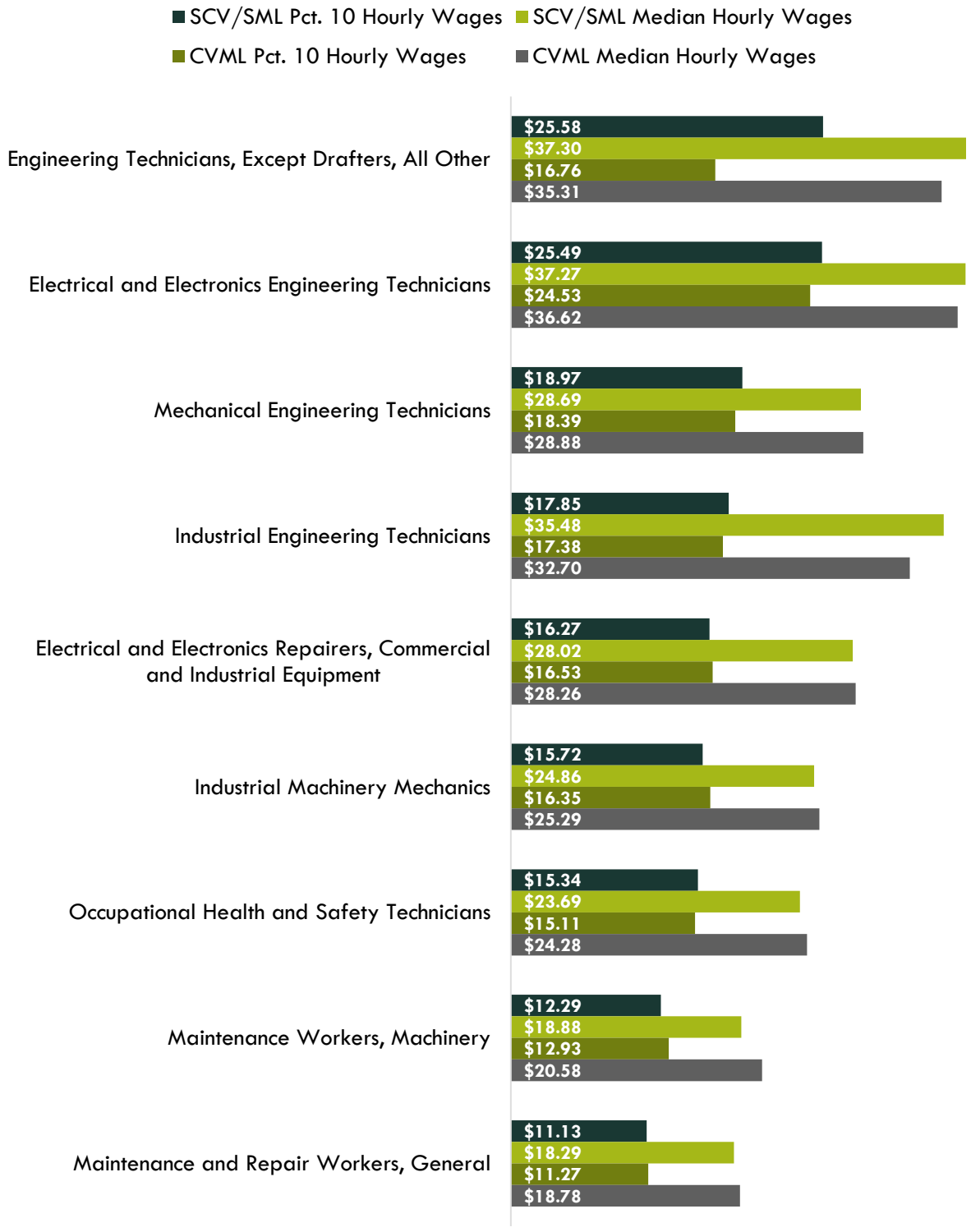
EXHIBIT 3. Employment and occupational projections for occupational groups related to industrial maintenance technicians in the SCV/SML subregion

Occupation	2017 Jobs	5-Year Change	5-Year % Change	Annual Openings
Maintenance and Repair Workers, General	9,188	678	7%	1,050
Industrial Machinery Mechanics	3,458	210	6%	345
Maintenance Workers, Machinery	876	51	6%	100
Electrical and Electronics Engineering Technicians	1,066	(7)	(1%)	95
Engineering Technicians, Except Drafters, All Other	739	6	1%	66
Electrical and Electronics Repairers, Commercial and Industrial Equipment	471	12	3%	44
Industrial Engineering Technicians	114	10	9%	12
Mechanical Engineering Technicians	116	6	5%	12
Occupational Health and Safety Technicians	164	8	5%	10
TOTAL	**16,192**	**974**	**6%**	**1,732**

WAGES

Exhibit 4 compares the entry-level and experienced wages of the nine occupational groups identified for this study. The entry-level wages for all nine occupations exceed the average self-sufficiency wage for a single adult in the eight-county subregion, $10.29/hour. Eight of the nine occupational groups offer entry-level wages that are higher than the average living wage for a single adult, $11.28/hour, in the subregion. The exception is maintenance and repair workers (general).

EXHIBIT 4. Entry-level and experienced wage comparison in the region and subregion



JOB POSTINGS

From August 2017 through July 2018, there were 2,478 job postings for the nine occupational groups related to industrial maintenance technicians in the seven counties of the South Central Valley/Southern Mother Lode subregion. The top employers that posted the 2,478 job ads are listed in Exhibit 5. The top three employers are the U.S. Air Force, Saalex Solutions Incorporated, and the U.S. Navy.

EXHIBIT 5. Top employers by number of job postings

EMPLOYER	JOB POSTINGS
US Air Force	49
Saalex Solutions Incorporated	42
US Navy	39
Winncompanies	30
McDonald's	29
Northrop Grumman	29
Home Depot Incorporated	24
Visalia Unified School District	23
Fresno Unified School District	22
Virgin Galactic	22

Exhibit 6 shows how job postings for the nine targeted occupational groups in the subregion are distributed. The majority of job postings listed the occupational title "maintenance and repair workers (general)." However, other common occupational titles include industrial engineering technician and engineering technician (except drafters).

EXHIBIT 6. Occupational titles related to industrial maintenance technicians in job postings

OCCUPATION	JOB POSTINGS
Maintenance and Repair Workers, General	1,285
Industrial Engineering Technicians	356
Engineering Technicians, Except Drafters	261
Industrial Machinery Mechanics	209
Occupational Health and Safety Specialists	147

JOB TITLES

Analysis of the 2,478 advertised job titles for the targeted occupational groups reveals that the majority of job titles involve maintenance: maintenance technicians, maintenance mechanics, and maintenance workers. Exhibit 7 shows the top job titles among the job postings.

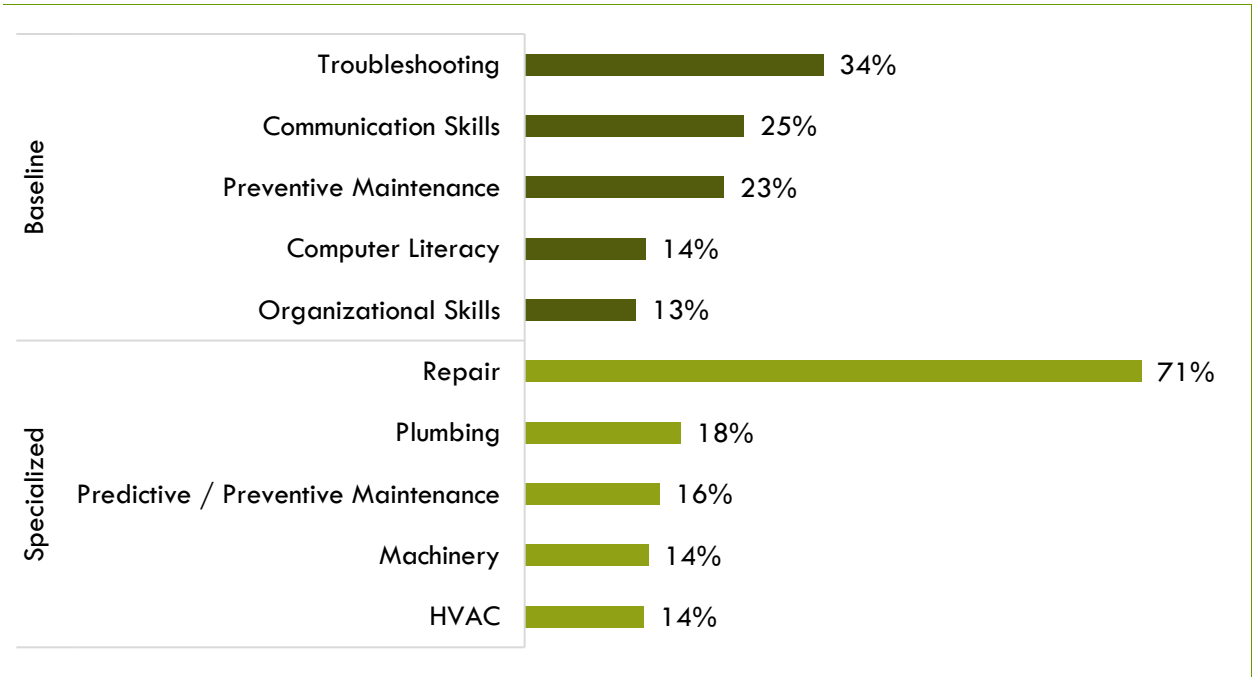
EXHIBIT 7. Top job titles related to industrial maintenance technicians by number of job postings

TITLE	JOB POSTINGS
Maintenance technician	350
Maintenance mechanic	210
Maintenance worker	148
Field service technician	147
Engineering technician	132
Service technician	132
Mechanic	72
Repair technician	63

SKILLS

Exhibit 8 depicts the top baseline and specialized skills for the 22 targeted occupations related to industrial maintenance technicians. Just over 81% of the job postings contain skills data. Of these, the three most common baseline skills are troubleshooting, 34% of job postings, communication skills, 25%, and preventive maintenance, 23%. The top three specialized skills are repair, 71% of job postings, plumbing, 18%, and predictive/preventive maintenance, 16%.

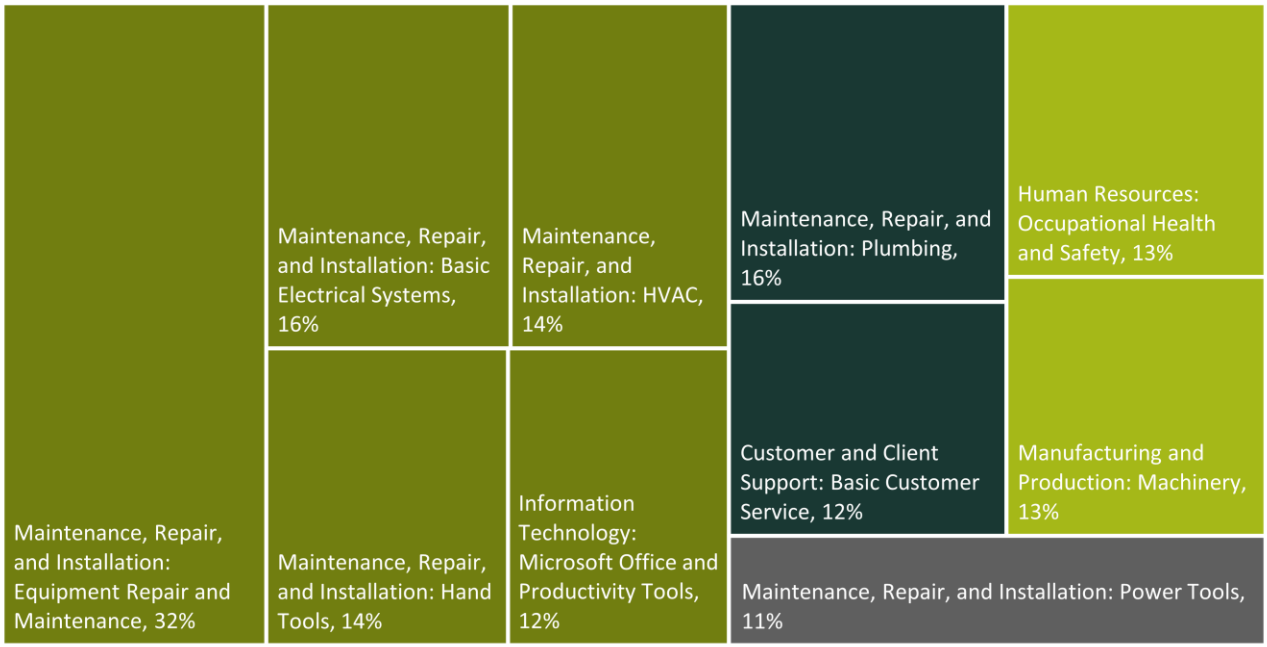
EXHIBIT 8. Top baseline and specialized skills requested by employers in job postings related to industrial maintenance technicians



SKILL CLUSTER PROJECTIONS

Approximately 70 percent of the 2,478 job postings contain skill cluster projections data. An evaluation of the top skill clusters that will have the greatest gains in level of importance shows that the top area is maintenance, repair, and installation: equipment repair and maintenance, 32%. Other clusters with large gain projections include maintenance, repair, and installation: basic electrical systems (16%), maintenance, repair, and installation: plumbing (16%) and maintenance, repair, and installation: HVAC (14%).

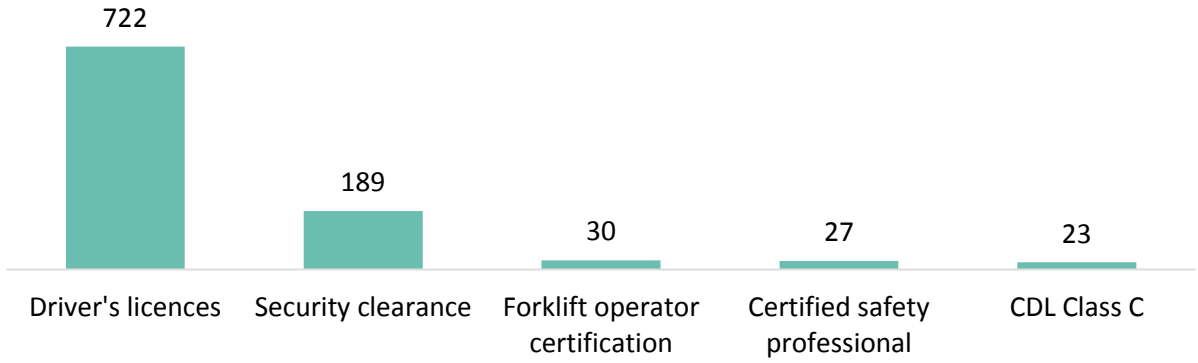
EXHIBIT 9. Skill cluster projections for industrial maintenance technicians



CERTIFICATIONS

Of the 2,478 postings related to industrial maintenance technicians, 722 indicated a need for a driver's license. The next two top certifications were a security clearance and forklift operator (Exhibit 10).

EXHIBIT 10. Industrial maintenance technician certifications requested in job postings



EDUCATION, WORK EXPERIENCE & TRAINING

The typical entry-level education for the occupational groups related to industrial maintenance technicians is shown in Exhibit 11. The five occupational groups associated with engineering technicians, such as civil engineering technicians and industrial engineering technicians, typically require an associate degree. Maintenance workers and industrial machinery mechanics must have a high school diploma and moderate-term to long-term on-the-job training. One occupation—occupational health and safety specialists—typically requires a bachelor's degree and is only relevant to transfer-focused programs.

Beyond the need for on-the-job training, these occupations also qualify as relevant to community colleges due to one or more of the following requirements:

- State of California certification requirements,
- Specialized industry knowledge and
- Performance of duties that are taught through agricultural science and food safety programs offered by local community colleges.

EXHIBIT 11. Education, work experience, training and Current Population Survey results[1]

OCCUPATION	TYPICAL ENTRY-LEVEL EDUCATION	WORK EXPERIENCE REQUIRED	TYPICAL ON-THE-JOB TRAINING	CPS
Electrical and Electronics Engineering Technicians	Associate degree	None	None	53.6%
Industrial Engineering Technicians	Associate degree	None	None	53.6%
Mechanical Engineering Technicians	Associate degree	None	None	53.6%
Engineering Technicians, Except Drafters	Associate degree	None	None	53.6%
Occupational Health and Safety Specialists	Bachelor's degree	None	None	22.0%
Electrical and Electronics Repairers, Commercial and Industrial Equipment	Postsecondary non-degree award	None	Long-term	51.8%
Industrial Machinery Mechanics	HS Diploma	None	Long-term	41.4%
Maintenance Workers, Machinery	HS Diploma	None	Long-term	38.6%
Maintenance and Repair Workers, General	HS Diploma	None	Moderate-term	37.9%

[1] "Labor Force Statistics from the Current Population Survey," Bureau of Labor Statistics, https://www.bls.gov/cps/.

SUPPLY

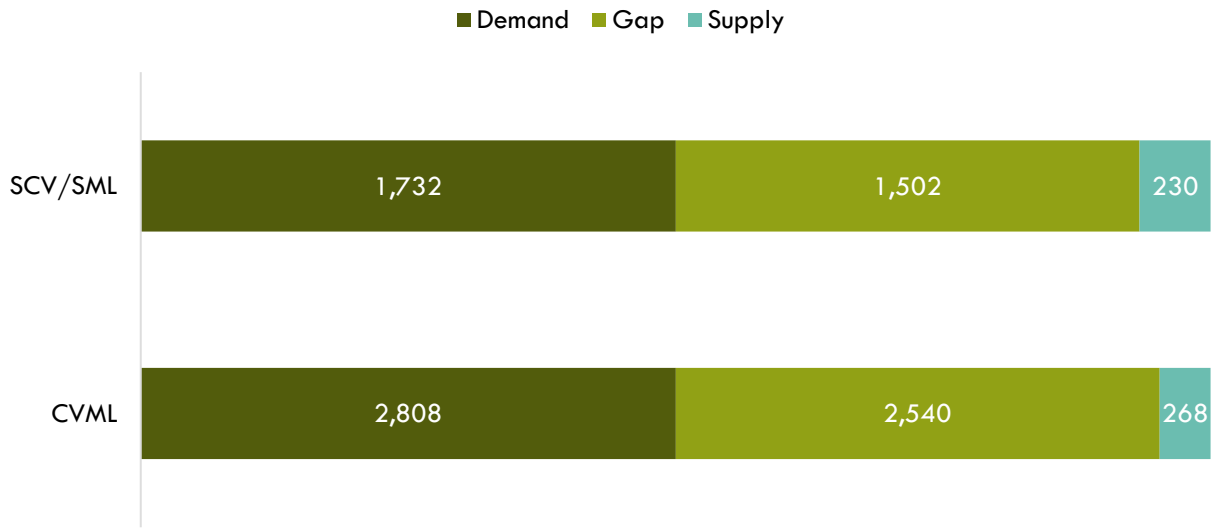
Analysis of the last three years of statewide TOP code data, from 2014 through 2017, shows that, on average, 215 certificates, and 53 degrees are conferred each year in the region (Exhibit 12).

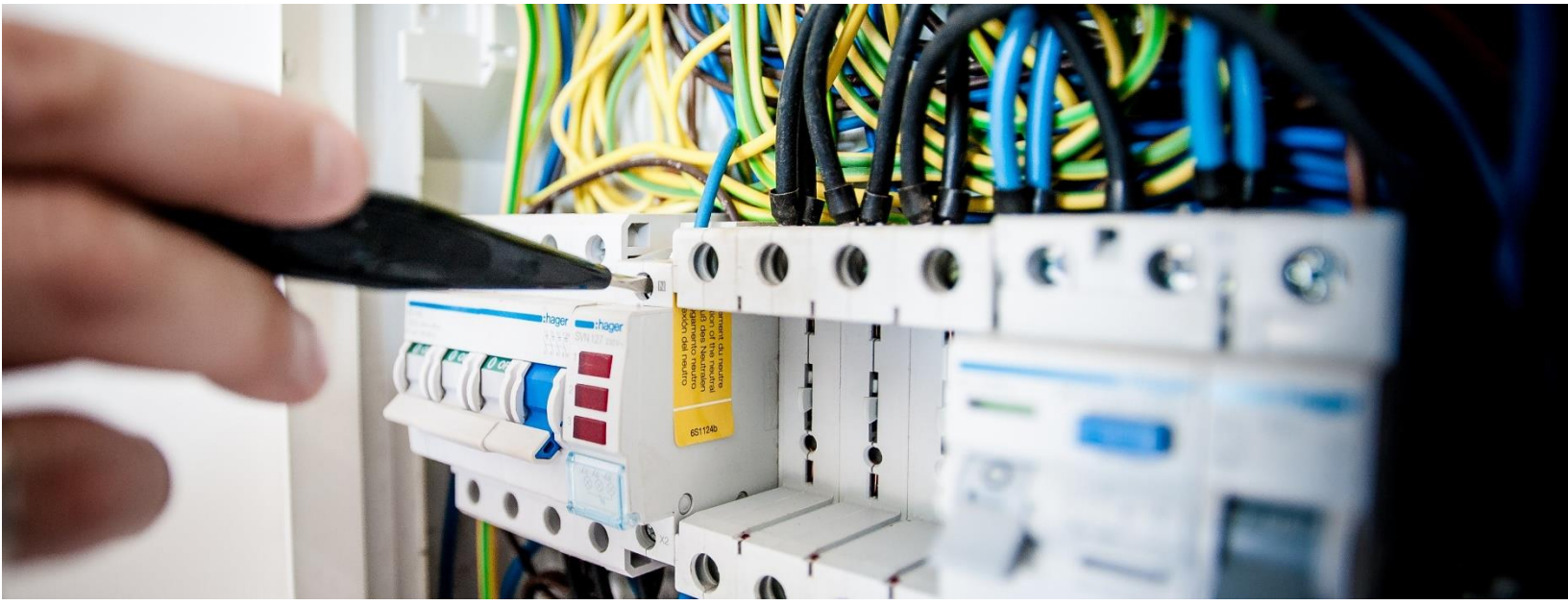
EXHIBIT 12. Community college supply related to industrial maintenance technicians in the region

TOP TITLE & CODE	COLLEGE	3-YEAR AVERAGE CERTIFICATES	DEGREES
Electro-Mechanical Technology-093500	San Joaquin Delta	1	
	Subtotal	**1**	
Electronics and Electric Technology-093400	Bakersfield	56	8
	Fresno City	10	15
	Merced	1	2
	San Joaquin Delta	12	
	Sequoias	8	
	Subtotal	**88**	**25**
Engineering Technology, General (requires Trigonometry)-092400	Bakersfield		0
	Merced		1
	San Joaquin Delta		1
	Subtotal		**2**
Industrial and Occupational Safety and Health-095670	Taft	7	10
	Subtotal	**7**	**10**
Industrial Electronics-093420	Fresno City	18	
	Merced	0	1
	Modesto Junior	2	9
	Subtotal	**21**	**10**
Industrial Systems Technology and Maintenance-094500	Fresno City	9	
	Merced	1	1
	Modesto Junior		0
	San Joaquin Delta	3	0
	Sequoias	33	2
	Subtotal	**46**	**4**
Manufacturing and Industrial Technology-095600	Bakersfield	1	2
	Fresno City	26	2
	Modesto Junior	3	
	Porterville	24	
	Subtotal	**53**	**3**
TOTAL		**215**	**53**

An undersupply of industrial maintenance technicians appears to exist in the region and subregion. In the subregion, there is a shortage of 1,502 trained workers. In the region, the shortage is 2,540 trained workers (Exhibit 13).

EXHIBIT 13. Annual demand and supply for industrial maintenance technicians in the subregion and region





STUDENT OUTCOMES

Exhibit 14 summarizes employment and wage outcomes for the related program TOP codes based on the Career Technical Education Outcomes Survey (CTEOS) conducted by Santa Rosa Junior College.

Programs with the greatest number of enrollments were 093400-Electronics and Electric Technology, 3,246 students in the region, and 095670-Industrial and Occupational Safety and Health, 9,041 students. A high percentage of students in nearly all the programs were employed in the second fiscal quarter after completing their coursework. In addition, except for students who enrolled in 095670-Industrial and Occupational Safety and Health, a majority of students attained at least a living wage after completing coursework. (Electro-mechanical technology-093500 is not contained in Exhibit 14 because the program had only 10 course enrollments and no other metrics.)

EXHIBIT 14. Central Valley/Mother Lode results from the Career Technical Education Outcomes Survey for TOP codes related to industrial maintenance mechanics[2]

	METRICS				
TOP CODE & TITLE	**COURSE ENROLLMENTS**	**STUDENTS WHO RECEIVED A DEGREE OR CERTIFICATE**	**NUMBER OF STUDENTS WHO TRANSFERRED**	**EMPLOYED IN SECOND FISCAL QUARTER AFTER EXIT**	**ATTAINED A LIVING WAGE**
092400-Engineering Technology, General	857	*	86	*	*
093400-Electronics and Electric Technology	3,246	89	47	70% (n=427)	63% (n=252)
093420-Industrial Electronics	549	25	16	78% (n=102)	61% (n=61)
094500-Industrial Systems Technology and Maintenance	541	67	0	72% (n=123)	60% (n=67)
095600-Manufacturing and Industrial Technology	1,252	26	*	79% (n=203)	68% (n=128)
095670-Industrial and Occupational Safety and Health	9,041	15	*	57% (n=929)	39% (n=628)

[2] The Career and Technical Education Outcomes Survey (CTEOS) is a survey of former students in career education programs, conducted one year after they exited the California Community Colleges. Students either earned an award or completed at least nine units in the same 2-digit TOP code. https://cteos.santarosa.edu/.

CONCLUSION

The entry-level wages for occupational groups related to industrial maintenance technicians exceed the average self-sufficiency wage for the subregion. The entry-level wages for eight of the nine occupational groups exceed the living wage at the regional and subregional levels. The exception is maintenance and repair workers (general).

There were nearly 2,500 job postings in the past 12 months for occupations related to industrial maintenance technicians in the South Central Valley/Southern Mother Lode subregion.

Analysis of skills and certificate requirements in job postings indicates:

- The top baseline skill requirement is troubleshooting, and the top specialized skill is repair.
- The top certification is a driver's license.

There are eight community colleges in the region offering programs contributing to workforce supply of industrial maintenance technicians. However, there is an undersupply of trained workers, a shortage of 1,502 in the region and 2,540 in the subregion.

RECOMMENDATION

It is recommended that Fresno City College work with the region's advanced manufacturing deputy sector navigator, the college's advisory board and local industry in the expansion of its industrial maintenance technicians program.

APPENDIX A: METHODOLOGY & DATA SOURCES

Data Sources

Labor market and educational supply data compiled in this report derive from a variety of sources. Data were drawn from external sources, including the Economic Modeling Specialists, Inc., the California Community Colleges Chancellor's Office Management Information Systems Data Mart and the National Center for Educational Statistics (NCES) Integrated Postsecondary Education Data System (IPEDS). Below is the summary of the data sources found in this study.

Data Type	Source
Labor Market Information/Population Estimates and Projections/Educational Attainment	Economic Modeling Specialists, Intl. (EMSI). EMSI occupational employment data are based on final EMSI industry data and final EMSI staffing patterns. Wage estimates are based on Occupational Employment Statistics (QCEW and Non-QCEW Employees classes of worker) and the American Community Survey (Self-Employed and Extended Proprietors). Occupational wage estimates also affected by county-level EMSI earnings by industry: economicmodeling.com.
Living Wage	A living wage calculator that estimates the cost of living in a specific community or region: livingwage.mit.edu.
Typical Education Level and On-the-job Training	Bureau of Labor Statistics (BLS) uses a system to assign categories for entry-level education and typical on-the-job training to each occupation for which BLS publishes projections data: www.bls.gov/emp/ep_education_tech.htm.
Labor Force, Employment and Unemployment Estimates	California Employment Development Department, Labor Market Information Division, labormarketinfo.edd.ca.gov
Job Posting and Skills Data	Burning Glass, http://www.burning-glass.com/
Additional Education Requirements/ Employer Preferences	The O*NET Job Zone database includes over 900 occupations as well as information on skills, abilities, knowledge, work activities and interests associated with specific occupations: www.onetonline.org

Key Terms and Concepts

Annual Job Openings: Annual openings are calculated by dividing the number of years in the projection period by total job openings.

Education Attainment Level: The highest education attainment level of workers age 25 years or older.

Employment Estimate: The total number of workers currently employed.

Employment Projections: Projections of employment are calculated by a proprietary Economic Modeling Specialists, Intl. (EMSI) formula that includes historical employment and economic indicators along with national, state and local trends.

Living Wage: The cost of living in a specific community or region for one adult and no children. The cost increases with the addition of children.

Occupation: An occupation is a grouping of job titles that have a similar set of activities or tasks that employees perform.

Percent Change: Rate of growth or decline in the occupation for the projected period; this does not factor in replacement openings.

Replacements: Estimate of job openings resulting from workers retiring or otherwise permanently leaving an occupation. Workers entering an occupation often need training. These replacement needs, added to job openings due to growth, may be used to assess the minimum number of workers who will need to be trained for an occupation.

Total Job Openings (New + Replacements): Sum of projected growth (new jobs) and replacement needs. When an occupation is expected to lose jobs, or retain the current employment level, number of openings will equal replacements.

Typical Education Requirement: represents the typical education level most workers need to enter an occupation.

Typical On-The-Job Training: indicates the typical on-the-job training needed to attain competency in the skills needed in the occupation.

Wages Family Compositions: The living wage calculator estimates the living wage needed to support families. For single adult families, the adult is assumed to be employed full time. For two adult families where both adults are in the labor force, both adults are assumed to be employed full time. For two adult families where one adult is not in the labor force, one of the adults is assumed to be employed full time while the other non-wage-earning adult provides full-time child care for the family's children. Full-time work is assumed to be year-round, 40 hours per week for 52 weeks, per adult. Families with one child are assumed to have a 'young child' (4 years old). Families with two children are assumed to have a 'young child' and a 'child' (9 years old). Families with three children are assumed to have a 'young child,' a 'child,' and a 'teenager' (15 years old).