March 2021

Labor Market Analysis

Industrial Maintenance

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California Community Colleges

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Prepared by the Central Valley/Mother Lode Center of Excellence

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COVID-19 Statement: This report includes employment projection data by Emsi. Emsi's projections are modeled on recorded (historical) employment figures and incorporate several underlying assumptions, including the assumption that the economy during the projection period will be at approximately full employment or potential output. To the extent that a recession or labor shock, such as the economic effects of COVID-19, can cause long-term structural change, they may impact the projections. At this time, it is not possible to quantify the impact of COVID-19 on projections of industry and occupational employment. Other measures such as unemployment rates and monthly industry employment estimates will reflect the most recent information on employment and jobs in the state and, in combination with input from local employers, may help validate current and future employment needs as depicted here.

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Summary

Please note the COVID-19 statement on page 2 when considering this report's findings.

This study conducted by the Central Valley/Mother Lode Center of Excellence examines labor market demand, wages, skills, and postsecondary supply for industrial maintenance. Seven occupations related to industrial maintenance were identified for Cerro Coso College:

- 49-9041, Industrial Machinery Mechanics
- 17-3023, Electrical and Electronic Engineering Technologists and Technicians
- 17-2199, Engineers, All Other
- 11-3051, Industrial Production Managers
- 49-9043, Maintenance Workers, Machinery
- 17-3026, Industrial Engineering Technologists and Technicians
- 17-3027, Mechanical Engineering Technologists and Technicians

Key findings:

- **Occupational demand —** More than 7,000 workers were employed in jobs related to industrial maintenance in 2019 in the South Central Valley/Southern Mother Lode (SCV/SML) subregion. The largest occupation is industrial machinery mechanics with 3,211 workers in 2019, a projected growth rate of 5% over the next five years, and 303 annual openings.
- **Wages —** Engineers, all other, earn the highest entry-level wage, $36.34/hour in the subregion and $35.42/hour in the region.
- **Employers —** Employers with the most job postings in the subregion are Anthem Blue Cross, Teleflora, and Applied Materials.
- **Occupational titles —** The most common occupational title in job postings in the subregion is industrial engineering technicians. The most common job title is maintenance mechanics.
- **Skills and certifications —** The top baseline skill is troubleshooting, the top specialized skill is repair, and the top software skill is Microsoft Office. The most in-demand certification is a driver's license.
- **Education —** An associate degree is typically required for three of the seven occupations—electrical and electronic engineering technologists and technicians, industrial engineering technologists and technicians, and mechanical engineering technologists and technicians.
- **Supply —** Analysis of postsecondary completions in the region shows that on average 515 awards were conferred in the Central Valley/Mother Lode region each year.

Based on a comparison of occupational demand and supply, there is an undersupply of 113 trained workers in the subregion and 418 workers in the region. The Center of Excellence recommends that Cerro Coso College work with the Advanced Manufacturing Regional Director, the college's advisory board, and local industry in the expansion of programs to address the shortage of industrial maintenance workers in the region.

Introduction

The Central Valley/Mother Lode Center of Excellence was asked by Cerro Coso College to provide labor market information for industrial maintenance. The geographical focus for this report is the South Central Valley/Southern Mother Lode (SCV/SML) subregion, but regional demand and supply data has been included for broader applicability and use. The average living wage for a single adult in the SCV/SML subregion is $10.30/hour.[1] Analysis of the program and occupational data related to industrial maintenance resulted in the identification of applicable occupations. The Standard Occupational Classification (SOC) System codes and titles used in this report are:

- 49-9041, Industrial Machinery Mechanics
- 17-3023, Electrical and Electronic Engineering Technologists and Technicians
- 17-2199, Engineers, All Other
- 11-3051, Industrial Production Managers
- 49-9043, Maintenance Workers, Machinery
- 17-3026, Industrial Engineering Technologists and Technicians
- 17-3027, Mechanical Engineering Technologists and Technicians

The occupational titles, job descriptions, sample job titles, and knowledge and skills from the Bureau of Labor Statistics and O*NET OnLine are shown below. Data was not available for engineers, all other.

Industrial Machinery Mechanics
Job Description: Repair, install, adjust, or maintain industrial production and processing machinery or refinery and pipeline distribution systems. May also install, dismantle, or move machinery and heavy equipment according to plans.
Knowledge: Mechanical, Engineering and Technology, Production and Processing, English Language, Mathematics
Skills: Equipment Maintenance, Repairing, Operation Monitoring, Troubleshooting, Operation and Control

Electrical and Electronic Engineering Technologists and Technicians
Job Description: Apply electrical and electronic theory and related knowledge, usually under the direction of engineering staff, to design, build, repair, adjust, and modify electrical components, circuitry, controls, and machinery for subsequent evaluation and use by engineering staff in making engineering design decisions.
Knowledge: Computers and Electronics, Engineering and Technology, English Language, Design, Mathematics
Skills: Critical Thinking, Reading Comprehension, Complex Problem Solving, Active Listening, Troubleshooting

Industrial Production Managers
Job Description: Plan, direct, or coordinate the work activities and resources necessary for manufacturing products in accordance with cost, quality, and quantity specifications.
Knowledge: Production and Processing, Administration and Management, Customer and Personal Service, Personnel and Human Resources, English Language
Skills: Critical Thinking, Monitoring, Speaking, Coordination, Time Management

[1] The term "living wage" in Center of Excellence reports is calculated by averaging the self-sufficiency wages from the Insight Center's California Family Needs Calculator for each county in the subregion: https://insightcced.org/tools-metrics/self-sufficiency-standard-tool-for-california/.

Maintenance Workers, Machinery
Job Description: Lubricate machinery, change parts, or perform other routine machinery maintenance.
Knowledge: Mechanical, Mathematics, Design, English Language, Engineering and Technology
Skills: Equipment Maintenance, Operation Monitoring, Repairing, Troubleshooting, Operation and Control

Industrial Engineering Technologists and Technicians
Job Description: 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.
Knowledge: Mechanical, Engineering and Technology, Production and Processing, Mathematics, Design
Skills: Reading Comprehension, Active Listening, Critical Thinking, Complex Problem Saving, Monitoring

Mechanical Engineering Technologists and Technicians
Job Description: Apply theory and principles of mechanical engineering to modify, develop, test, or adjust machinery and equipment under direction of engineering staff or physical scientists.
Knowledge: Engineering and Technology, Design, Mechanical, Mathematics, Computers and Electronics
Skills: Reading Comprehension, Active Listening, Critical Thinking, Operation Monitoring, Complex Problem Saving

Occupational Demand

The South Central Valley/Southern Mother Lode subregion employed 7,020 workers in industrial process technician occupations in 2019 (Exhibit 1). The largest occupation is industrial machinery mechanics with 3,211 workers in 2019. This occupation is projected to grow by 5% over the next five years and has the greatest number of projected annual openings, 303.

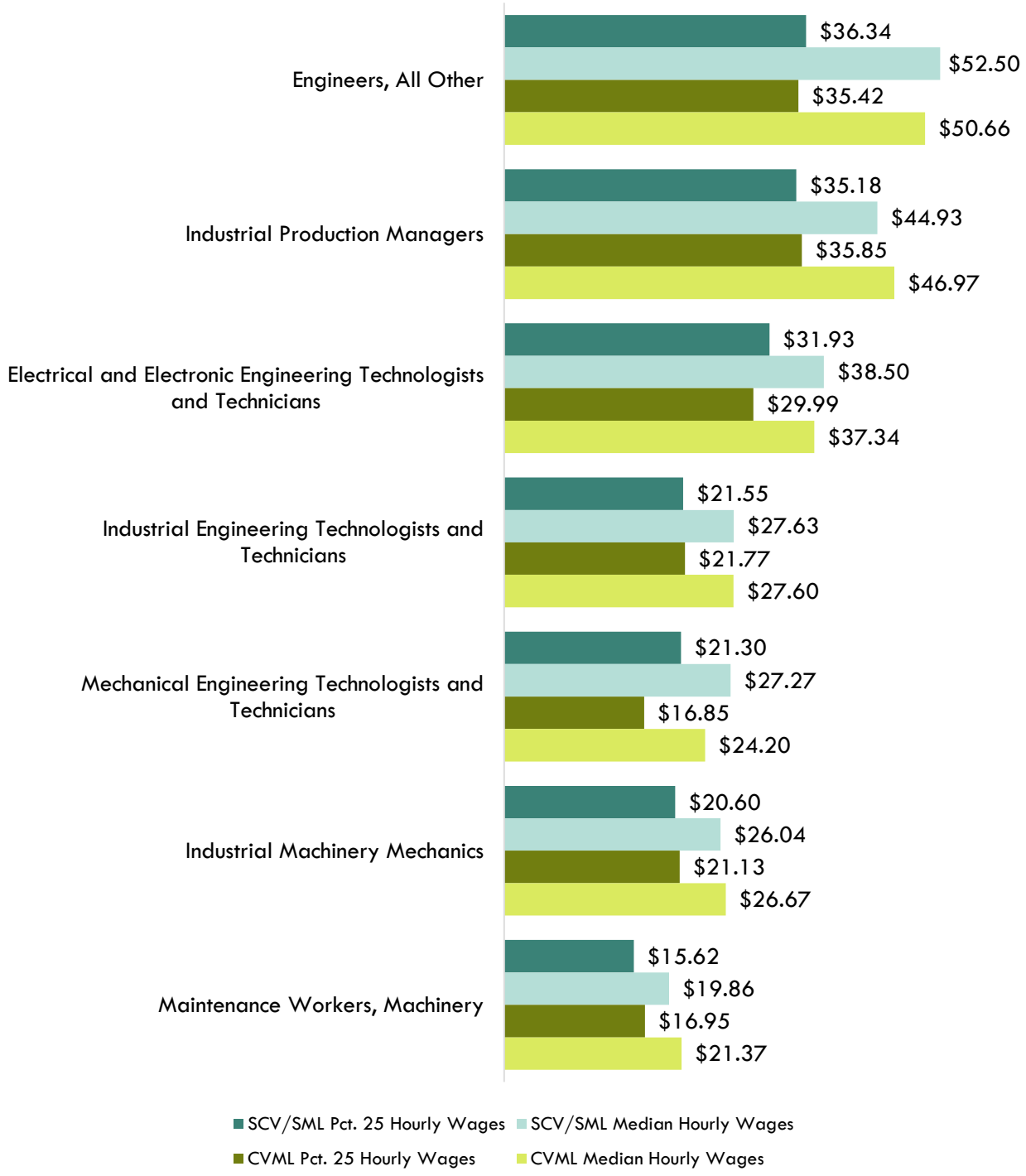
Exhibit 1. Industrial process technician employment and occupational projections in the SCV/SML subregion

Occupation	2019 Jobs	2024 Jobs	5-Year Change	5-Year % Change	Annual Openings
Industrial Machinery Mechanics	3,211	3,384	173	5%	303
Electrical and Electronic Engineering Technologists and Technicians	988	977	(11)	(1%)	84
Engineers, All Other	1,006	1,027	21	2%	64
Industrial Production Managers	912	926	14	2%	60
Maintenance Workers, Machinery	684	683	(1)	(0%)	56
Industrial Engineering Technologists and Technicians	122	130	8	6%	12
Mechanical Engineering Technologists and Technicians	98	103	6	6%	10
TOTAL	**7,020**	**7,230**	**211**	**3%**	**590**

Wages

Exhibit 2 compares the entry-level and experienced wages of the industrial maintenance occupations. Engineers, all other, earn the highest entry-level wage, $36.34/hour in the subregion and $35.42/hour in the region.

Exhibit 2. Entry-level and experienced wage comparison in the SCV/SML subregion and region



Median salary data from Emsi shows that engineers, all other, earn the highest median salary, more than $109,192 annually, followed by industrial production managers, more than $93,451 annually.

Exhibit 3. Median salaries for industrial process technician occupations

Occupation	Median Salary
Engineers, All Other	$109,192.77
Industrial Production Managers	$93,451.43
Electrical and Electronic Engineering Technologists and Technicians	$80,077.07
Industrial Engineering Technologists and Technicians	$57,473.28
Mechanical Engineering Technologists and Technicians	$56,727.82
Industrial Machinery Mechanics	$54,153.34
Maintenance Workers, Machinery	$41,316.60

Job Postings

There were 1,012 job postings for the seven occupations in the SCV/SML subregion from September 2020 to February 2021.[2] The employers with the most job postings are listed in Exhibit 4.

Exhibit 4. Top employers of industrial maintenance by number of job postings

Employer	Job Postings	% Job Postings
Anthem Blue Cross	12	2%
Teleflora	11	1%
Applied Materials	9	1%
Graphic Packaging International	8	1%
Target	8	1%
Walmart / Sam's	8	1%
Lockheed Martin Corporation	7	1%
Grimmway Farms	6	1%
Koch Industries, Incorporated	6	1%
Leprino Foods Company	6	1%

[2] Other than occupation titles and job titles, the categories below can be counted one or multiple times per job posting, and across several areas in a single posting. For example, a skill can be counted in two different skill types, and an employer can indicate more than one education level.

Exhibit 4 shows how job postings for the targeted occupations in the SCV/SML subregion are distributed across 10 O*NET OnLine occupations. The occupational title industrial engineering technicians is listed in 312 job postings. Note how this occupational title dominates the job posting results. Common job titles in postings include maintenance mechanic in 70 job postings, maintenance technician in 68 job postings, and quality assurance manager in 33 job postings.

Exhibit 5. Top occupational titles in job postings for industrial maintenance

Occupational Title	Job Postings	% of Job Postings
Industrial Engineering Technicians	312	31%
Industrial Machinery Mechanics	210	21%
Quality Control Systems Managers	185	18%
Electronics Engineering Technicians	142	14%
Industrial Production Managers	91	9%
Manufacturing Engineers	29	3%
Mechanical Engineering Technicians	20	2%
Maintenance Workers, Machinery	12	1%
Robotics Engineers	9	1%
Electrical Engineering Technicians	2	0%

Education

Of the 1,012 job postings, 578 listed an education level preferred for the positions being filled. Of those, 54% requested high school or vocational training, 42% requested a bachelor's degree, and 16% requested an associate degree (Exhibit 6). A job posting can indicate more than one education level. Hence, the percentages shown in the chart below may total more than 100%.

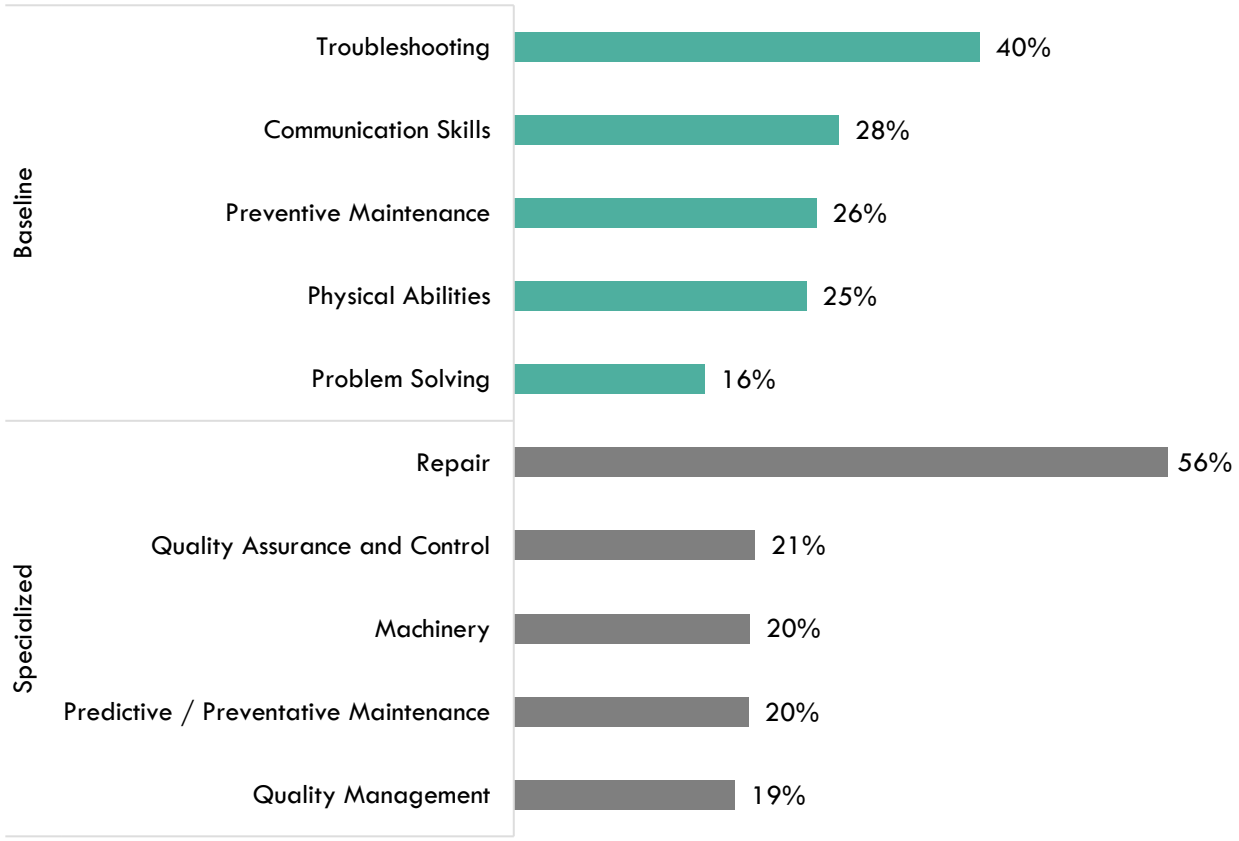
Exhibit 6. Education levels requested in job postings for industrial maintenance

Education Level	Job Postings	% of Job Postings
High school or vocational training	311	54%
Bachelor's degree	245	42%
Associate degree	93	16%
Master's degree	28	5%
Doctoral degree	10	2%

Baseline and Specialized Skills

Exhibit 7 depicts the top baseline and specialized skills for the targeted occupations. The three most important baseline skills are troubleshooting, 40% of job postings, communication, 28%, and preventive maintenance, 26%. The top three specialized skills are repair, 56% of job postings, quality assurance and control, 21%, and machinery, 20%.

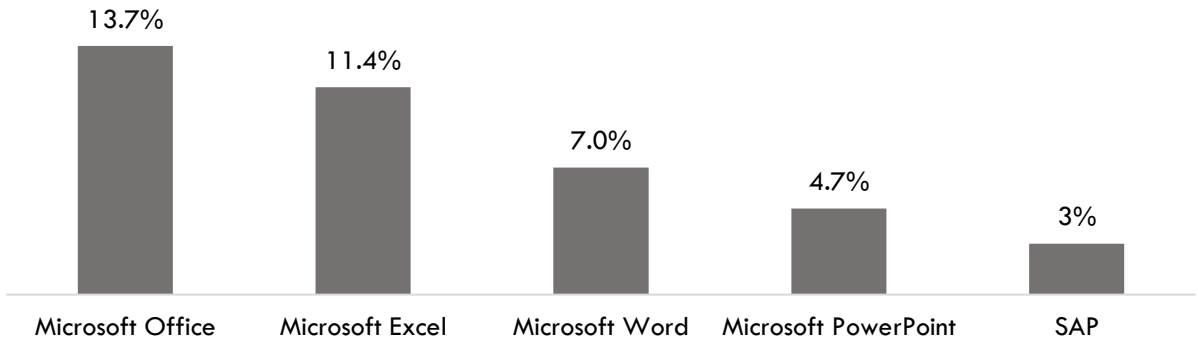
Exhibit 7. In-demand industrial process technician baseline and specialized skills



Software Skills

Analysis also included the software skills most in demand by employers. Microsoft Office and Excel were the top two software skills identified in job postings (Exhibit 8).

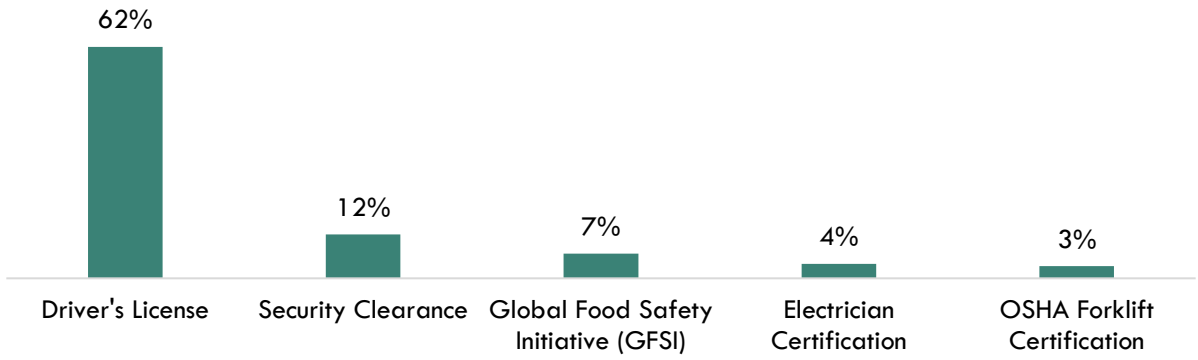
Exhibit 8. In-demand industrial process technician software skills



Certifications

Of the 1,012 job postings, 331 contained certification data. Among those, 62% indicated a need for a driver's license. The next top certifications are security clearance and Global Food Safety Initiative (Exhibit 9). (Due to the low number of job postings with certifications listed, the chart below may not be representative of the full sample.)

Exhibit 9. Top industrial process technician certifications requested in job postings



Education, Work Experience & Training

An associate degree is typically required for three of the seven occupations—electrical and electronic engineering technologists and technicians, industrial engineering technologists and technicians, and mechanical engineering technologists and technicians (Exhibit 10). A high school diploma or the equivalent is typically required for industrial machinery mechanics and maintenance workers, machinery. A bachelor's degree is typically required for engineers, all other, and industrial production managers.

Exhibit 10. Education, work experience, training, and Current Population Survey results for industrial process technician occupations[3]

Occupation	Typical Entry-level Education	Work Experience Required	Typical On-The-Job Training	CPS
Industrial Machinery Mechanics	High school diploma or equivalent	None	Long-term	42.1%
Electrical and Electronic Engineering Technologists and Technicians	Associate degree	None	None	53.5%
Engineers, All Other	Bachelor's degree	None	None	15.1%
Industrial Production Managers	Bachelor's degree	5 years or more	None	30.2%
Maintenance Workers, Machinery	High school diploma or equivalent	None	Long-term	38.2%
Industrial Engineering Technologists and Technicians	Associate degree	None	None	53.5%
Mechanical Engineering Technologists and Technicians	Associate degree	None	None	53.5%

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

Supply

Analysis of program data from the California Community Colleges Chancellor's Office Data Mart included the TOP and CIP codes and titles: 092400 - Engineering Technology, General (requires Trigonometry), 093400 - Electronics and Electric Technology, 093420 - Industrial Electronics, 093500 - Electro-Mechanical Technology, 094500 - Industrial Systems Technology and Maintenance, 095600 - Manufacturing and Industrial Technology, and 47.0303 - Industrial Mechanics and Maintenance Technology. Analysis of the last three years of data shows that, on average, 515 awards were conferred in the Central Valley/Mother Lode region each year (Exhibit 11).

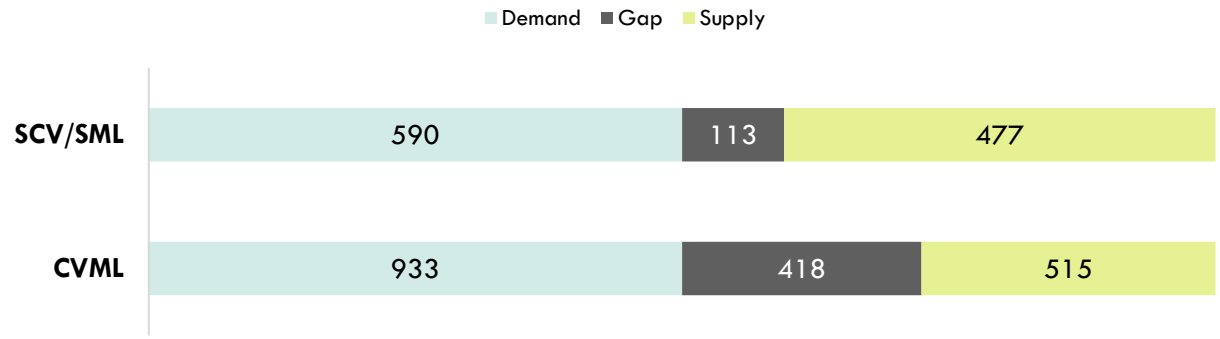
Exhibit 11. Postsecondary supply for industrial process technician occupations in the region

TOP Code - Title	Colleges	Associate Degree	Award 1 < 2 Academic Years	Bachelor's Degree	Certificate 12 < 18 Semester Units	Certificate 18 < 30 Semester Units	Certificate 30 < 60 Semester Units	Certificate 6 < 18 Semester Units	Noncredit Award 144 < 192 Hours	Noncredit Award 48 < 96 Hours	Noncredit Award 960+ Hours	Subtotal
092400 - Engineering Technology, General (requires Trigonometry)	Bakersfield	0										0
	Merced	0										0
093400 - Electronics and Electric Technology	Bakersfield	11					11	52				74
	Fresno City	13				1	11					25
	Merced	1					2					3
	San Joaquin Delta						10					10
	Sequoias					1		1				2
093420 - Industrial Electronics	Fresno City				21							21
	Merced	1					0					1
	Modesto	7					6	1				14
093500 - Electro-Mechanical Technology	Bakersfield	6		6		2						14
	San Joaquin Delta	1				2						3
094500 - Industrial Systems Technology and Maintenance	Clovis					0						0
	Fresno City								26			26
	Merced	1					1					2
	San Joaquin Delta					1	2					3
	Sequoias	4					42				12	58

TOP Code - Title	Colleges	Associate Degree	Award 1 < 2 Academic Years	Bachelor's Degree	Certificate 12 < 18 Semester Units	Certificate 18 < 30 Semester Units	Certificate 30 < 60 Semester Units	Certificate 6 < 18 Semester Units	Noncredit Award 144 < 192 Hours	Noncredit Award 48 < 96 Hours	Noncredit Award 960+ Hours	Subtotal
095600 - Manufacturing and Industrial Technology	Bakersfield	5					0					6
	Cerro Coso	1					1					2
	Fresno City	2					4			21		27
	Modesto					6						6
	Porterville					13		29				41
	Reedley College	1				53	0					54
47.0303 - Industrial Mechanics and Maintenance Technology	San Joaquin Valley College-Visalia	21	101									122
TOTAL		**75**	**101**	**6**	**21**	**78**	**90**	**83**	**26**	**21**	**12**	**515**

There is an undersupply of 113 industrial maintenance workers in the SCV/SML subregion and 418 workers in the region (Exhibit 12).

Exhibit 12. Industrial process technician workforce annual demand and supply in the SCV/SML subregion and region



Student Outcomes

Exhibit 13 summarizes employment and wage outcomes from the California Community College Chancellor's Cal-PASS Plus LaunchBoard for the TOP codes related to industrial maintenance. Of note, there were 125 manufacturing and industrial technology students who received a degree or certificate or attained apprenticeship journey status and 16 who transferred; 79% of students obtained a job closely related to their field of study; 55% reported a median change in earnings; and 78% attained a living wage.

Exhibit 13. Regional metrics for the TOP codes related to industrial maintenance

Metric	Engineering Technology General (requires Trigonometry) 092400	Electronics & Electric Technology 093400	Industrial Electronics 093420	Electro-Mechanical Technology 093500
Students Who Got a Degree or Certificate or Attained Apprenticeship Journey Status	*	51	24	24
Number of Students Who Transferred	91	56	*	*
Job Closely Related to Field of Study	*	75%	63%	*
Median Change in Earnings	100%	33%	33%	65%
Attained a Living Wage	62%	68%	78%	84%
* denotes data not available.				

Metric	Industrial Systems Technology & Maintenance 094500	Manufacturing & Industrial Technology 095600
Students Who Got a Degree or Certificate or Attained Apprenticeship Journey Status	100	125
Number of Students Who Transferred	*	16
Job Closely Related to Field of Study	100%	79%
Median Change in Earnings	34%	55%
Attained a Living Wage	76%	78%
* denotes data not available.		

Conclusion

The entry-level wages of the seven occupations exceed the SCV/SML subregion's average living wage. There were 1,012 job postings in the past six months for occupations related to industrial maintenance in the subregion. Analysis of skills and certification requirements in job postings indicates:

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

There is an undersupply of trained workers, a shortage of 113 in the SCV/SML subregion and 418 in the region.

Recommendation

Based on these findings, it is recommended that Cerro Coso College work with the Advanced Manufacturing Regional Director, the college's advisory board, and local industry in the expansion of programs to address the shortage of industrial maintenance in the region.

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.
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: https://www.bls.gov/emp/tables/educational-attainment.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: 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: 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.