Labor Market Analysis for Program Recommendation: 0946.10/Energy Systems Technology
(*Renewable Energy Technician*)
Orange County Center of Excellence, May 2023

Summary

Program LMI Endorsement	Endorsed: All LMI Criteria Met	☒	Endorsed: Some LMI Criteria Met	☐	Not LMI Endorsed	☐

Program LMI Endorsement Criteria	

	Yes ☑	No ☐
Supply Gap:	*Comments:* there is projected to be **1,094 annual job openings** throughout Los Angeles and Orange counties for these renewable energy occupations, which **is more than the 415 awards conferred by educational institutions.**	

	Yes ☑	No ☐
Living Wage: (Entry-Level, 25th)	*Comments:* **The majority (87%) of annual job openings** for these renewable energy occupations **have entry-level hourly wages above the OC living wage of $20.63**.	

	Yes ☑	No ☐
Education:	*Comments:* Three of these renewable energy occupations typically require a high school diploma or equivalent and one typically requires a postsecondary nondegree award. Additionally, **over one-third of workers in the field have completed some college or an associate degree as their highest level of education.**	

Emerging Occupation(s)	
Yes ☐	No ☑
Comments: N/A	

The Orange County Center of Excellence for Labor Market Research (OC COE) prepared this report to determine whether there is a supply gap in the Los Angeles/Orange County regional labor market related to four middle-skill occupations:

- Solar Photovoltaic Installers (47-2231)
- Industrial Machinery Mechanics (49-9041)
- Wind Turbine Service Technicians (49-9081)
- Power Plant Operators (51-8013)

Based on the available data there does not appear to be a supply gap for these renewable energy occupations. Additionally, the majority of annual job openings have entry-level wages above the living wage and typical education requirements align with a community college education. **Therefore, due to some of the regional labor market criteria being met, the COE endorses this proposed program.**

Exhibit 1 lists the occupational demand, supply, typical entry-level education, and educational attainment for the occupations included in this report.

Exhibit 1: Labor Market Endorsement Summary

Occupation (SOC)	Demand (Annual Openings)	Supply (CC and Non-CC)	Entry-Level Hourly Earnings (25th Percentile)	Typical Entry-Level Education	Community College Educational Attainment
Solar Photovoltaic Installers (47-2231)	91	283	OC: $18.46	High school diploma or equivalent	52%
Industrial Machinery Mechanics (49-9041)	907	132	OC: $23.56	High school diploma or equivalent	41%
Wind Turbine Service Technicians (49-9081)	31	Accounted for Above	OC: $19.06	Postsecondary nondegree award	36%
Power Plant Operators (51-8013)	66	Accounted for Above	OC: $36.37	High school diploma or equivalent	49%
Total	**1,094**	**415**	**N/A**	**N/A**	**N/A**

Demand:

- The number of jobs related to these renewable energy occupations is projected to increase 6% through 2026, equating to 1,094 annual job openings.
- Hourly entry-level wages for these renewable energy occupations range from $18.46 to $36.37 in Orange County; the majority of annual job openings have entry-level wages above the living wage.
- There were 2,583 online job postings for these renewable energy occupations over the past 12 months. The highest number of postings were for maintenance mechanics, solar installers, and lead solar installers.
- The typical entry-level education for these renewable energy occupations ranges from a high school diploma or equivalent to a postsecondary nondegree award.
- Between 36% and 52% of workers in the field have completed some college or an associate degree as their highest level of education.

Supply:

- There was an average of 415 awards conferred by 22 community colleges in Los Angeles and Orange Counties from 2018 to 2021.
- Non-community college institutions did not confer any related awards from 2017 to 2020.
- Orange County community college students that exited energy systems technology programs in the 2019-2020 academic year had a median annual wage of $35,784 after exiting the program and 41% attained the regional living wage.
- Throughout Orange County, 100% of energy systems technology students that exited their program in 2018-19 reported that they are working in a job closely related to their field of study; however, this figure represents only three students that responded to the CTE Outcomes Survey (CTEOS).

Demand

Occupational Projections:

Exhibit 2 shows the annual percent change in jobs for these renewable energy occupations from 2016 through 2026. Employment in these renewable energy occupations declined 5% from 2019 to 2020 in Orange County due to the COVID-19 pandemic, which is similar to the 6% decline across all occupations during the same period. These renewable energy occupations are projected to grow at a similar rate for all occupations through 2026.

Exhibit 2: Annual Percent Change in Jobs for Renewable Energy Occupations, 2016-2026
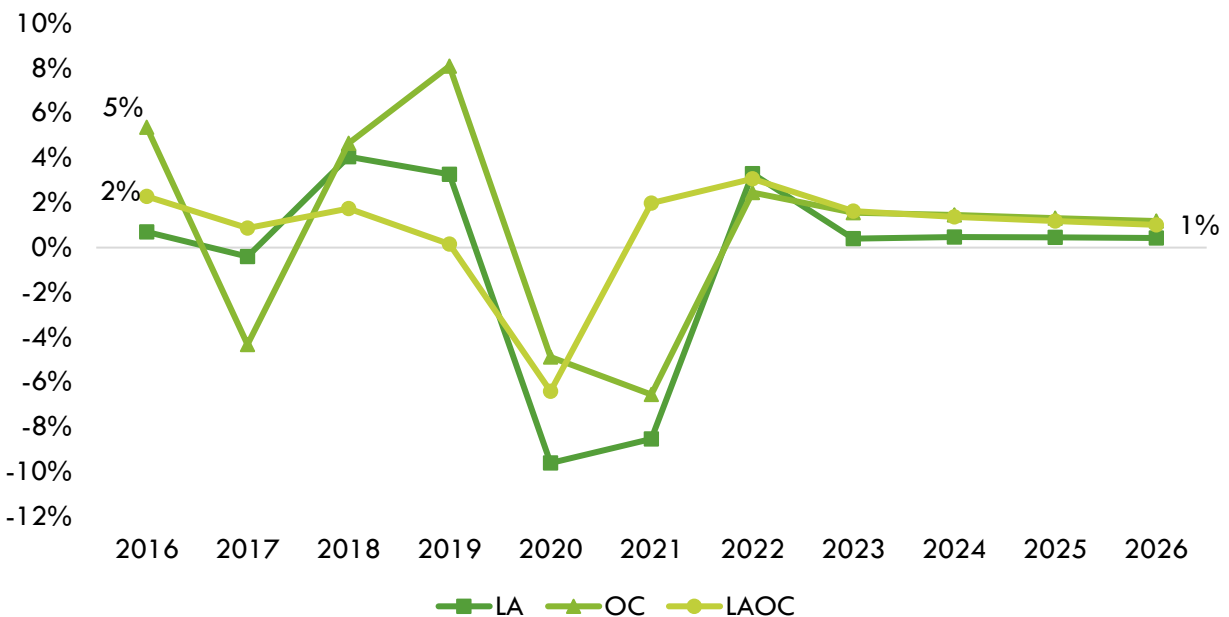

Exhibit 3 shows the five-year occupational demand projections for these renewable energy occupations. In Los Angeles/Orange County, the number of jobs related to these occupations is projected to increase by 6% through 2026. There is projected to be 1,094 jobs available annually.

Exhibit 3: Occupational Demand in Los Angeles and Orange Counties[1]

Geography	2021 Jobs	2026 Jobs	2021-2026 Change	2021-2026 % Change	Annual Openings
Los Angeles	7,428	7,810	381	5%	775
Orange	2,786	3,015	229	8%	319
Total	**10,214**	**10,824**	**610**	**6%**	**1,094**

Wages:

The labor market endorsement in this report considers the entry-level hourly wages for these renewable energy occupations in Orange County as they relate to the county's living wage. Los Angeles County wages are included below in order to provide a complete analysis of the LA/OC region.

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[1] Five-year change represents new job additions to the workforce. Annual openings include new jobs and replacement jobs that result from retirements and separations.

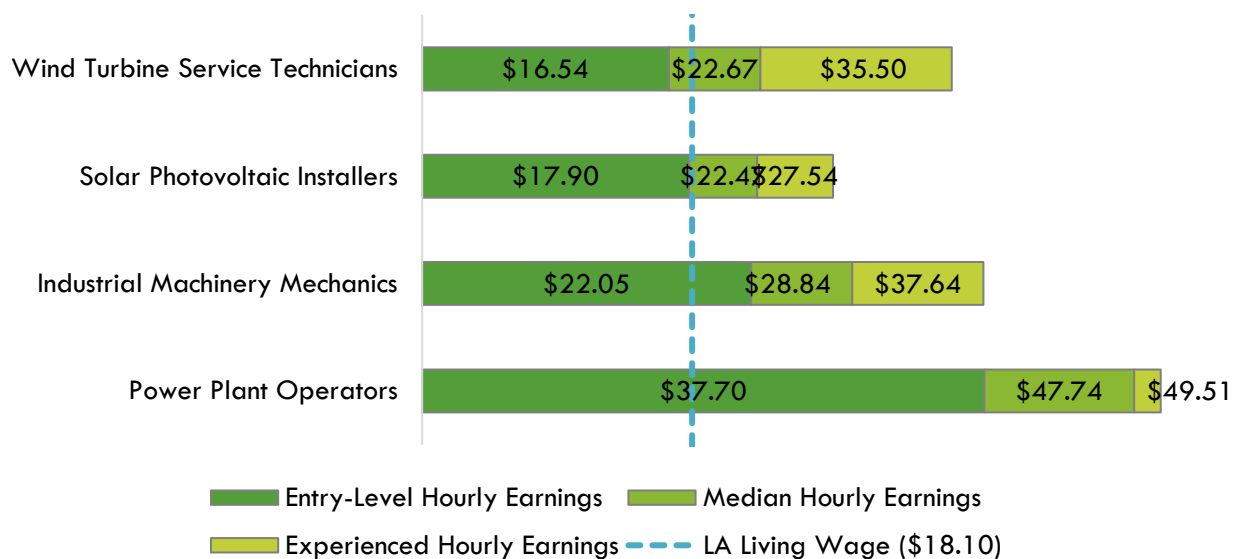The majority (87%) of annual openings for these renewable energy occupations have entry-level wages above the living wage for one adult ($20.63 in Orange County). Typical entry-level hourly wages range between $18.46 and $36.37. Orange County's average wages are slightly higher than the average statewide wage of $31.58 for these occupations. Exhibit 4 shows the wage range for each of these renewable energy occupations in Orange County and how they compare to the regional living wage, sorted from lowest to highest entry-level wage.

Exhibit 4: Wages by Occupation in Orange County

Occupation	Entry-Level	Median	Experienced
Solar Photovoltaic Installers	$18.46	$22.98	$27.98
Wind Turbine Service Technicians	$19.06	$20.94	$29.42
Industrial Machinery Mechanics	$23.56	$30.07	$38.69
Power Plant Operators	$36.37	$46.02	$47.75

Legend: Entry-Level Hourly Earnings, Median Hourly Earnings, Experienced Hourly Earnings, OC Living Wage ($20.63)
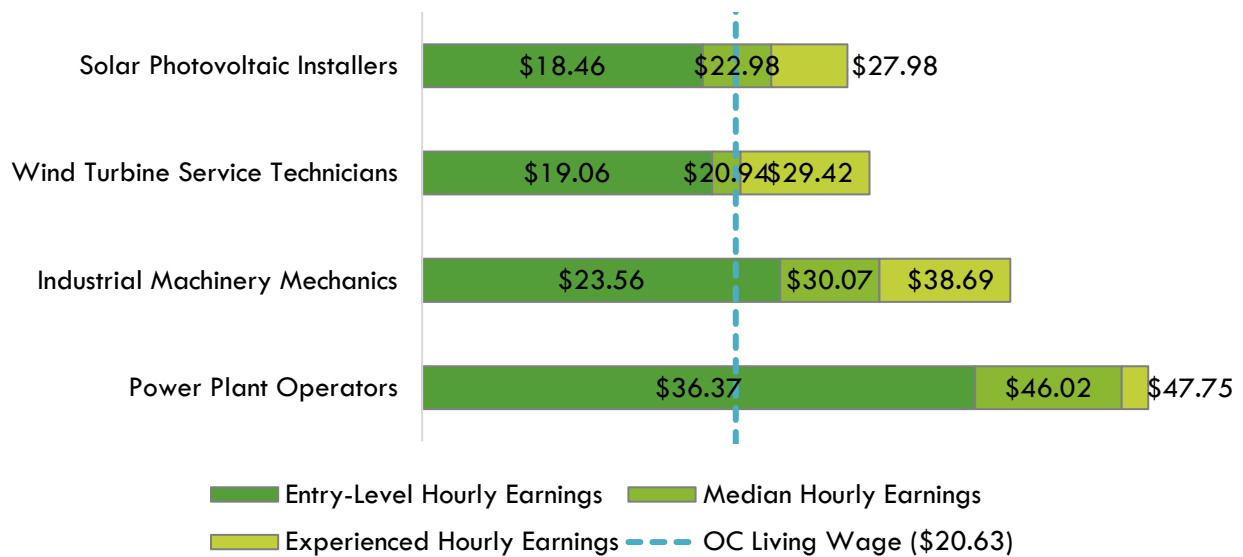
The majority (90%) of annual openings for these renewable energy occupations have entry-level wages above the living wage for one adult ($18.10 in Los Angeles County). Typical entry-level hourly wages are in a range between $16.54 and $37.70. Los Angeles County's average wages are slightly higher than the average statewide wage of $31.58 for these occupations. Exhibit 5 shows the wage range for each of these renewable energy occupations in Los Angeles County and how they compare to the regional living wage, sorted from lowest to highest entry-level wage.

Exhibit 5: Wages by Occupation in Los Angeles County

Occupation	Entry-Level	Median	Experienced
Wind Turbine Service Technicians	$16.54	$22.67	$35.50
Solar Photovoltaic Installers	$17.90	$22.43	$27.54
Industrial Machinery Mechanics	$22.05	$28.84	$37.64
Power Plant Operators	$37.70	$47.74	$49.51

Legend: Entry-Level Hourly Earnings, Median Hourly Earnings, Experienced Hourly Earnings, LA Living Wage ($18.10)

Job Postings:

Important Online Job Postings Data Note: *Online job postings data is sourced from Lightcast, a labor market analytics firm that scrapes, collects, and organizes data from online job boards such as LinkedIn, Indeed, Glassdoor, Monster, GovernmentJobs.com, and thousands more. Lightcast uses natural language processing (NLP) to determine the related company, industry, occupation, and other information for each job posting. However, NLP has limitations that include understanding contextual words of phrases; determining differences in words that can be used as nouns, verbs, and/or adjectives; and misspellings or grammatical errors.[2] For these reasons, job postings could be assigned to the wrong employer, industry, or occupation within Lightcast's database.*

Additionally, there are several limitations when analyzing job postings. A single job posting may not represent a single job opening, as employers may be creating a pool of candidates for future openings or hiring for multiple positions with a single posting. Additionally, not all jobs are posted online, and jobs may be filled through other methods such as internal promotion, word-of-mouth advertising, physical job boards, or a variety of other channels.

There were 2,583 online job postings related to these renewable energy occupations listed in the past 12 months. Of those, 67% (1,737) were for *industrial machinery mechanics*.

Exhibit 6: Number of Job Postings by Occupation (n=2,583)

Occupation	Job Postings	Percentage of Job Postings
Industrial Machinery Mechanics	1,737	67%
Solar Photovoltaic Installers	541	21%
Power Plant Operators	267	10%
Wind Turbine Service Technicians	38	1%
Total Postings	**2,583**	**100%**

The top employers in the region, by number of job postings, are shown in Exhibit 7.

Exhibit 7: Top Employers by Number of Job Postings (n=2,583)

Employer	Job Postings	Percentage of Job Postings
The Coca-Cola Company	228	9%
Aerotek	131	5%
Randstad	83	3%
Anheuser-Busch	29	1%
Disneyland Resort	29	1%
SunPower Corp.	28	1%
B. Braun	26	1%
Freedom Forever	26	1%
La Solar Group	26	1%
Cargill	24	1%

The top specialized, soft, and computer skills listed by those most frequently mentioned in job postings (denoted in parentheses) are shown in Exhibit 8.

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[2] K. R. Chowdhary, Fundamentals of Artificial Intelligence (Basingstoke: Springer Nature, 2020), https://link.springer.com/book/10.1007/978-81-322-3972-7.

Exhibit 8: Top Skills by Number of Job Postings (n=2,583)

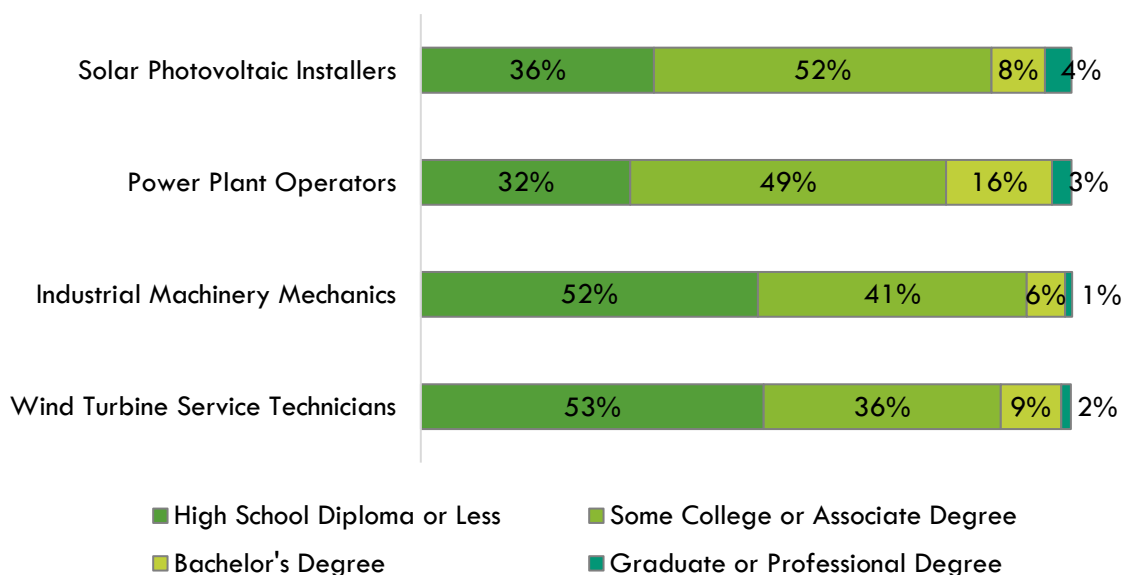| Top Specialized Skills	Top Soft Skills	Top Computer Skills
Machinery (624)	Troubleshooting (Problem Solving) (1,200)	Microsoft Excel (110)
Preventive Maintenance (604)	Communications (583)	Microsoft Office (71)
Hand Tools (555)	Lifting Ability (573)	SAP Applications (70)
Industrial Repair And Maintenance (360)	Operations (557)	Microsoft Outlook (65)
Power Tool Operation (334)	Computer Literacy (389)	Inventory Control Systems (45)
Hydraulics (321)	Customer Service (370)	Microsoft Word (44)
Lock Out / Tag Out (298)	Management (363)	Operating Systems (25)
Corrective Maintenance (296)	Detail Oriented (267)	Microsoft PowerPoint (24)
Plumbing (292)	Problem Solving (264)	Business Software (21)
Facility Repair And Maintenance (289)	Packaging And Labeling (254)	Disassembler (16)

Educational Attainment:

The Bureau of Labor Statistics (BLS) lists a high school diploma or equivalent as the typical entry-level education for *solar photovoltaic installers, industrial machinery mechanics,* and *power plant operators* and a postsecondary nondegree award for *wind turbine service technicians.*

The national-level educational attainment data indicates between 36% and 52% of workers in the field have completed some college or an associate degree as their highest level of education. Exhibit 9 shows the educational attainment for each occupation, sorted by highest community college educational attainment to lowest.

Of the 49% of the cumulative job postings for these renewable energy occupations that listed a minimum education requirement in Los Angeles/Orange County, 93% (1,191) requested a high school diploma or an associate degree and 7% (86) requested a bachelor's, master's, or doctoral degree.

Exhibit 9: National-level Educational Attainment for Occupations

Occupation	High School Diploma or Less	Some College or Associate Degree	Bachelor's Degree	Graduate or Professional Degree
Solar Photovoltaic Installers	36%	52%	8%	4%
Power Plant Operators	32%	49%	16%	3%
Industrial Machinery Mechanics	52%	41%	6%	1%
Wind Turbine Service Technicians	53%	36%	9%	2%

■ High School Diploma or Less ■ Some College or Associate Degree
■ Bachelor's Degree ■ Graduate or Professional Degree

Educational Supply

Community College Supply:

Exhibit 10 shows the three-year average number of awards conferred by community colleges in the related TOP codes: Electronics and Electric Technology (0934.00), Industrial Systems Technology and Maintenance (0945.00), and Energy Systems Technology (0946.10). The colleges with the most completions in the region are: LA Trade and Coastline. Over the past 12 months, there were no other related program recommendation requests from regional community colleges.
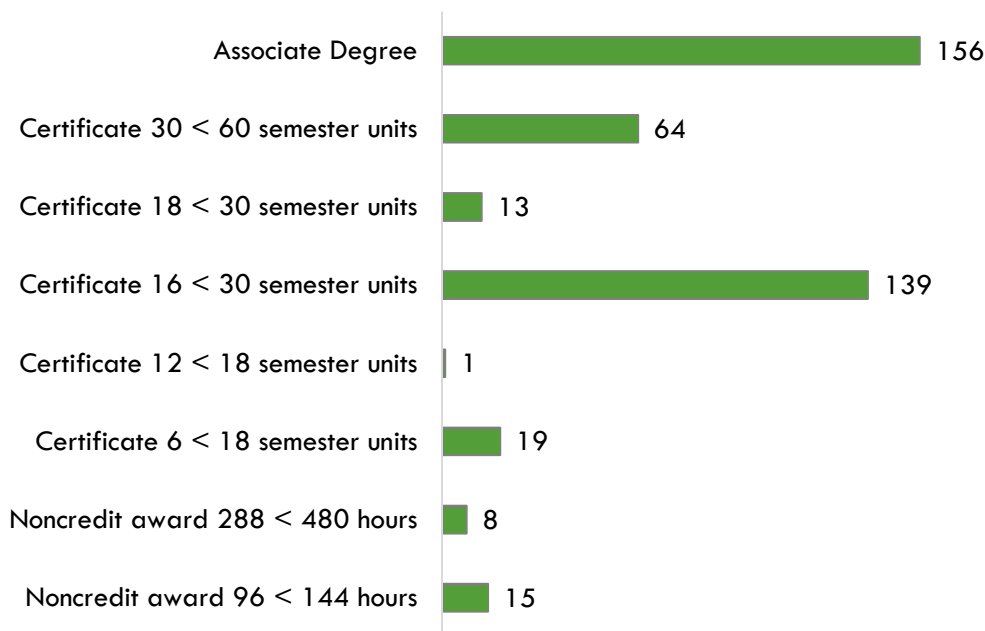
Exhibit 10: Regional Community College Awards (Certificates and Degrees), 2018-2021

TOP Code	Program	College	2018-2019 Awards	2019-2020 Awards	2020-2021 Awards	3-Year Award Average
0934.00	Electronics and Electric Technology	East LA	4	1	2	2
		El Camino	9	8	5	7
		Glendale	1	5	0	2
		LA City	0	4	0	1
		LA Pierce	11	4	17	11
		LA Swest	0	9	0	3
		LA Valley	25	14	21	20
		Long Beach	55	50	42	49
		Mt San Antonio	42	48	39	44
		Pasadena	27	24	23	25
		Rio Hondo	3	0	1	2
		LA Subtotal	**177**	**167**	**150**	**166**
		Coastline	88	58	53	66
		Irvine	17	37	9	21
		Orange Coast	4	12	12	10
		Saddleback	13	14	22	16
		Santa Ana	5	8	0	4
		OC Subtotal	**127**	**129**	**96**	**117**
		Supply Subtotal/Average	**304**	**296**	**246**	**283**
0945.00	Industrial Systems Technology and Maintenance	LA Harbor	1	1	0	1
		LA Swest	0	9	0	3
		LA Trade	90	61	59	70
		West LA	14	20	3	12
		LA Subtotal	**105**	**91**	**62**	**86**
		Santiago Canyon	23	16	2	13
		OC Subtotal	**23**	**16**	**2**	**13**
		Supply Subtotal/Average	**128**	**107**	**64**	**99**
0946.10		LA Trade	11	18	12	14

TOP Code	Program	College	2018-2019 Awards	2019-2020 Awards	2020-2021 Awards	3-Year Award Average
	Energy Systems Technology	Mt San Antonio	4	8	3	5
		Pasadena	3	5	6	5
		Rio Hondo	4	7	1	4
		Santa Monica	10	2	2	5
		LA Subtotal	**32**	**40**	**24**	**33**
		Golden West	1	0	0	0
		OC Subtotal	**1**	**0**	**0**	**0**
	Supply Subtotal/Average		**33**	**40**	**24**	**33**
	Supply Subtotal/Average		**465**	**443**	**334**	**415**

Exhibit 11 shows the annual average community college awards by type from 2018-19 through 2020-21. The majority of the awards are for associate degress, followed by certificates between 16 and less than 30 semester units.

Exhibit 11: Annual Average Community College Awards by Type, 2018-2021

Associate Degree	156
Certificate 30 < 60 semester units	64
Certificate 18 < 30 semester units	13
Certificate 16 < 30 semester units	139
Certificate 12 < 18 semester units	1
Certificate 6 < 18 semester units	19
Noncredit award 288 < 480 hours	8
Noncredit award 96 < 144 hours	15

Community College Student Outcomes:

Exhibit 12 shows the Strong Workforce Program (SWP) metrics for energy systems technology programs in Coast Community College District (CCCD), the Orange County Region, and California. Throughout Orange County, there were 100 students in energy systems technology courses in the 2020-21 academic year. Of those, 80% (80) attended a CCCD college.

CCCD students that exited energy systems technology programs in the 2019-20 academic year had similar median annual earnings ($35,784) compared to all energy systems technology students in Orange County ($35,936). However, both figures are below the living wage.

Exhibit 12: Energy Systems Technology (0946.10) Strong Workforce Program Metrics, 2020-21[3]

SWP Metric	CCCD	OC Region	California
SWP Students	80	100	677
SWP Students Who Earned 9 or More Career Education Units in the District in a Single Year	35%	36%	37%
SWP Students Who Completed a Noncredit CTE or Workforce Preparation Course	Insufficient Data	Insufficient Data	64%
SWP Students Who Earned a Degree or Certificate or Attained Apprenticeship Journey Status	Insufficient Data	Insufficient Data	36
SWP Students Who Transferred to a Four-Year Postsecondary Institution (2019-20)	27	27	39
SWP Students with a Job Closely Related to Their Field of Study (2018-19)	100%	100%	55%
Median Annual Earnings for SWP Exiting Students (2019-20)	$35,784 ($17.20)	$35,936 ($17.28)	$31,826 ($15.30)
Median Change in Earnings for SWP Exiting Students (2019-20)	41%	43%	31%
SWP Exiting Students Who Attained the Living Wage (2019-20)	41%	42%	44%

Non-Community College Supply:

For a comprehensive regional supply analysis, it is also important to consider the supply from other institutions in the region that provide training programs for these renewable energy occupations. Between 2017 and 2020, no related awards were conferred by non-community college institutions.

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[3] All SWP metrics are for 2020-21 unless otherwise noted.
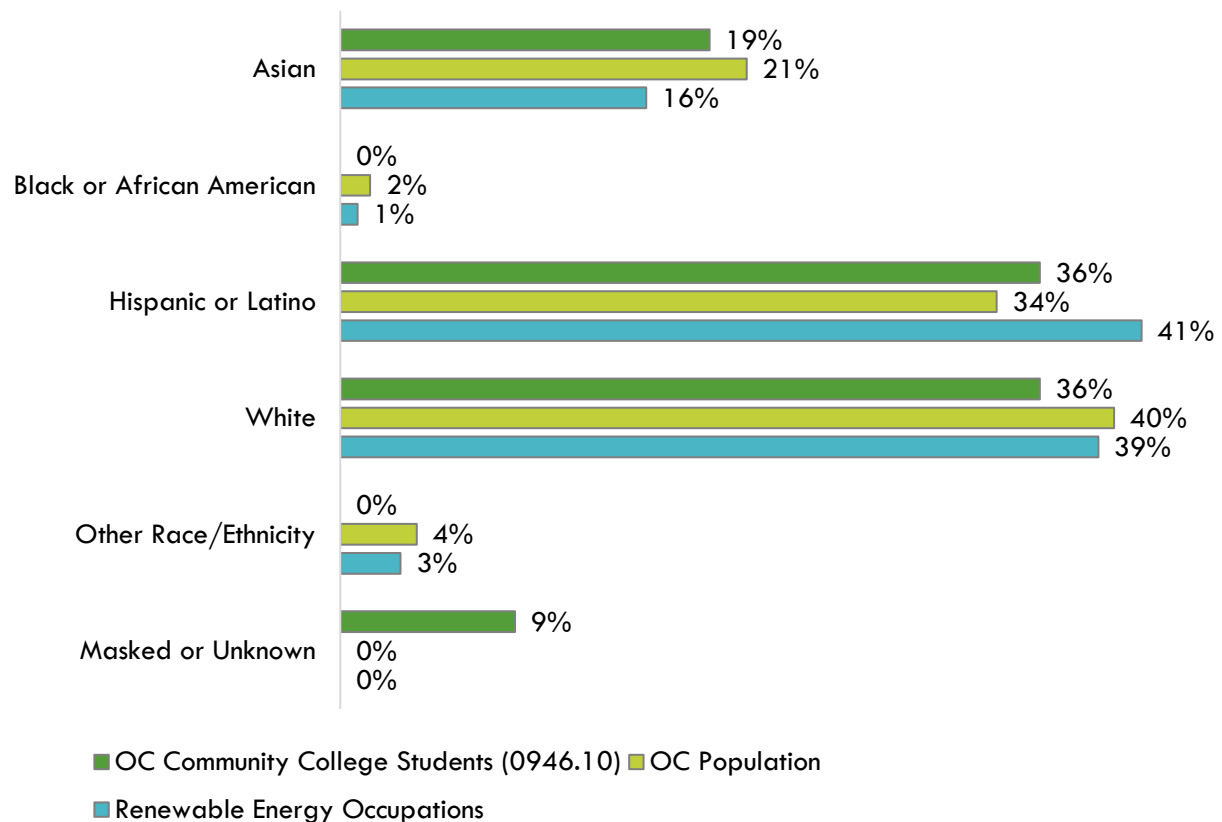
Regional Demographics

This section analyzes demographic data for Orange County community college students enrolled in energy systems technology compared to the OC population, as well occupational data, for the purpose of identifying potential diversity and equity issues that can be addressed by community college programs.

Ethnicity:

Exhibit 14 shows the ethnicity of Orange County community college students enrolled in energy systems technology programs compared to the overall Orange County population, as well as these renewable energy occupations. Notably, the race and ethnicity of energy systems technology students, the Orange County population, and these renewable energy occupations are relatively similar.

Examining disaggregated data by occupation (not shown), 93% of *power plant operators* are white. This occupation also has the highest entry-level wages of all renewable energy occupations analyzed in this report. Additionally, *solar photovoltaic installers* has the highest percentage of Hispanic or Latino workers (73%) and the lowest entry-level wages of the four renewable energy occupations in this report.

Exhibit 14: Program and County Demographics by Ethnicity

Ethnicity	OC Community College Students (0946.10)	OC Population	Renewable Energy Occupations
Asian	19%	21%	16%
Black or African American	0%	2%	1%
Hispanic or Latino	36%	34%	41%
White	36%	40%	39%
Other Race/Ethnicity	0%	4%	3%
Masked or Unknown	9%	0%	0%

■ OC Community College Students (0946.10) ■ OC Population
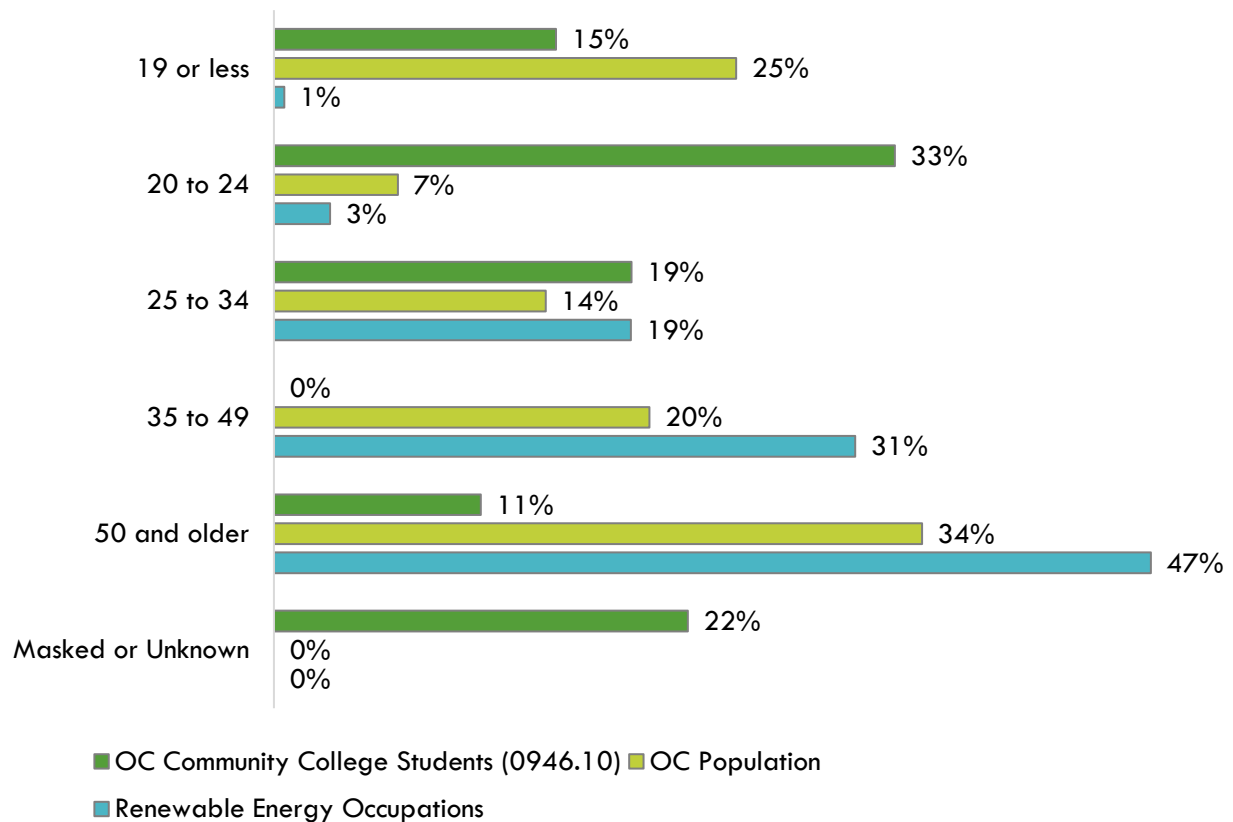■ Renewable Energy Occupations

Age:

Exhibit 14 shows the age of Orange County community college students enrolled in energy systems technology programs compared to the overall Orange County population, as well as these renewable energy occupations. The plurality (47%) of workers in these renewable energy occupations are 50 and older, which is significantly higher than both the population (34%) and community college energy systems technology students (11%). Conversely, 48% of community college energy systems technology students are 24 or less, which is significantly higher than the population (32%), and these renewable energy occupations (4%).

Examining disaggregated data by occupation (not shown), over 60% of *industrial machinery mechanics* and *power plant operators* are 50 and older. These occupations also have the highest entry-level wages of all four occupations analyzed in this report. Conversely, 53% of *solar photovoltaic installers* are 35 or less; this occupations has the lowest entry-level wages of the four occupations analyzed in this report.

Exhibit 14: Program and County Demographics by Age

19 or less
- 15%
- 25%
- 1%

20 to 24
- 33%
- 7%
- 3%

25 to 34
- 19%
- 14%
- 19%

35 to 49
- 0%
- 20%
- 31%

50 and older
- 11%
- 34%
- 47%

Masked or Unknown
- 22%
- 0%
- 0%

Legend:
■ OC Community College Students (0946.10) ■ OC Population
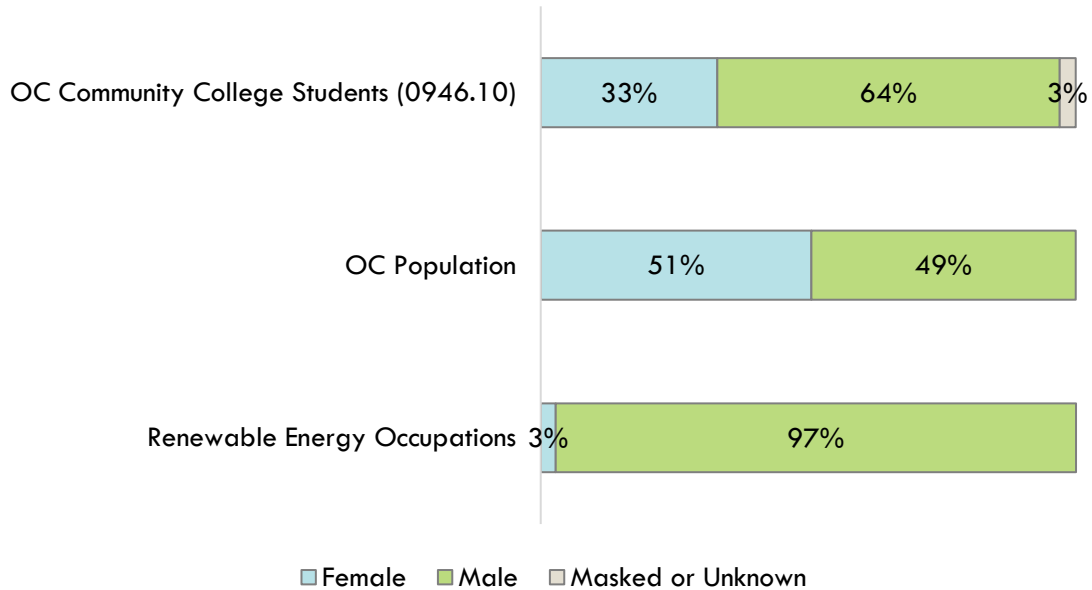■ Renewable Energy Occupations

Sex:

Exhibit 15 shows the sex of Orange County community college students enrolled in energy systems technology programs compared to the overall Orange County population as well as *photographers*.

Though the Orange County population is split nearly evenly between men and women, there is a significantly higher percentage of male community college energy systems technology students (33%) and nearly all workers in these renewable energy occupations are men (97%).

Exhibit 15: Program and County Demographics by Sex

	Female	Male	Masked or Unknown
OC Community College Students (0946.10)	33%	64%	3%
OC Population	51%	49%	
Renewable Energy Occupations	3%	97%	

☐ Female ☐ Male ☐ Masked or Unknown

Appendix A: Methodology

The OC COE prepared this report by analyzing data from occupations and education programs. Occupational data is derived from Lightcast, a labor market analytics firm that consolidates data from the California Employment Development Department (EDD), U.S. Bureau of Labor Statistics (BLS) and other government agencies. Program supply data is drawn from two systems: Taxonomy of Programs (TOP) and Classification of Instructional Programs (CIP).

Using a TOP-SOC crosswalk, the OC COE identified middle-skill jobs for which programs within these TOP codes train. Middle-skill jobs include:

- All occupations that require an educational requirement of some college, associate degree or apprenticeship;
- All occupations that require a bachelor's degree, but also have more than one-third of their existing labor force with an educational attainment of some college or associate degree; or
- All occupations that require a high school diploma or equivalent or no formal education, but also require short- to long-term on-the-job training where multiple community colleges have existing programs.

The OC COE determined labor market supply for an occupation or SOC code by analyzing the number of program completers or awards in a related TOP or CIP code. The COE developed a "supply table" with this information, which is the source of the program supply data for this report. TOP code data comes from the California Community Colleges Chancellor's Office MIS Data Mart (datamart.cccco.edu) and CIP code data comes from the Integrated Postsecondary Education Data System (nces.ed.gov/ipeds/use-the-data), also known as IPEDS. TOP is a system of numerical codes used at the state level to collect and report information on California community college programs and courses throughout the state that have similar outcomes. CIP codes are a taxonomy of academic disciplines at institutions of higher education in the United States and Canada. Institutions outside of the California Community College system do not use TOP codes in their reporting systems.

Data included in this analysis represent the labor market demand for relevant positions most closely related to the proposed program as expressed by the requesting college in consultation with the OC COE. Traditional labor market information was used to show current and projected employment based on data trends, as well as annual average awards granted by regional community colleges. Real-time labor market information captures job post advertisements for occupations relevant to the field of study which can signal demand and show what employers are looking for in potential employees, but is not a perfect measure of the quantity of open positions.

All representations have been produced from primary research and/or secondary review of publicly and/or privately available data and/or research reports. The most recent data available at the time of the analysis was examined; however, data sets are updated regularly and may not be consistent with previous reports. Efforts have been made to qualify and validate the accuracy of the data and findings; however, neither the Centers of Excellence for Labor Market Research (COE), COE host district, nor California Community Colleges Chancellor's Office are responsible for the applications or decisions made by individuals and/or organizations based on this study or its recommendations.

Appendix B: Data Sources

Data Type	Source
Occupational Projections, Wages, and Job Postings	Traditional labor market information data is sourced from Lightcast, a labor market analytics firm. Lightcast occupational employment data are based on final Lightcast industry data and final Lightcast staffing patterns. Wage estimates are based on Occupational Employment Statistics and the American Community Survey. For more information, see https://lightcast.io/
Living Wage	The living wage is derived from the Insight Center's California Family Needs Calculator, which measures the income necessary for an individual of family to afford basic expenses. The data assesses the cost of housing, food, child care, health care, transportation, and taxes. For more information, see: https://insightcced.org/family-needs-calculator/

The living wage for one adult in Orange County is $20.63 per hour ($42,910.40 annually). This figure is used by the CCCCO to calculate the percentage of students that attained the regional living wage. |
| Typical Education and Training Requirements, and Educational Attainment | The Bureau of Labor Statistics (BLS) provides information about education and training requirements for hundreds of occupations. BLS uses a system to assign categories for entry-level education, work experience in a related occupation, and typical on-the-job training to each occupation for which BLS publishes projections data. For more information, see https://www.bls.gov/emp/documentation/education/tech.htm |
| Emerging Occupation Descriptions, Additional Education Requirements, and Employer Preferences | The O*NET database includes information on skills, abilities, knowledges, work activities, and interests associated with occupations. For more information, see https://www.onetonline.org/help/online/ |
| Educational Supply | The CCCCO Data Mart provides information about students, courses, student services, outcomes and faculty and staff. For more information, see: https://datamart.cccco.edu

The National Center for Education Statistics (NCES) Integrated Postsecondary Integrated Data System (IPEDS) collects data on the number of postsecondary awards earned (completions). For more information, see https://nces.ed.gov/ipeds/use-the-data/survey-components/7/completions |
| Student Metrics and Demographics | LaunchBoard, a statewide data system supported by the California Community Colleges Chancellor's Office and hosted by Cal-PASS Plus, provides data on progress, success, employment, and earnings outcomes for California community college students. For more information, see: https://www.calpassplus.org/LaunchBoard/Home.aspx |

Data Type	Source
Population and Occupation Demographics	The Census Bureau's American Community Survey (ACS) is the premier source for detailed population and housing information. For more information, see: https://www.census.gov/programs-surveys/acs Data is sourced from IPUMS USA, a database providing access to ACS and other Census Bureau data products. For more information, see: https://usa.ipums.org/usa/about.shtml

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