ENERGY, CONSTRUCTION, & UTILITIES

Orange County Sector Analysis Project

Nov 2021

Prepared by:
Orange County Center of Excellence
for Labor Market Research

POWERED BY
California Community Colleges

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ENERGY, CONSTRUCTION, AND UTILITIES
Demand and Supply Analysis: Orange County 2021

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2021 ORANGE COUNTY SECTOR ANALYSIS PROJECT DATA REFRESH

The Orange County Sector Analysis Project was originally completed in 2019. In addition to the normal annual refresh of labor market information, the COVID-19 pandemic and subsequent economic recession occurred after the first publication. Furthermore, since 2019, the Bureau of Labor Statistics (BLS) updated the Standard Occupational Classification (SOC) system, which resulted in the removal, modification, or addition of occupations and their definitions. The Integrated Postsecondary Data Education System (IPEDS) also updated the Classification of Instructional Programs (CIP) classification system, which removed, modified, or added new CIP codes. The changes in these federal data systems required the Centers of Excellence to create an updated TOP-CIP-SOC crosswalk and determine skill classifications for new SOC codes. Moreover, the living wage for a single adult in Orange County increased from $17.39 per hour to $20.63 per hour.

To address these changes, and to provide the most recent labor market data available, the Orange County Center of Excellence for Labor Market Research (COE) pulled and analyzed current labor market information in November 2021 and applied the same methodology that was used in 2019 to update the data included in this brief. Due to these updates, three occupations from the 2019 report are no longer included in this updated brief. There are three new occupations in this brief that were not included in the 2019 version. The occupations that were removed, changed, or added, as well as detailed explanations of these differences for each occupation, are summarized in Appendix B.

INTRODUCTION

This sector brief is a product of the Orange County Sector Analysis Project. It provides information about the Energy, Construction, and Utilities sector in Orange County, one of Orange County's six priority sectors; it compares labor market demand with educational program supply for middle-skill jobs and provides qualitative information from experts in the field. Orange County community colleges could use the information in this report for strategic planning and discussions about program development, career pathways work, sector strategies, noncredit-to-credit pipelines, apprenticeship programs, and work-based learning opportunities.

All of the Orange County Sector Analysis Project briefs began with quantitative labor market demand and supply analysis; however, they also include qualitative information derived from the project's focus group discussions. Between July and August 2019, the COE hosted a total of 12 sector-specific focus groups with regional stakeholders, including faculty and deans, as well as regional and state directors for employer engagement. Two of these focus groups were specific to the Energy, Construction, and Utilities sector. The objectives of the focus groups were to identify labor market supply gaps (supply gaps) in middle-skill jobs; understand where programs exist or do not exist to fill in the supply gaps; and discuss how Orange County's community colleges could close the supply gaps. Focus group participants reviewed the demand and supply analysis prior to meeting and provided intelligence regarding how they are working to close supply gaps as well as the challenges they encounter in their programs; this valuable information could not be captured via traditional labor market research methods. The COE recorded then analyzed these discussions which resulted in the "Focus Group Insights" sections throughout this brief, supplementing traditional, quantitative labor market data with important, qualitative information.

Middle-Skill Jobs and Living Wage Introduction

In this brief, 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.

In this brief, top middle-skill jobs are defined as jobs that have both the most labor market demand (annual job openings) and entry-level wages at or above the California Family Needs Calculator[1] (commonly known as a "living wage"). The living wage is the hourly wage that a single adult needs to earn in order to meet basic needs in Orange County, and is currently $20.63 per

[1] https://insightcced.org/family-needs-calculator/

hour. The living wage is defined by the California Family Needs Calculator, which calculates the income necessary to cover costs including housing, food, transportation, health care, and other basic necessities.

Entry-level wage is defined as the 25th percentile hourly wage, which means that 25% of all workers in that occupation earn equal to or below this amount. Percentile wages represent the distribution of wages for each occupation. Generally, workers with minimal education and experience can expect to earn wages near the 10th percentile. With the additional education and training students receive in community college programs, they are more likely to earn wages at the 25th percentile, rather than the 10th percentile. Generally, with even more education and experience, students could expect to progress and earn the median wage, which is defined as the 50th percentile hourly wage.

Demand Introduction

For the purpose of this report, labor market demand is determined by the number of annual job openings employers expect to fill due to job growth and employee turnover between 2020 and 2025. Job growth is when an employer experiences increased demand for products and hires new employees to increase production, while employee turnover is when an employer hires replacement workers for employees who leave the workforce or change occupations.

Supply Introduction

Supply is determined by the average annual number of related awards (e.g., certificates, degrees) generated between 2017 and 2020 by the region's community colleges and other educational institutions (e.g., private providers) for the purpose of this report. However, it should be noted that a student may earn more than one award; therefore, supply may be overestimated for certain occupations.

Whether or not there is a supply gap is determined by the difference between the demand and supply. The methodology regarding how these numbers are calculated is described in Appendix A.

FOCUS GROUP INSIGHTS

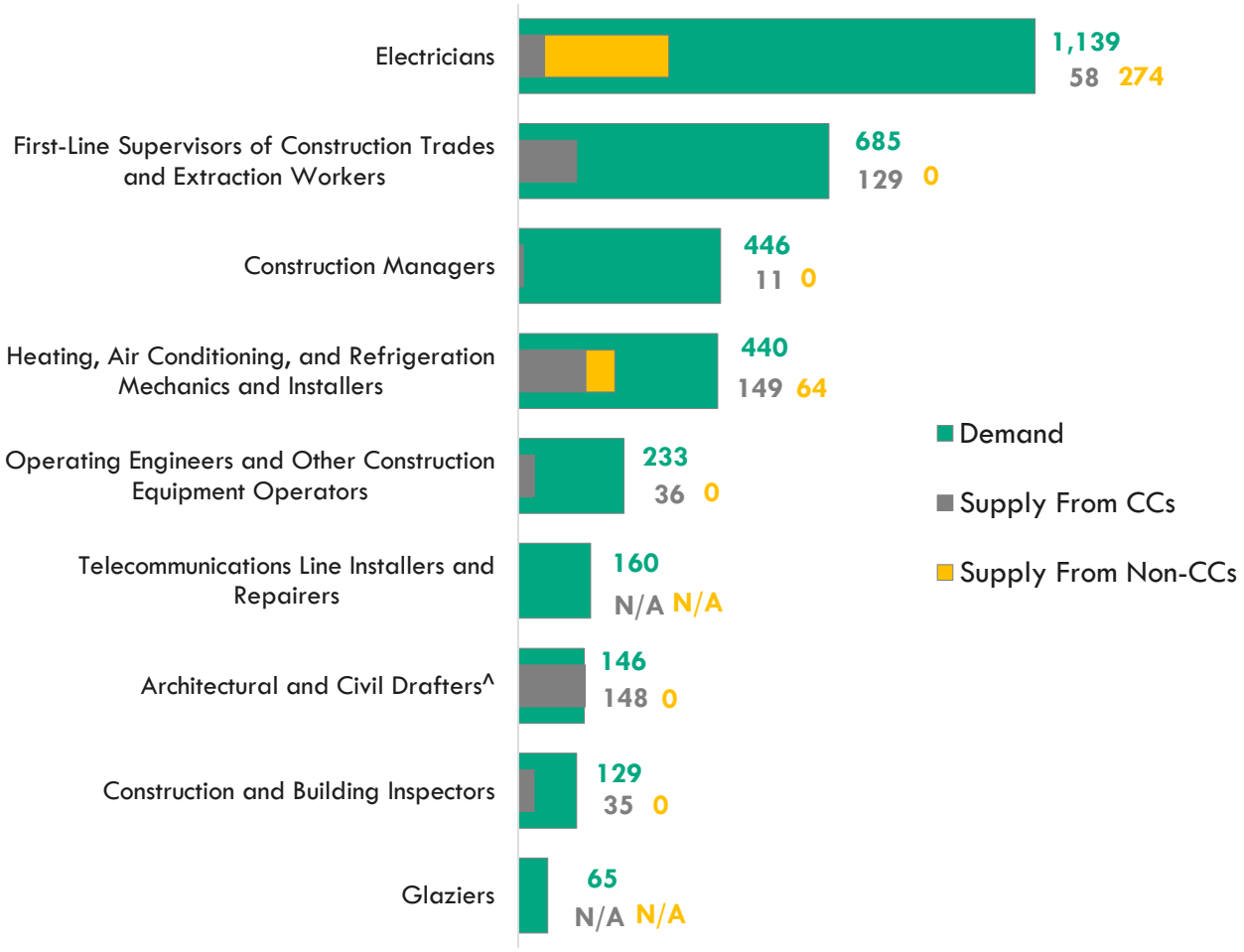
The Energy, Construction, and Utilities sector was split into two focus groups that were held on different days and included a total of two faculty members and two administrators from 10 institutions – five of the nine community colleges, and one noncredit school – that offered Energy, Construction, and Utilities programs in Orange County between 2015 and 2017. Both the Statewide and Regional Director for Employer Engagement Team also attended one of the two focus groups.

Focus group participants identified several data limitations, challenges in expanding programs, and other issues that were common across multiple sectors. The cross-sector, common themes are expanded on and explained in further detail in the standalone Orange County Sector Analysis Project Executive Summary report. Focus group participants also reported on limitations and challenges that were unique to the Energy, Construction, and Utilities sector. This sector-specific information is highlighted throughout this report in the Focus Group Insights and the Focus Group Insights – The Big Picture sections.

ENERGY, CONSTRUCTION, AND UTILITIES TOP MIDDLE-SKILL JOBS

This section compares Orange County's labor market demand for the top middle-skill jobs in Energy, Construction, and Utilities with program supply from the region's community colleges and non-community college providers (Exhibit 1). As seen in Exhibit 2, the entry-level wages[2] for these top middle-skill jobs are higher than the $20.63 per hour living wage. Descriptions for each occupational title can be found in Appendix C. Detailed supply and demand data analyzed for each occupation, including supply numbers by institutions is included in Appendix D.

Exhibit 1: Energy, Construction, and Utilities Top Middle-Skill Jobs in Orange County: Labor Market Demand vs. Program Supply



*(Please note: * indicates that the occupation has an oversupply of labor, ^ indicates that demand has been met, and N/A indicates that no community college program reported awards for this occupation or no community college program is available for this occupation.)*

[2] In this report, entry-level wage is defined as the 25th percentile hourly wage, which means that 25% of all workers in the field earn equal to or below this amount. Generally, workers with less experience earn lower wages.

FOCUS GROUP INSIGHTS

Missing TOP Codes, Occupations, and Cross-Sector Programs

Focus group participants pointed out that at least two programs, Electronics and Electric Technology (TOP code 0934.00) and Industrial Electronics (TOP code 0934.20) were not included in this sector brief. Because the California Community Colleges Chancellor's Office (CCCCO) only allows TOP codes to be assigned to one sector and they have determined that these programs, and occupations related to those programs, belong to the Advanced Manufacturing sector they are not included in this sector brief and are instead analyzed in their assigned sector's brief. Focus group participants acknowledged this shortcoming and pointed out that sectors, particularly Energy, Construction, and Utilities and Advanced Manufacturing, are being blended together as technology evolves. Though programs are assigned to sectors, the skills taught in these programs could transfer to several sectors and make students more attractive to employers.

> *"Technologies are being used in all sectors and are blending sectors together…what used to be Advanced Manufacturing has turned more into construction and utilities, which has elements of factory work because of the integration of technology."*
> *– Saddleback College Administrator*

All focus group participants agreed that there are several problems with the TOP code system. The Statewide Director for Employer Engagement said that skill sets, competencies, and student learning outcomes (SLOs), do not always align with the available TOP codes. Faculty members and administrators also pointed out that there is no TOP code for automation, so it is not possible to capture a full picture of supply from programs related to automation.

Additionally, one faculty member pointed out that the Water and Wastewater Treatment Plant and System Operators (SOC Code 51-8031) occupation was not included in the supply and demand analysis. Because this occupation had less than 50 annual job openings, it did not meet the threshold to be included, as defined in the methodology in Appendix A.

Local Low-Unit Certificates

Focus group participants felt that supply data from traditional labor market information is limited; it does not capture locally issued low-unit certificates that are not reported to, or approved by, the CCCCO. According to focus group participants, Energy, Construction, and Utilities programs attract industry professionals who are interested in upskilling or learning new skills for their current jobs. However, the supply data does not capture students that take a small number of courses to gain additional skills. If colleges do not report data for low-unit certificate programs. This could result in an under-reporting of the supply number.

Exhibit 2. Energy, Construction, and Utilities Top Middle-Skill Jobs in Orange County: Entry-Level and Median Wages

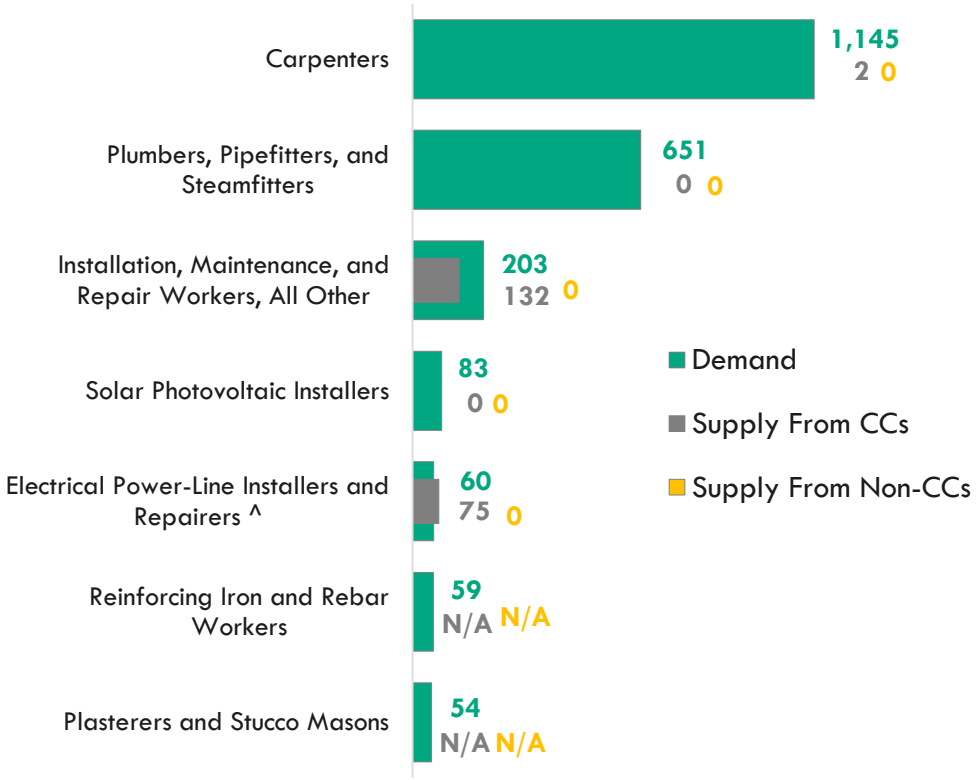
SOC Code	SOC (Occupational) Title	Demand (Annual Openings)	Entry-Level Wage (25th Percentile)	Median Wage
47-2111	Electricians	1,139	$25.09	$35.51
47-1011	First-Line Supervisors of Construction Trades and Extraction Workers	685	$30.37	$39.96
11-9021	Construction Managers	446	$32.27	$48.40
49-9021	Heating, Air Conditioning, and Refrigeration Mechanics and Installers	440	$23.97	$31.47
47-2073	Operating Engineers and Other Construction Equipment Operators	233	$30.60	$42.46
49-9052	Telecommunications Line Installers and Repairers	160	$21.38	$29.80
17-3011	Architectural and Civil Drafters	146	$26.74	$30.97
47-4011	Construction and Building Inspectors	129	$32.06	$43.76
47-2121	Glaziers	65	$22.22	$28.98

ENERGY, CONSTRUCTION, AND UTILITIES MIDDLE-SKILL JOBS WITH ENTRY-LEVEL WAGES BELOW CALIFORNIA FAMILY NEEDS CALCULATOR

While it is important to understand which top middle-skill jobs have opportunities for increased program supply, it is also important to consider middle-skill occupations that have entry-level wages below the California Family Needs Calculator, but median wages above it. Since wages generally increase with additional experience and training, students could potentially earn self-sustaining wages with additional apprenticeship or work-based learning opportunities.

As seen in Exhibit 3, middle-skill Energy, Construction, and Utilities jobs with entry-level wages below the California Family Needs Calculator have a significant number of annual job openings (labor market demand). While these occupations have entry-level wages below the California Family Needs Calculator of $20.63 per hour, all middle-skill occupations except for Reinforcing Iron and Rebar Workers have median wages higher than the regional living wage as denoted via the gray shading in Exhibit 4.

Exhibit 3: Energy, Construction, and Utilities Middle-Skill Jobs in Orange County with Entry-Level Wages Below the Regional Living Wage



*(Please note: * indicates that the occupation has an oversupply of labor, ^ indicates that this occupation's demand has been met, and N/A indicates that no community college program reported awards for this occupation or no community college program is available for this occupation.)*

Exhibit 4. Energy, Construction, and Utilities Middle-Skill Jobs with Entry-Level Earnings Below the California Family Needs Calculator in Orange County: Entry-Level and Median Wages

SOC Code	SOC (Occupational) Title	Demand (Annual Openings)	Entry-Level Wage (25th Percentile)	Median Wage
47-2031	Carpenters	1,145	$19.54	$29.01
47-2152	Plumbers, Pipefitters, and Steamfitters	651	$18.71	$28.32
49-9099	Installation, Maintenance, and Repair Workers, All Other	203	$16.16	$21.19
47-2231	Solar Photovoltaic Installers	83	$19.54	$23.69
49-9051	Electrical Power-Line Installers and Repairers	60	$17.18	$37.16
47-2171	Reinforcing Iron and Rebar Workers	59	$14.43	$16.83
47-2161	Plasterers and Stucco Masons	54	$20.37	$24.47

FOCUS GROUP INSIGHTS

Low Completion Numbers

According to the demand and supply exhibits in this brief, the community colleges in Orange County are undersupplying for both top middle-skill jobs and jobs that have entry-level wages below the regional living wage, but median wages above the regional living wage. According to the CCCCO's dashboard tool, LaunchBoard[3], 8,327 (unduplicated) students took one or more courses in Energy, Construction, and Utilities programs in the 2019-20 program year in Orange County. However, in that same year, only 324 students earned a certificate or degree. Focus group participants explained that several students enroll in one or two courses to gain a skill, but do not complete the program. Some reasons that students do not complete the program is because they are "skills-builders" that have gained specific skills and do not need a degree or certificate to find employment, are currently working and go back to their current job after gaining skills, or because employers are hiring at a fast pace and it is easy for students to find a job. One faculty member suggested that, if students do not need to complete an existing full certificate to gain employment, some programs could be truncated to help improve completion and/or moved to noncredit.

> *"Right now, any CTE program is on the table to go to noncredit."*
> *– Saddleback College Administrator*

Faculty members noted that it is difficult to track these students after they leave. Additionally, faculty members said that colleges generally do not have good metrics on non-completers. Colleges could consider using the CTE Outcomes Survey (CTEOS) to help track outcomes for non-completers and skills-builders.

Noncredit Programs

Faculty and administrators said that low completion numbers could also be because noncredit awards are not being consistently reported for all Orange County colleges. If colleges are not reporting their noncredit awards, data for noncredit programs will not be included in Data Mart, LaunchBoard, or the COE's supply table. One administrator noted that the dollar per career development/college preparatory (CDCP) FTES for noncredit has increased and is now the same as it is for credit, so it is particularly important for colleges to look into their noncredit data and make sure it is being reported correctly.

[3] calpassplus.org/Launchboard/Community-College-Pipeline.aspx

FOCUS GROUP INSIGHTS – THE BIG PICTURE

Focus group participants addressed other issues and challenges that cannot be captured by traditional labor market information and provided insight on the tactics colleges and employers are currently using to address supply gaps in the Energy, Construction, and Utilities sector.

How Employers are Filling Supply Gaps

According to focus group participants, employers are primarily relying on apprenticeships and poaching from other companies to fill supply gaps. Companies are also adding additional workload to their current workforce in order to meet production goals. Faculty members also noted that companies sometimes attend college career fairs or will reach out directly to colleges to find workers.

> *"We're hearing that employers are having a hard time filling positions. [Employers say] A lot of times it's just a situation of 'post and pray.'"*
>
> *– Statewide Director for Employer Engagement*

Creative Ways Community Colleges are Offering Programs

Focus group participants discussed several creative ways they are offering programs and some of the challenges they face when developing new ways to offer programs:

- The Regional Director for Employer Engagement and faculty noted that compressed schedules for eight weeks or during the four-week intersession work well for students.
- Fullerton College has created articulation agreements with the K-12 system within the North Orange County Community College District so that high school academy students can earn college units while in high school. It may be of interest to note that according to LaunchBoard. The Energy, Construction, and Utilities sector has the lowest percentage of students that are age 19 or younger (12%) across all priority and emerging sectors in Orange County. These efforts could help increase the number of young students taking courses in this sector.
- The Regional Director for Employer Engagement has been working with six community colleges throughout Orange County to create a collaborative Industrial Automation program. Articulation agreements will be developed so students will be able to take a sequence of core courses at any participating college in the region, then take specialty courses at another college, if they desire.
- One faculty member said that they are exploring simulations as an alternative to expensive training equipment. However, focus group participants agreed that there is no consensus from employers on whether or not simulation is an adequate form of training.

Challenges in Expanding Programs

Focus group participants identified several challenges to expanding programs in the Energy, Construction, and Utilities sector. Many of these challenges, including the lack of dedicated lab space, difficulty hiring faculty and staff, and high costs for equipment, cut across all sectors. However, a unique challenge for this sector is the difficulty in finding Heating, Ventilation, and Air Conditioning (HVAC) faculty members as well recruiting faculty that have sector-specific required industry certifications or credentials. One administrator noted that they are having difficulty finding construction safety instructors because candidates do not have OSHA 30 certification.

KEY FINDINGS: ENERGY, CONSTRUCTION, AND UTILITIES

Based on the demand and supply data, as well as the focus group insights analyzed in this brief, the COE identified the following key research findings and recommendations:

Demand and Supply

5,698	1,113	4,585
annual job openings (labor market demand)	average annual program awards (labor market supply)	supply gap (number of awards needed to close the gap)

Focus Group Key Findings and Recommendations

Key Finding	Recommendation
1. **Energy, Construction, and Utilities skills are transferable and not necessarily exclusive to a particular occupation:** Skills taught in Energy, Construction, and Utilities courses and programs are transferable to other sectors such as Advanced Manufacturing. Technology is blending these two sectors together and students can become employable in either sector with the right knowledge, skills, and abilities.	1. Faculty and the Regional Employer Engagement Team in Energy, Construction, and Utilities and Advanced Manufacturing could work with each other to develop cross-sector training programs that provides students with a diverse skill set that can be applied towards occupations in both sectors.
2. **Thousands of students take Energy, Construction, and Utilities courses, but few complete a degree or certificate. Tracking outcomes for non-completers is difficult:** In the 2019-2020 academic year, 8,327 students took at least one Energy, Construction, and Utilities course, but only 567 students completed a degree or certificate. Several students enroll in one or two courses to gain a skill, but do not complete the program. Some reasons that students do not complete the program is because they are "skills-builders" that have gained specific skills and do not need a degree or certificate to find employment, are currently working and go back to their current job after gaining skills, or because employers are hiring at a fast pace and it is easy for students to find a job.	2. To increase completion numbers in Energy, Construction, and Utilities programs, faculty, deans, and the Regional Employer Engagement Team should review program curriculum and identify programs that may be overdesigned. These are programs that offer more courses than what may be needed in the labor market, creating long-term programs that could actually be shortened by offering fewer courses/credits yet still prepare students for companies' needs. In order to track outcomes for students that do not complete programs, colleges should consider using the CTE Outcomes Survey (CTEOS) to better understand why students do not complete programs, their employment status, and their change in earnings after taking community college courses.

Key Finding	Recommendation
3. **Noncredit awards for Energy, Construction, and Utilities programs are not consistently reported:** One of the reasons for low completion numbers could be a result of inconsistent noncredit program reporting. If colleges ae not reporting their noncredit awards, data for these programs will not be included in the supply numbers or be counted in the Strong Workforce Program (SWP) metrics. Additionally, enhanced noncredit has been increased and is now funded the same as it is for credit, so it is particularly important for colleges to look into their noncredit data and make sure it is being reported correctly.	3. To better understand noncredit reporting, faculty and administrators could work with their Institutional Effectiveness/Research offices to see how noncredit information is collected locally and reported to the CCCCO. More accurate reporting could increase both the sector metrics and the amount of funding colleges receive while also helping the COE more accurately measure supply for each occupation.
4. **Across all priority and emerging sectors, this sector has the lowest percentage of students that are age 19 or younger:** Only 12% of students enrolled in Energy, Construction, and Utilities are recent high school graduates.	4. Colleges could explore partnerships with the K-12 system and targeted marketing efforts to attract younger students to enroll in programs that will train them for in-demand, high wage jobs. Dual enrollment agreements would allow high school students to earn college credit and help colleges create a K-12-to-community college-pipeline.
5. **Knowledge, Skills, and Abilities (KSAs) for the sector have not been validated by employers:** The OC Sector Analysis Project brief examines job gaps but does not explore the specific KSAs taught at the colleges and compare them to the labor market's demand for Energy, Construction, and Utilities KSAs.	5. To determine if the region's community colleges are training for the right KSAs, the Regional Employer Engagement Team should convene employers in a "regional advisory group" where employers can review program KSAs, provide feedback, and validate the KSAs' current relevance and demand in the labor market.

APPENDIX A: METHODOLOGY AND ENERGY, CONSTRUCTION, AND UTILITIES DATA DEFINITIONS

The Centers of Excellence for Labor Market Research (COE) prepared this report by analyzing data from occupations and education programs. Occupational data is derived from Emsi, a software program 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).

The California Community Colleges (CCC) define "sectors" by TOP codes. To determine what occupations should be analyzed in this brief, the COE first reviewed the TOP codes associated with the sector and then matched them with the SOC codes. According to the CCC, the following six-digit TOP codes define the Energy, Construction, and Utilities sector:

TOP6 Program Name	TOP6 Code
Architectural Drafting	0953.10
Architecture and Architectural Technology	0201.00
Carpentry	0952.10
Civil and Construction Management Technology	0957.00
Civil Drafting	0953.20
Construction Crafts Technology	0952.00
Construction Inspection	0957.20
Drafting Technology	0953.00
Drywall and Insulation	0952.80
Electrical	0952.20
Electrical Systems and Power Transmission	0934.40
Electro-Mechanical Technology	0935.00
Energy Systems Technology	0946.10
Environmental Control Technology	0946.00
Glazing	0952.40
Masonry, Tile, Cement, Lath and Plaster	0952.60
Mill and Cabinet Work	0952.50
Other Architecture and Environmental Design	0299.00
Painting, Decorating, and Flooring	0952.70
Plumbing, Pipefitting and Steamfitting	0952.30
Public Works	2102.10
Roofing	0952.90
Sheet Metal and Structural Metal	0956.40
Water and Wastewater Technology	0958.00

Using a TOP-SOC crosswalk, the COE then identified middle-skill jobs for which programs within these TOP codes train. The COE examined more than 850 occupational codes from the Standard Occupational Classification (SOC)[4] system and identified approximately 300 occupational codes as middle-skill jobs.

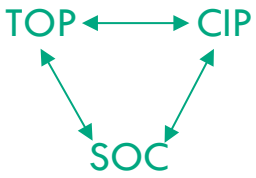
Middle-skill jobs include:

- 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.

For this study, the COE analyzed occupations with a labor market demand of at least 50 annual job openings. (For comparison, the average and median demand for an occupation in Orange County is 307 and 63 annual job openings, respectively.)[5] The number of annual job openings estimates employment change and turnover for an occupation each year between 2018 and 2023. Annual job openings include:

- Job Growth: An employer experiences increased demand for products and hires new employees to increase production. If job growth is zero or negative, then any and all openings are due to replacement needs.
- Replacement Needs: An employer hires replacement workers for employees who leave the workforce or change occupations. Replacement rates are derived from national 10-year, occupation-specific percentages published by the U.S. BLS's Employment Projections program.

The COE then cross-referenced the SOC codes with CIP and TOP codes to compare labor market demand with program supply. The following diagram illustrates this process:



The 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 data comes from the California Community Colleges Chancellor's Office (CCCCO) MIS Data Mart (datamart.cccco.edu) and CIP 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.

Because a TOP/CIP code may train for more than one occupation, simply aggregating all supply from all related codes may overestimate supply for an occupation. Therefore, the COE de-duplicated TOP codes that trained for more than one occupation to avoid counting the program supply more than once. Doing so provides a more accurate representation of the supply gaps in the region by occupation. This information can be seen in the demand and supply tables in Appendix C of this study.

[4] SOC is a federal statistical standard used by EDD, BLS and other federal agencies to classify workers into occupational categories for the purpose of collecting, calculating, or disseminating data.
[5] Emsi. Data set 2021.3. QCEW Employees + Non-QCEW + Self-Employed. 2020-2025.

Qualitative Methodology

An integral aspect of the Orange County Sector Analysis Project was the qualitative data collected during the project's focus groups. In May 2019, the COE created an advisory group comprised of the Orange County Regional Consortium Director as well as five CTE deans and directors that represented the four community college districts in Orange County. The advisory group created a process and timeline for inviting faculty and administrators to participate in focus groups to better understand where programs exist or do not exist to fill supply gaps and discuss how Orange County's community colleges could close the supply gaps for the county's eight priority and emerging sectors.

To create the invite list of faculty and administrators, Employer Engagement Team and career education deans at each college were asked to identify faculty and administrators that could represent their respective colleges in the sector-specific focus groups. Once this list was compiled, the career education deans invited faculty and administrators to express their interest in participating in a focus group via email. The email introduced the COE, provided an overview of the Orange County Sector Analysis Project, described the goals of the focus groups, and informed faculty that they would be compensated for their participation, and that lunch would be provided for all participants. All those that stated their interest were then connected with the COE who managed the focus groups scheduling and details.

In order to be as inclusive as possible, 12 focus groups were scheduled for the eight sectors – four sectors had one focus group each and four sectors had two focus groups each, during a three-week period from July to August 2019. All focus groups participants received a confirmation email before the event that included the focus group agenda, their sector-specific draft brief, and a pre-assignment with questions based off of the information contained in the draft sector briefs. Focus group participants were instructed to complete and bring the pre-assignment to the convening so that they were prepared to discuss the data, the challenges they face in their programs, and strategies to close supply gaps. Each focus group was recorded, with permission of the participants, by the COE solely for transcription purposes.

The COE conducted no more than two focus group sessions per day. During the focus groups the Orange County Sector Analysis Project was explained and then the information contained in the draft sector briefs was presented in detail. Participants were encouraged to ask questions and engage in dialogue throughout the entire focus group session. The COE took notes of each discussion as well as recorded the sessions, with permission of the participants and solely for transcription purposes.

Following the conclusion of the focus groups, the COE compiled the audio files, transcripts, notes, and pre-assignments to conduct a qualitative analysis of the themes for each focus group and to identify commonalities across multiple focus groups. The findings from this analysis have been highlighted throughout this report in the "Focus Group Insight" sections.

APPENDIX B: OCCUPATIONAL DIFFERENCES BETWEEN 2019 AND 2021 VERSIONS

Removed Occupations

The following occupations were included in the 2019 version of this brief but were not included in the 2021 version because they were not projected to have at least 50 annual job openings between 2020 and 2025, were assigned to a different sector in 2019, or were classified as below or above middle-skill in 2021:

- Stonemasons (47-2022)
- Insulation Workers, Mechanical (47-2132)
- Brickmasons and Blockmasons (47-2021)

New Occupations

There were not any occupations from the 2019 version of this brief for which BLS assigned a new or modified SOC code.

New Occupations

The following occupations were included in the 2019 version of this brief but were not included in the 2021 version because they were not projected to have at least 50 annual job openings between 2020 and 2025:

- Plasterers and Stucco Masons (47-2161)
- Electrical Power-Line Installers and Repairers (49-9051)
- Installation, Maintenance, and Repair Workers, All Other (49-9099)

APPENDIX C: DEFINITIONS FOR ENERGY, CONSTRUCTION, AND UTILITIES MIDDLE-SKILL JOBS

The following definitions and sample job titles for each occupation are derived from O*NET, the nation's primary source of occupational information. The O*NET database contains hundreds of standardized and occupation-specific descriptors on nearly 1,000 occupations. O*NET is developed and sponsored by the U.S. Department of Labor[6]

Architectural and Civil Drafters (SOC 17-3011): Prepare detailed drawings of architectural and structural features of buildings or drawings and topographical relief maps used in civil engineering projects, such as highways, bridges, and public works. Use knowledge of building materials, engineering practices, and mathematics to complete drawings. Sample job titles include:

- Architectural Technician
- Intern Architect
- Drafting Technician
- Computer-Aided Drafting and Design Operator

Carpenters (SOC 47-2031): Construct, erect, install, or repair structures and fixtures made of wood, such as concrete forms; building frameworks, including partitions, joists, studding, and rafters; and wood stairways, window and door frames, and hardwood floors. May also install cabinets, siding, drywall and batt or roll insulation. Includes brattice builders who build doors or brattices (ventilation walls or partitions) in underground passageways. Sample job titles include:

- Framer
- Production Worker
- Construction Worker
- Bridge Carpenter
- Form Carpenter
- Rough Carpenter

Construction and Building Inspectors (SOC 47-4011): Inspect structures using engineering skills to determine structural soundness and compliance with specifications, building codes, and other regulations. Inspections may be general in nature or may be limited to a specific area, such as electrical systems or plumbing. Sample job titles include:

- Plumbing Inspector
- Home Inspector
- Elevator Inspector
- Construction Inspector
- Building Inspector
- Construction Materials Testing Technician

Construction Managers (SOC 11-9021): Plan, direct, or coordinate, usually through subordinate supervisory personnel, activities concerned with the construction and maintenance of structures, facilities, and systems. Participate in the conceptual development of a construction project and oversee its organization, scheduling, budgeting, and implementation. Includes managers in specialized construction fields, such as carpentry or plumbing. Sample job titles include:

- Construction Superintendent
- General Contractor
- Construction Area Manager
- Senior Site Manager
- Project Superintendent
- Construction Foreman

Electricians (SOC 47-2111): Install, maintain, and repair electrical wiring, equipment, and fixtures. Ensure that work is in accordance with relevant codes. May install or service street lights, intercom systems, or electrical control systems. Sample job titles include:

- Maintenance Electrician
- Industrial Electrician
- Control Electrician
- Qualified Craft Worker, Electrician
- Mechanical Trades Specialist, Electrician
- Inside Wireman

[6] https://www.onetonline.org/

Electrical Power-Line Installers and Repairers (SOC 49-5051): Install or repair cables or wires used in electrical power or distribution systems. May erect poles and light or heavy duty transmission towers. Sample job titles include:

- Class Gloving Electrical Lineman
- Class Rubber Gloving Lineman
- Electrical Lineman
- Electrical Lineworker
- Power Lineman
- Third Step Lineman

First-Line Supervisors of Construction Trades and Extraction Workers (SOC 47-1011): Directly supervise and coordinate activities of construction or extraction workers. Sample job title includes:

- Construction Supervisor
- Field Supervisor
- Working Supervisor
- Welding Foreman
- Solar Installation Manager
- Residential Field Manager

Glaziers (SOC 47-2121): Install glass in windows, skylights, store fronts, and display cases, or on surfaces, such as building fronts, interior walls, ceilings, and tabletops. Sample job titles include:

- Glass Installer
- Commercial Glazier
- Glass Technician
- Automobile Glass Technician

Heating, Air Conditioning, and Refrigeration Mechanics and Installers (SOC 49-9021): Install or repair heating, central air conditioning, or refrigeration systems, including oil burners, hot-air furnaces, and heating stoves. Sample job titles include:

- Refrigeration Mechanic
- Systems Mechanic
- Service Technician
- Maintenance Mechanic
- Refrigeration Technician
- Transportation Refrigeration Technician

Installation, Maintenance, and Repair Workers, All Other (SOC 49-9099): All installation, maintenance, and repair workers not listed separately. No sample job titles are available for this occupation. "All Other" titles represent occupations with a wide range of characteristics which do not fit into one of the detailed O*NET-SOC occupations. O*NET data is not available for this type of title.

Operating Engineers and Other Construction Equipment Operators (SOC 47-2073): Operate one or several types of power construction equipment, such as motor graders, bulldozers, scrapers, compressors, pumps, derricks, shovels, tractors, or front-end loaders to excavate, move, and grade earth, erect structures, or pour concrete or other hard surface pavement. May repair and maintain equipment in addition to other duties. Sample job titles include:

- Scraper Operator
- Motor Grader Operator
- Loader Operator
- Excavator Operator
- Heavy Equipment Operator
- Roller Operator

Plasterers and Stucco Masons (SOC 47-2161 Apply interior or exterior plaster, cement, stucco, or similar materials. May also set ornamental plaster. Sample job titles include:

- Applicator
- Artisan Plasterer
- Plaster and Stucco Worker
- Plaster Mechanic
- Plasterer
- Plastering Contractor

Plumbers, Pipefitters, and Steamfitters (SOC 47-2152): Assemble, install, alter, and repair pipelines or pipe systems that carry water, steam, air, or other liquids or gases. May install heating and cooling equipment and mechanical control systems. Includes sprinkler fitters. Sample job titles include:

- Sprinkler Fitter
- Pipe Fitter
- Steamfitter
- Service Plumber
- Residential Plumber
- Plumbing and Heating Mechanic

Reinforcing Iron and Rebar Workers (SOC 47-2171): Position and secure steel bars or mesh in concrete forms in order to reinforce concrete. Use a variety of fasteners, rod-bending machines, blowtorches, and hand tools. Includes rod busters. Sample job titles include:

- Rodbuster
- Steel Tier
- Ironworker Foreman
- Ironworker
- Rodman
- Field Ironworker

Solar Photovoltaic Installers (SOC 47-2231): Assemble, install, or maintain solar photovoltaic (PV) systems on roofs or other structures in compliance with site assessment and schematics. May include measuring, cutting, assembling, and bolting structural framing and solar modules. May perform minor electrical work such as current checks. Sample job titles include:

- Photovoltaic Installer
- Solar Technician
- Solar Tech
- Solar Installer Technician
- Solar Designer/Installer
- PV Installer Tech

Telecommunications Line Installers and Repairers (SOC 49-9052): Install and repair telecommunications cable, including fiber optics. Sample job titles include:

- Cable Splicer
- Cable Technician
- Field Service Technician
- Installation and Repair Technician
- Lineman
- Service Technician

APPENDIX D: ENERGY, CONSTRUCTION, AND UTILITIES DEMAND AND SUPPLY DATA

The following tables compare labor market demand and program supply by occupation. Because a TOP/CIP code may train for more than one occupation, simply aggregating all supply from all related codes may overestimate supply for that occupation. Therefore, the COE de-duplicated TOP codes that train for more than one occupation to avoid counting program supply more than once. This de-duplication process is denoted by the "Accounted for Above" statements in the tables on the following pages.

Additionally, the COE reviewed program data from the LaunchBoard[7] and the statewide COE Supply Table[8] and identified conflicting information. For certain occupations, LaunchBoard indicates that a college has a program for that occupation, but the COE Supply Table does not show program data for that college, and vice versa. These discrepancies are marked with the following:

+ The COE Supply Table indicates that this college supplies awards for this TOP code, but this college is not listed in the LaunchBoard

* LaunchBoard indicates that this college/school supplies awards for this TOP code, but this college is not listed in COE Supply Table

The demand and supply tables in the following pages have three categories:

1. **Supply Gap** – If Average Annual Openings exceed Average Annual Awards by more than 25 percent, then the cell is shaded in light green.
2. **Supply Met** – If Average Annual Openings is within 25 percent +/- of Average Annual Awards, then the cell is shaded in light blue.
3. **Oversupply** – If Average Annual Openings exceed the Average Annual Awards by more than 25 percent, then the cell is shaded in red.

[7] calpassplus.org/LaunchBoard/Home.aspx
[8] https://coeccc.net/our-resources/supply-and-demand/

DEMAND AND SUPPLY DATA FOR TOP ENERGY, CONSTRUCTION, AND UTILITIES MIDDLE-SKILL JOBS IN ORANGE COUNTY

OCCUPATIONAL TITLE	AVERAGE ANNUAL OPENINGS (2020-2025)	SUPPLY GAP/ SUPPLY MET/ OVERSUPPLY	AVERAGE ANNUAL AWARDS (2017-2020)	TOP6 TITLE	TOP6 OR CIP	COLLEGE	COLLEGE SUPPLY (3-YR AVG)
Electricians	1,139	Supply Gap	332	Electrical	0952.20	Irvine	10
						North Orange Adult	18
						Orange Coast	3
						Santiago Canyon	27
					CIP 46.0302	InterCoast Colleges-Santa Ana	35
						Southern California Institute of Technology	239
First-Line Supervisors of Construction Trades and Extraction Workers	685	Supply Gap	129	Construction Crafts Technology	0952.00	Fullerton	11
						Orange Coast	62
						Santa Ana	56
				Civil and Construction Management Technology	0957.00	Already Accounted For	0
Construction Managers	446	Supply Gap	11	Construction Crafts Technology	0952.00	Already Accounted For	0
				Civil and Construction Management Technology	0957.00	Fullerton	11
Heating, Air Conditioning, and Refrigeration Mechanics and Installers	440	Supply Gap	213	Environmental Control Technology	0946.00	Cypress	106
						Orange Coast	43
					CIP 47.0201	Brownson Technical School	11
						InterCoast Colleges-Santa Ana	16
						United Education Institute-Anaheim	37
Operating Engineers and Other Construction Equipment Operators	233	Supply Gap	36	Diesel Technology	0947.00	Santa Ana	8
				Heavy Equipment Operation	0947.30	Santiago Canyon	28
Telecommunications Line Installers and Repairers	160	Supply Gap	0	No Programs	No Programs	No Programs	0
Architectural and Civil Drafters	146	Supply Met	148	Architecture and Architectural Technology	0201.00	Fullerton	8
						Orange Coast	61
						Saddleback	11
				Drafting Technology	0953.00	Fullerton	7
						Golden West	28

OCCUPATIONAL TITLE	AVERAGE ANNUAL OPENINGS (2020-2025)	SUPPLY GAP/ SUPPLY MET/ OVERSUPPLY	AVERAGE ANNUAL AWARDS (2017-2020)	TOP6 TITLE	TOP6 OR CIP	COLLEGE	COLLEGE SUPPLY (3-YR AVG)
						Irvine	4
						Saddleback	1
						Santa Ana	21
				Architectural Drafting	0953.10	Fullerton	3
						Santa Ana	2
				Civil Drafting	0953.20	Irvine	2
Construction and Building Inspectors	129	Supply Gap	35	Construction Inspection	0957.20	Coastline	13
						Fullerton	8
						Saddleback	9
						Santiago Canyon	5
Glaziers	65	Supply Gap	0	No Programs	No Programs	No Programs	0

DEMAND AND SUPPLY DATA FOR ENERGY, CONSTRUCTION, AND UTILITIES MIDDLE-SKILL JOBS WITH ENTRY-LEVEL WAGES BELOW CALIFORNIA FAMILY NEEDS CALCULATOR IN ORANGE COUNTY

OCCUPATIONAL TITLE	AVERAGE ANNUAL OPENINGS (2020-2025)	SUPPLY GAP/ SUPPLY MET/ OVERSUPPLY	AVERAGE ANNUAL AWARDS (2017-2020)	TOP6 TITLE	TOP6 OR CIP	COLLEGE	COLLEGE SUPPLY (3-YR AVG)
Carpenters	1,145	Supply Gap	2	Carpentry	0952.10	Fullerton	1
						Santiago Canyon	1
Plumbers, Pipefitters, and Steamfitters	651	Supply Gap	0	Plumbing, Pipefitting and Steamfitting	0952.30	Orange Coast	0
Plasterers and Stucco Masons	54	Supply Gap	0	No Programs	No Programs	No Programs	0
Reinforcing Iron and Rebar Workers	59	Supply Gap	0	No Programs	No Programs	No Programs	0
Installation, Maintenance, and Repair Workers, All Other	203	Supply Gap	132	Electronics and Electric Technology	0934.00	Coastline	80
						Irvine	25
						Orange Coast	9
						Saddleback	11
						Santa Ana	5
				Energy Systems Technology	0946.10	Golden West	2
Solar Photovoltaic Installers	83	Supply Gap	0	Electronics and Electric Technology	0934.00	Already Accounted For	0
				Energy Systems Technology	0946.10	Already Accounted For	0
Electrical Power-Line Installers and Repairers	60	Supply Met	75	Electrical Systems and Power Transmission	0934.40	Santiago Canyon	75
				Electrical	0922.20	Already Accounted For	0