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# UTILITIES INDUSTRY

Los Angeles Region

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Contents:

Executive Summary.....	2
Industry Overview .....	3
Utilities Industry Employment .....	4
Demographic and Economic Issues: Impact on Regional Demand and Supply for Workers.....	8
Employer Needs and Challenges .....	10
Occupational Assessment .....	11
Community Support and Resources .....	18
Training and Education Model Programs.....	19
Conclusion and Recommendations .....	21
References.....	24
Appendix A: How to Utilize this Report.....	25
Appendix B: Occupational Summaries .....	26
Appendix C: California Community College Programs.....	36

**THE LOS ANGELES DEPARTMENT OF WATER AND POWER ANTICIPATES HIRING 500 ENTRY LEVEL WORKERS EACH YEAR OVER THE NEXT FIVE YEARS. SOURCE: WORKING FOR A SUSTAINABLE FUTURE FORUM REPORT**

**Executive Summary**

The Utilities Industry is dealing with major changes across the nation. Multiple factors are affecting the way this industry will move forward, including major policy changes dealing with renewable energy, an aging workforce rapidly approaching retirement, and an ever-increasing demand for services.

Los Angeles County spans over 4,000 square miles and exceeds 10 million people and continues to grow. Residents need heat, air-conditioning, water and many other services that are typically taken for granted.

It is the utility companies that deliver these services and according to Carnegie Mellon University's Electricity Industry Center, about half of the USA's 400,000 power industry workers, largely baby boomers, are eligible to retire in the next five to 10 years.

In addition, Los Angeles Mayor Antonio Villaraigosa has released a plan to conserve resources and create new technologies to better deliver vital services. Key elements of the plan include increasing renewable energy use to 35 percent by 2020, completing energy efficiency retrofits, and reducing per capita water consumption by 20 percent.

Major utilities such as the Los Angeles Department of Water and Power, Southern California Edison, and the Southern California Gas Company are implementing measures to meet these standards.

This increasing demand, along with strained natural resources, changing technologies, and a potential lack of a trained workforce are all greatly impacting this industry.

The California Community Colleges System has charged the Economic & Workforce Development (EWD) Network to identify industries and occupations with unmet employee development needs.

The Los Angeles Center of Excellence collaborated with BW research to explore the needs of the utilities industry in Los Angeles in the coming years. This report:

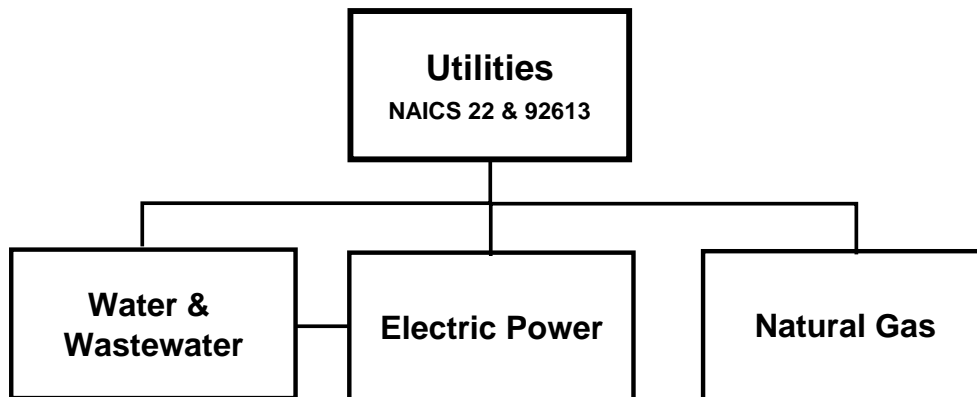
- provides a detailed overview of the utilities industry in Los Angeles County including the identification of the prominent sectors within the industry;
- assesses the education, training and skill gaps/deficiencies among recent applicants and new hires;
- identifies the demographic and economic issues impacting the regional demand and supply for workers, and
- develops occupational profiles for eight occupations that are likely to be undersupplied in the future and/or can best be supported through training programs at the community colleges.

The eight occupations that will be discussed are computer support specialists, electrical power-line installers and repairers, first-line supervisors or managers of mechanics, installers, and repairers, first-line supervisors or managers of production and operating workers, industrial machinery mechanics, pipelayers, power plant operators, and water and liquid waste treatment plant and system operators.

## Industry Overview

The Utilities Industry consists of both public and private agencies engaged in the generation, transmission, distribution, and operation of utilities for electric power, natural gas, water and wastewater. These entities are classified under the US Census Bureau's North American Industry Classification System (NAICS) 22. Government establishments primarily engaged in the administration, regulation, licensing, and inspection of utilities, and not their operation, are classified under NAICS 92613. This report focuses on NAICS 22 and 92. Agencies primarily engaged in the construction of utility systems (NAICS 23) were not included as a component of this study.

**Figure 1 Utilities Industry and Sectors**



Three main sectors within the utilities industry include:

**Water and Wastewater:** This segment includes agencies that treat and distribute water to customers (water) as well as those that operate treatment facilities and plants to collect, treat, and dispose of waste from homes and industries (wastewater and sewer).

Los Angeles County is home to multiple agencies focused on water, such as the Metropolitan Water District, California Water Service Company, North Hollywood Waste Water, and the Los Angeles Bureau of Sanitation.

**Electric Power:** Agencies that generate, transmit, and distribute electric power are classified in this category. Renewable sources of electric power, such as geothermal, wind, and solar energy, currently only account for a small percentage of generation, but are growing within the industry.

Within Los Angeles County, this category includes agencies such as Southern California Edison. Additionally, many agencies combine both water and power services for customers such as the Los Angeles Department of Water and Power and Burbank Water and Power.

**Natural Gas:** These firms distribute natural gas to customers. The extraction of the gas from an underground source is classified separately within the oil and gas extraction industry (NAICS 21). Companies within the natural gas utilities industry take natural gas from the pipeline, depressurize it, add its odor (the gas is odorless in its naturally occurring state), and operate the system that delivers the gas from transmission pipelines to customers.

Within Los Angeles County, this category includes agencies such as the Southern California Gas Company and the Gas Utility of Long Beach.

**Public and Private Employers**

Although the US Census Bureau’s industry classification system (NAICS) categorizes both public and private establishments that operate utilities under NAICS 22, many data sources, including the California Employment Development Department (EDD) and the Bureau of Labor Statistics (BLS) categorize firms by ownership (public or private). As such, public utility data is typically combined into the larger government category and is not always available to be separated out for analysis. Such data limitations will be noted where relevant throughout this report.

From a workforce perspective, the needs of public and private utilities are more similar than they are different. Most private utility employment is found in large employers, such as Southern California Gas and Sempra Energy. These companies face the same workforce development, turnover, and recruiting issues that are faced by their large public utility counterparts. Larger utility firms are more likely to have a lengthy assessment and interview process. These typically include at least one comprehensive exam, multiple layers of interviews, and a relatively extensive background check which can include criminal and credit checks. Many of the utilities, both public and private, work with unions and have requirements about who can or can not be allowed to advance into certain positions. These requirements may limit career lattices for individuals who are not currently employed by a given employer or union. They also put a large emphasis on starting with an entry-level position and working your way up.

Private consulting firms also support the utilities industry and are part of the Los Angeles utilities career lattices. These firms like Malcolm Pirnie, Kennedy Jenks, and CDM provide technical assistance in engineering, resource management, or information technology solutions. These private consulting firms typically hire individuals with at least a bachelor’s degree or significant industry experience.

**Utilities Industry Employment**

Consistent with the state average, approximately one in 143 workers (0.7 percentage points) within Los Angeles County was employed within the utilities industry in 2006.

**Table 1: Total Utilities Industry Employment within the County, 2006**

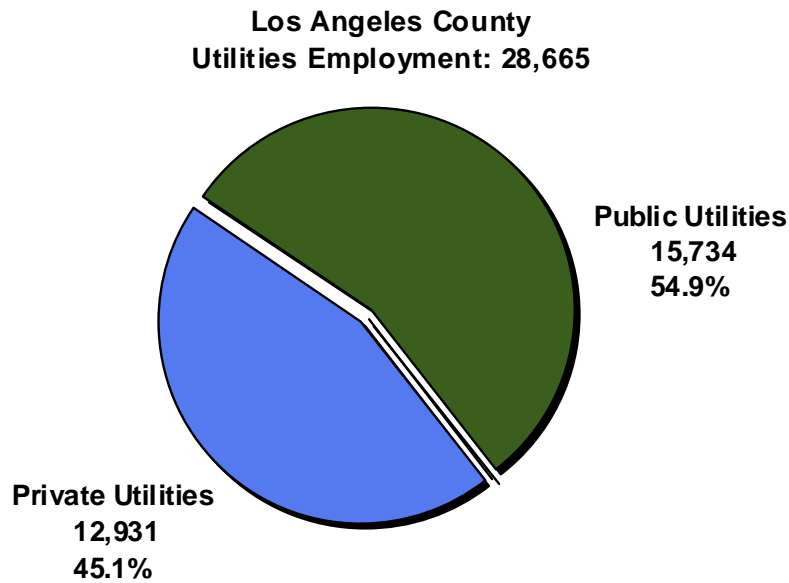
	2006 Utilities Employment	Total, Nonfarm Employment	Percent of Total
Los Angeles County	28,665	4,092,500	0.7%
California	110,495	15,072,800	0.7%

Source: California Employment Development Department (EDD), Quarterly Census of Employment & Wages, 2006 Annual Average.

Just over half of the region’s 28,665 utilities workers (54.9 percent) were employed by public utility agencies, including those that operate and administer or regulate utilities, and 45.1 percent were employed by private utility companies.

Utilities employment was spread across 301 establishments with an average of 95.2 workers each. Although public utilities only accounted for 58 of the firms, they are much larger; their average number of workers was five times the number of their private sector counterparts – 271 workers on average compared to 53 workers each at the 243 private firms.

**Figure 2: Public and Private Utilities Employment by Type, 2006**

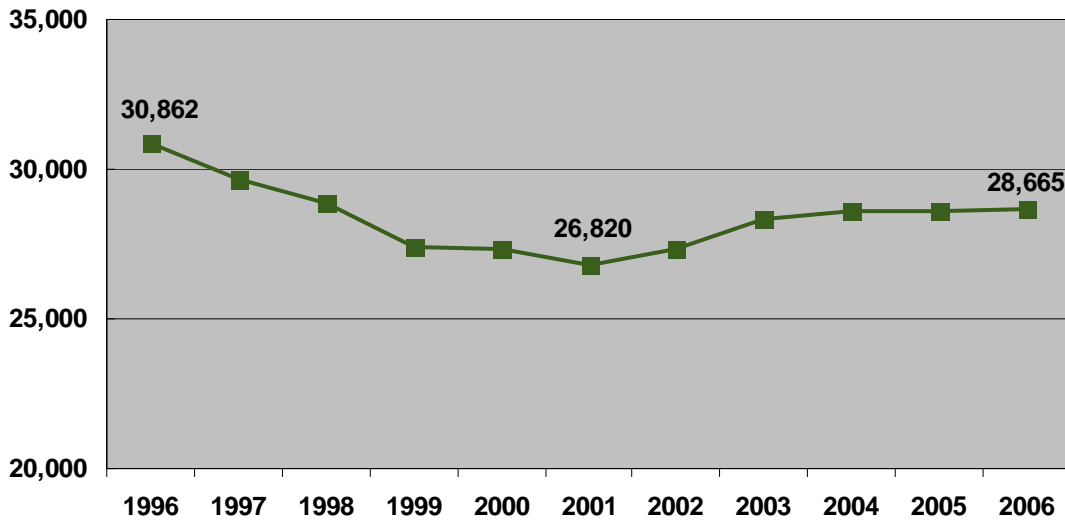


Source: California Employment Development Department (EDD), Quarterly Census of Employment & Wages, 2006 Annual Average.

**Historical Industry Growth**

Over the ten year period from 1996 to 2006, the utilities industry employment experienced an overall decline of 7.1 percent, for a loss of 2,197 jobs. However, over the last five years from 2001 to 2006, utilities have experienced 6.9 percent growth, adding 1,845 new jobs, with private utilities accounting for 1,083 of the jobs (9.1 percent growth) and public utilities accounting for 762 of the jobs (5.1 percent growth). This decline and subsequent rise is consistent with growth over this period across all industries due to the economic downturn around the bursting of the “tech bubble” and September 11, 2001.

**Figure 3 Utilities Industry Employment: 1996-2006**



Source: California Employment Development Department (EDD), Quarterly Census of Employment & Wages.

**Table 2: Change in Utilities Industry Employment, 1996-2006**

	Annual Average Employment		Employment Growth	
	1996	2006	Numerical	Percent
<b>Los Angeles County Utilities Industry</b>	<b>30,862</b>	<b>28,665</b>	<b>-2,197</b>	<b>-7.1%</b>
Private Utilities	13,921	12,931	-990	-7.1%
Public Utilities	16,941	15,734	-1,207	-7.1%

Source: California Employment Development Department (EDD), Quarterly Census of Employment & Wages.

**Table 3: Change in Utilities Industry Employment, 2001-2006**

	Annual Average Employment		Employment Growth	
	2001	2006	Numerical	Percent
<b>Los Angeles County Utilities Industry</b>	<b>26,820</b>	<b>28,665</b>	<b>1,845</b>	<b>6.9%</b>
Private Utilities	11,848	12,931	1,083	9.1%
Public Utilities	14,972	15,734	762	5.1%

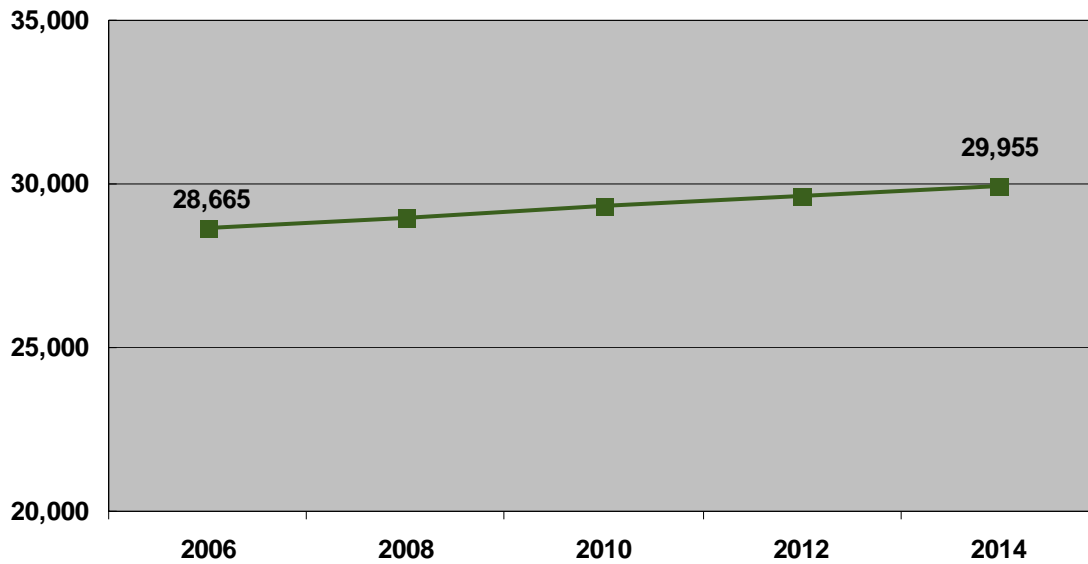
Source: California Employment Development Department (EDD), Quarterly Census of Employment & Wages.

**Industry Growth Expectations, 2006-2014**

The California EDD projects private utilities employment in Los Angeles County to increase 5.9 percent from 2006 to 2014, resulting in 769 new jobs. Using the ratio of private to public utility growth evidenced over the past five years (factor of 1.79 private to public), BW Research estimates public utilities to increase 3.3 percent from 2006 to 2014, which will result in an additional 521 new jobs.<sup>1,2</sup>

Taken together, employment in the utilities industry within Los Angeles County is projected to increase 4.5 percent from 2006 to 2014, resulting in 1,290 new jobs.

**Figure 4: Projected Utility Employment Growth, 2006-2014**



Source: California Employment Development Department (EDD), Projections data; and BW Research.

**Table 4: Projected Utility Employment Growth, 2006-2014**

	Annual Average Employment		Projected Employment Growth, 2006-2014	
	2006	2014	Numerical	Percent
<b>Los Angeles County Utilities Industry</b>	<b>28,665</b>	<b>29,995</b>	<b>1,290</b>	<b>4.5%</b>
Private Utilities	12,931	13,700	769	5.9%
Public Utilities	15,734	16,255	521	3.3%

Source: California Employment Development Department (EDD), Projections data; and BW Research.

<sup>1</sup> Public utilities projections are not available from the EDD.

<sup>2</sup> Public utilities is combined with “Government” and projection data could not be disaggregated; therefore, projection data for private utilities was used, and growth in public utilities was estimated based on the ratio of private to public growth from 1996-2006. Historically, private growth typically outpaces public growth within the same industries (BW Research).

## Demographic and Economic Issues: Impact on Regional Demand and Supply for Workers

### Replacing an Aging Workforce

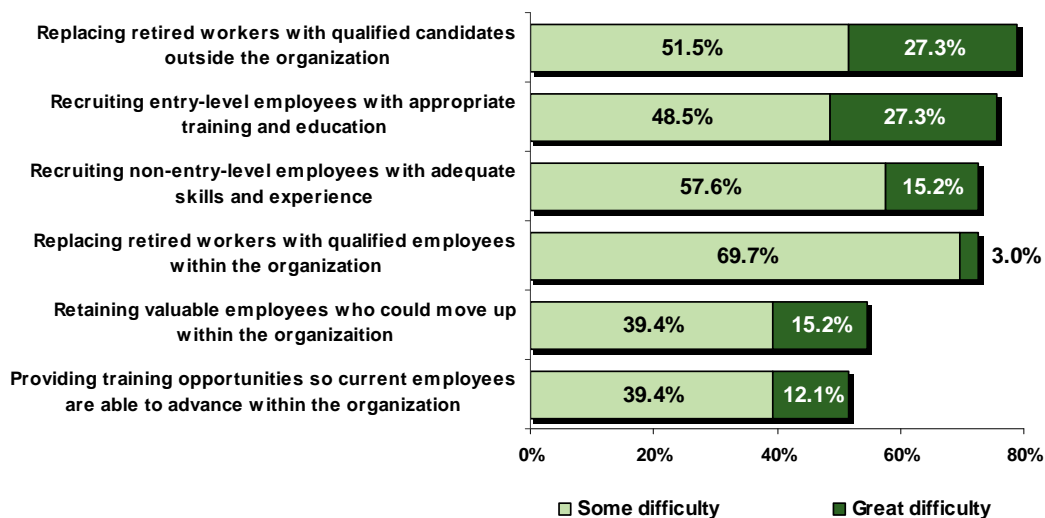
The Bureau of Labor Statistics projects that over half (55 percent) of workers employed within private utilities will reach retirement age within the next 10 years. Although data are not available specific to public utilities, available research points to the concern that the public sector will be one of the industries hardest hit with its older than average workforce and impending retirements. As a result, job prospects within the utilities industry are expected to be excellent for qualified applicants, especially those with technical education or college training.

Although prospects are excellent for applicants, employers are expected to face significant challenges finding enough qualified applicants to fill the variety of positions that will be available from retirements. Further complicating the issue is the extensive on-the-job training required for many positions. This will place an additional burden on employers. They will need to simultaneously search for qualified replacements while also developing ways to train new workers and transfer the institutional knowledge held by existing workers before they leave the organization.

Data from a recent study conducted by BW Research for the Los Angeles/Orange County Regional Consortium revealed the difficulty that public utility employers in Los Angeles County are already experiencing with regard to replacing retired workers and recruiting new employees (as shown in Figure 5. Over 70 percent of the 33 public utilities employers surveyed in Los Angeles County report difficulty with recruitment and replacement, with the most difficulty reported for “Replacing retired workers with qualified candidates from outside the organization” (78.8 percent difficulty) and “Recruiting entry-level employees with appropriate training and education” (75.8 percent difficulty).

The Bureau of Labor Statistics anticipates that the shortage of qualified employees may force utilities to automate their systems, rehire retirees as part-time consultants, and contract with employment services in order to fill the gap.

**Figure 5: Workforce Challenges for Los Angeles County Public Utilities Employers**



Source: BW Research, Survey of 33 Public Utilities Employers in Los Angeles County, June 2007.

### **Legislation and Economic Issues Impacting Utilities**

The economic and legislative environment in Los Angeles and California is in a state of flux. Energy prices have gone up considerably and voters expect something to be done to lower gas prices and also to control the inflation that is often connected to increases in energy prices. Sacramento and Washington, DC are not necessarily headed in the same direction as the state and local governments implement more aggressive goals to increase renewable energy and significantly change our energy portfolio. The changing energy portfolio will mean an increase in renewable energy, but also more reliance on incorporating energy efficiency planning among utilities related to both power and water.

#### ***Utilities industry legislative assessment from the Bureau of Labor Statistics:***

In 2005, Congress passed a new Energy Policy Act, which is the first major legislation on energy since 1992. This will be a major force in the industry through 2016. It was designed to promote conservation and use of cleaner technologies in energy production through higher efficiency standards and tax credits. It is expected that several new power plants will be built as a result of this legislation, including new clean-burning coal and nuclear facilities.

Utilities and the services they provide play such a critical role in everyday life that they are considered public goods and are typically heavily regulated. Most utility companies that distribute to consumers operate as regulated monopolies because utility distribution tends to require a large investment in plant and equipment and it is generally not desirable to have several competing systems of pipes or power lines in most areas. Since these companies do not face competition, they are regulated by public utility commissions that ensure that companies act in the public interest and set the rates that are charged. However, legislative changes in recent years have established and promoted competition in some parts of the utilities industry. Wholesale providers of electricity now face competition from a number of non-utility generators.

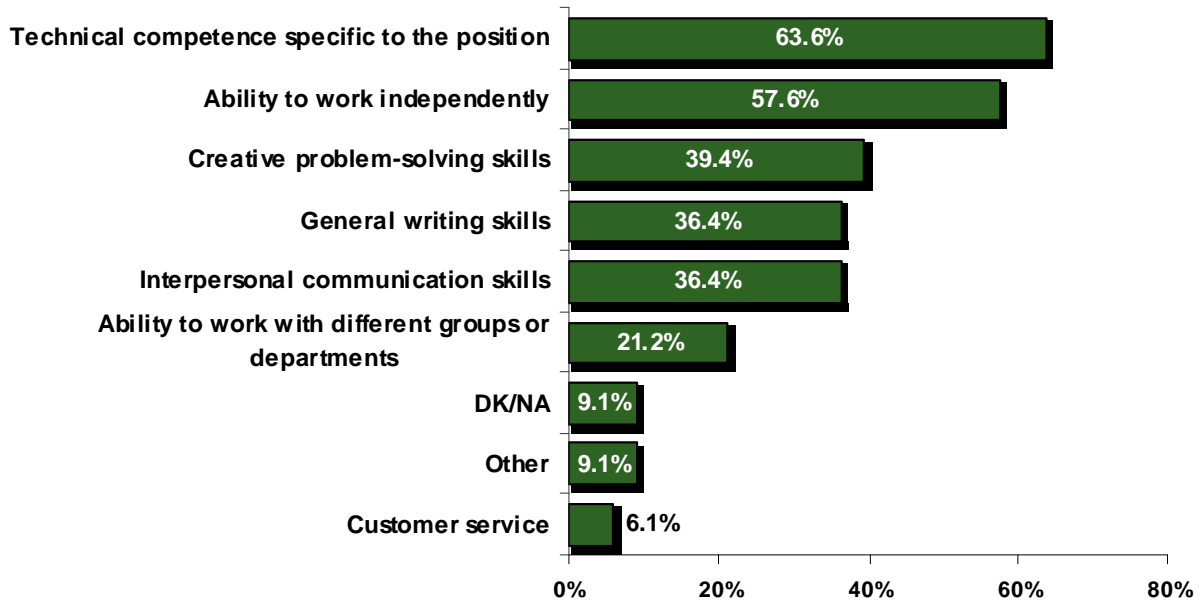
Additional federal legislation that will impact the utilities industry include: The New Direction for Energy Independence, National Security, and Consumer Protection Act – HR 3221 (2007) and the Green Jobs Act – HR 2847 (2007). At the state level are the Global Warming Emissions Standard for Electricity Generation – SB 1368 (2007) and the Accelerated Renewable Energy Standard – SB 107 (2006).

## Employer Needs and Challenges

### Education, Training, and Skills Gaps

Results of a recent study conducted by BW Research for the Los Angeles/ Orange County Regional Consortium revealed that the majority of public utilities employers in Los Angeles County indicated that recent hires at their organization were most deficient in technical competence specific to the position (63.6%) and the ability to work independently (57.6 percent).

**Figure 6: Recent Hire Skill Deficiencies in Public Utilities**



Source: BW Research, Survey of 33 Public Utilities Employers in Los Angeles County, June 2007.

Recent applicants in the utilities industry have also provided another indication of educational, training and skills gaps: applicant assessment exams. In 2007, the Metropolitan Water District had 638 individuals take the exam to go into the District’s apprentice program. Of the 638 individuals that took the exam, only 151 passed. With a success rate below 25 percent, most of the failed exams were due to the mathematics section. The math section of this exam is comparable to a high school senior exit exam and includes applied mathematics with some basic geometry as well as ratios, percentages and concepts from basic and intermediate algebra. The ability to use applied math was important to many employers in the utilities industry and it is an area that is particularly important for many of the technician positions that could be served by the community colleges.

## Occupational Assessment

The utilities industry offers a wide array of career opportunities for workers with varying levels of education and work experience. Opportunities can range from general office and administrative occupations (e.g., customer service representatives, bookkeepers) to production and operating positions (plant operators, maintenance workers) to specialty professional positions (chemists, engineers) to management and financial occupations (general manager, supervisors).

High school graduates qualify for many entry-level occupations; however, safety and security regulations may call for stricter hiring standards as compared to other industries (such as a valid driver's license, no criminal background, documentation of skills).

At the national level in 2006, approximately 41 percent of utilities jobs were in production, installation, maintenance, and repair occupations; 21 percent in office and administrative support occupations; 14 percent in professional and related occupations; and 12 percent in management, business, and financial occupations.<sup>3</sup> The remaining occupations were in construction, transportation, sales, and service occupations.

The current study focused on eight occupations within the utilities industry. To be included in the study, each occupation had to meet at least one of the following criteria: large employment in the County, above average growth, or easily served by the education and training programs provided by the community colleges.

Table 5 displays the eight occupations chosen for the study along with their corresponding standard occupational classification (SOC) system codes.

**Table 5: Eight Occupations of Focus for Current Study**

Occupation	SOC Code
Computer Support Specialists	15-1041
Electrical Power-Line Installers and Repairers	49-9051
First-Line Supervisors or Managers of Mechanics, Installers, and Repairers	49-1011
First-Line Supervisors or Managers of Production and Operating Workers	51-1011
Industrial Machinery Mechanics	49-9041
Pipelayers	47-2151
Power Plant Operators	51-8013
Water and Liquid Waste Treatment Plant and System Operators	51-8031

<sup>3</sup> Bureau of Labor Statistics, Utilities Industry Summary: <http://www.bls.gov/oco/cg/cqs018.htm>

### Occupational Employment

Table 6 shows the total employment in each occupation across industries in Los Angeles County as well as estimated employment within the utilities industry. Utilities employment for Los Angeles County was estimated based on statewide data for each occupation by industry and the table below is sorted from the highest estimated utilities employment in Los Angeles County to the lowest.<sup>4</sup>

Of the occupations examined for this study, water and liquid waste treatment plant and system operators (1,360 to 1,700 workers) and electrical power-line installers and repairers (630 to 680 workers) have the highest employment totals.

**Table 6: Employment by Occupation within Los Angeles County, 2006**

Occupation	Estimated Utilities Employment	Total Employment, All Industries
Water and Liquid Waste Treatment Plant and System Operators	1,360 to 1,700	1,780
Electrical Power-Line Installers and Repairers	630 to 680	1,530
First-Line Supervisors or Managers of Mechanics, Installers, and Repairers	335 to 445	11,230
Power Plant Operators	295 to 325	330
First-Line Supervisors or Managers of Production and Operating Workers	220 to 285	20,560
Pipelayers	95 to 120	960
Computer Support Specialists	80 to 140	14,580
Industrial Machinery Mechanics	70 to 90	3,000

Source: California Employment Development Department (EDD) and BW Research.

### Job openings: Growth and Replacements

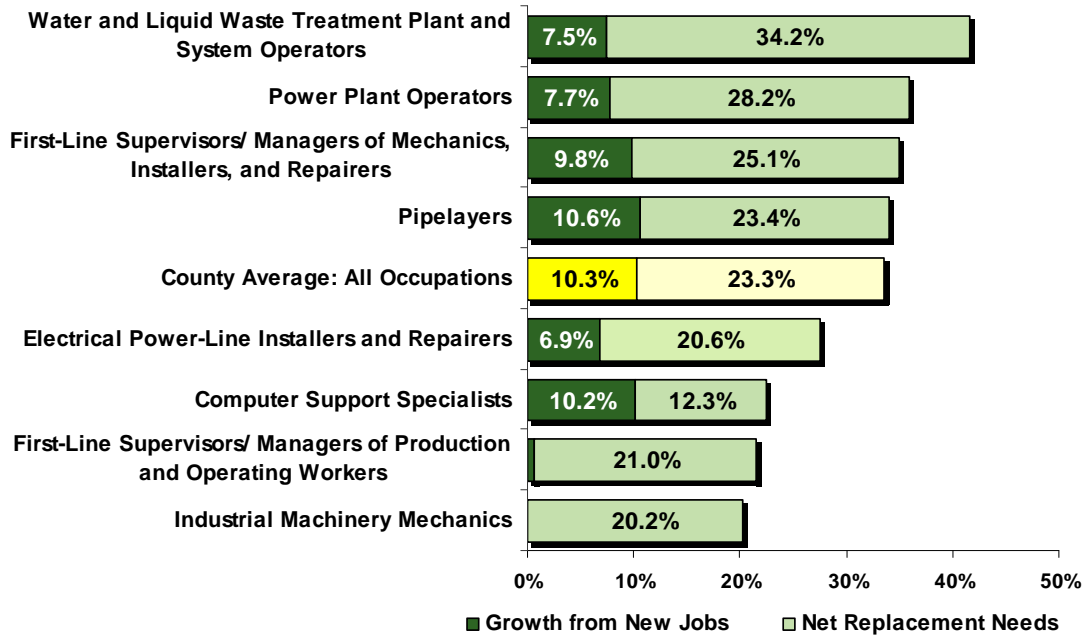
Although projection data are not available specific to the utilities industry in Los Angeles County by occupation, Figure 7 below shows estimated growth from new jobs as well as the net replacement needs by occupation within Los Angeles County for the 10-year period from 2004 to 2014.<sup>5</sup>

The total percentage of openings (growth plus replacements) exceeds the County average (across all occupations and industries) for half of the occupations in this study.

<sup>4</sup> The proportion of statewide employment by occupation within private utilities and an estimate for the proportion of public utilities employment within government was utilized for each occupation. Los Angeles County data for each occupation by industry was only available for Water and Liquid Waste Treatment Plant and System Operators. Data for the remaining occupations was classified as confidential by the EDD.

<sup>5</sup> Statewide data for electrical power-line installers and repairers were used and adjusted downward based on the ratio of Statewide to LA County growth across occupations since Los Angeles specific data were not available for this occupation.

**Figure 7: Growth and Replacement Needs by Occupation across Industries  
Los Angeles County, 2004-2014**



Source: California Employment Development Department (EDD), Projections data; and BW Research.

Table 7 shows estimated statewide growth in each occupation within private utilities along with the estimated growth and replacement needs across industries for each occupation within Los Angeles County. Given that data were not available specifically for public utilities, which have been growing at a slower rate than private utilities, the percentages are meant as an example of the potential growth range within each occupation.

Nearly all of the occupations have expected growth from new job creation within private utilities that surpasses the expectations across industries. The exceptions are power plant operators, whose growth across industries is likely more realistic than private utilities alone because of the number employed within public utilities, and computer support specialists. Although growth from computer support specialists is expected to be lower than average within private utilities, employers expressed difficulty finding qualified applicants to fill vacancies for this occupation in the 2007 Los Angeles/Orange County Regional Consortium Study.

Potentially more of a factor than growth is the anticipated need to replace a large number of employees due to retirements within the utilities industry. It is important to note that the replacement needs for each occupation with the utilities industry are likely much higher than those shown in the table, which represents the average across all industries.<sup>6</sup>

Although growth among industrial machinery mechanics was projected to decline by 1.8 percent from 2004 to 2014, 2006 employment figures show there are already 280 more industrial machinery mechanics employed in Los Angeles County than in 2004, resulting in a growth percentage of 9.3 percent. Given the growth experienced in the last two years, it is unlikely that this occupation will result in a net decline through 2014.

<sup>6</sup> Projected replacement data specific to the utilities industry were not available.

**Table 7: Growth and Replacement Needs by Occupation, 2004-2014**

Occupation	Statewide Growth in Private Utilities	Growth across Industries in LA County	Replacement Needs across Industries in LA County
Pipelayers	50.0%	10.6%	23.4%
First-Line Supervisors or Managers of Production and Operating Workers	25.0%	0.6%	21.0%
Water and Liquid Waste Treatment Plant and System Operators	25.0%	7.5%	34.2%
First-Line Supervisors or Managers of Mechanics, Installers, and Repairers	20.0%	0.6%	21.0%
Electrical Power-Line Installers and Repairers	12.5%	6.9%	20.6%
Power Plant Operators	5.9%	7.7%	28.2%
Computer Support Specialists	2.2%	10.2%	12.3%
Industrial Machinery Mechanics <sup>7</sup>	0.0%	-1.8%	20.2%

Source: California Employment Development Department (EDD) and BW Research.

**Table 8: Total Projected Openings across Industries in Los Angeles County, 2004-2014**

Occupation	Total Openings	New Growth	Replacement Jobs
First-Line Supervisors or Managers of Production and Operating Workers	4,820	130	4,690
First-Line Supervisors or Managers of Mechanics, Installers, and Repairers	3,760	1,060	2,700
Computer Support Specialists	3,180	1,440	1,740
Industrial Machinery Mechanics	550	0	550
Water and Liquid Waste Treatment Plant and System Operators	500	90	410
Pipelayers	320	100	220
Electrical Power-Line Installers and Repairers <sup>8</sup>	252	63	189
Power Plant Operators	140	30	110

Source: California Employment Development Department (EDD) and BW Research.

<sup>7</sup> Although this occupation was projected to decline from 2004 to 2014, EDD data shows a 9.3 percent increase in employment for this occupation from 2004 to 2006.

<sup>8</sup> Statewide data for electrical power-line installers and repairers were used and adjusted downward based on the ratio of Statewide to LA County growth across occupations since Los Angeles specific data were not available for this occupation.

**Utilities Industry Wages**

On average, utilities occupations pay higher than the median wage for all occupations within the County. The median pay for occupations within private utilities in 2005 was estimated at approximately \$47,700 a year (\$22.94 per hour),<sup>9</sup> compared with \$31,780 a year (\$15.28 per hour) across all occupations in Los Angeles County.

According to the Bureau of Labor Statistics, most full-time workers in the utilities industry receive substantial benefit packages in addition to their salaries. This is especially true among workers in collective bargaining agreements, or unions. At the national level, approximately 27 percent of utilities workers were covered by union contracts, which is more than double the proportion covered by unions across industries.

Table 9 below shows the 2007 first quarter wages for each of the eight occupations within the study, as well as the corresponding wage for that occupation across industries. With the exception of pipelayers (which have a higher wage in the construction industry), the occupational wage within the utilities industry is either the same as, or higher than, the wage for each occupation across industries within Los Angeles County.

**Table 9: Median Wages for Occupations in Utilities Compared to All Industries (1st Quarter, 2007)**

	Utilities Industry Median Wage		All Industries Median Wage	
	Hourly	Annual	Hourly	Annual
First-Line Supervisors/Managers of Production and Operating Workers	\$39.25	\$81,640	\$22.01	\$45,781
Computer Support Specialists	\$34.37	\$71,490	\$21.25	\$44,200
First-Line Supervisors/Managers of Mechanics, Installers, and Repairers	\$32.82	\$68,255	\$27.95	\$58,136
Power Plant Operators	\$30.54	\$63,523	\$30.54	\$63,523
Electrical Power-Line Installers and Repairers	\$28.30	\$58,872	Not Available	
Industrial Machinery Mechanics	\$27.56	\$57,321	\$21.10	\$43,888
Water and Liquid Waste Treatment Plant and System Operators	\$25.66	\$53,363	\$25.57	\$53,186
Pipelayers	\$20.30	\$42,222	\$21.54	\$44,803

Source: California Employment Development Department (EDD) and BW Research.

<sup>9</sup> Wage data were not available for public utilities.

Table 10 below shows the 2007 first quarter entry-level (25th percentile), median (50th percentile), and experienced (75th percentile) wage for each occupation within the utilities industry in Los Angeles County.

**Table 10: Entry-level, Median, and Experienced Wages in Utilities Occupations (1st Quarter, 2007)**

	Entry-level Wage		Median Wage		Experienced Wage	
	Hourly	Annual	Hourly	Annual	Hourly	Annual
First-Line Supervisors/Managers of Production and Operating Workers	\$30.21	\$62,837	\$32.82	\$68,255	\$35.53	\$73,902
Computer Support Specialists	\$29.58	\$61,526	\$39.25	\$81,640	\$48.31	\$100,485
First-Line Supervisors/Managers of Mechanics, Installers, and Repairers	\$26.66	\$55,453	\$30.54	\$63,523	\$34.59	\$71,947
Power Plant Operators	\$26.01	\$54,101	\$34.37	\$71,490	\$39.89	\$82,971
Electrical Power-Line Installers and Repairers	\$25.52	\$53,075	\$27.56	\$57,321	\$29.60	\$61,567
Industrial Machinery Mechanics	\$25.36	\$52,748	\$28.30	\$58,872	\$32.69	\$68,007
Water and Liquid Waste Treatment Plant and System Operators	\$21.80	\$45,340	\$25.66	\$53,363	\$30.71	\$63,870
Pipelayers	\$12.28	\$25,544	\$20.30	\$42,222	\$27.95	\$58,142

Source: California Employment Development Department (EDD) and BW Research.

### Career Ladders

Below are examples of career ladders for workers in water and wastewater, power, and general occupations within the utilities industry.

**Table 11: Example Career Ladders – Water and Wastewater**

Entry-level Positions	Mid-level Advancement	Top-level Advancement	Advancement Requirements
Water/Wastewater Technician or Junior Operator	Water/Wastewater Operator or Senior Technician	Plant/Systems Supervisor or General Manager	Work Experience & OJT; Top positions may require Associate or Bachelor's degree; Certifications may be required depending on plant or specialty
Water Utility Worker	Water Utility Supervisor	Water Utility Superintendent or General Manager	Work Experience & OJT; Top positions may require Associate or Bachelor's degree; Certifications may be required depending on plant or specialty
Pipelayer Laborer	Pipelayer	Crew Leader or Supervisor	Work Experience & OJT

**Table 12: Example Career Ladders – Electricity**

Entry-level Positions	Mid-level Advancement	Top-level Advancement	Advancement Requirements
Meter Reader or Grounds Worker	Electrical Power-line Installer or Repairer	Supervisor of Installers and Repairers	Work Experience & OJT
Electrical Power-line Installer or Repairer	Electric Utility Generation Technician	Electrician	Pass licensing exam for Electrician; OJT & Work Experience
Power Plant Operator	Senior Power Plant Operator or Supervisor	Power Plant Superintendent or General Manager	Work Experience & OJT; Top positions may require Associate or Bachelor's degree; Certifications may be required depending on plant or specialty.

**Table 13: Example Career Ladders – General Utilities Occupations**

Entry-level Positions	Mid-level Advancement	Top-level Advancement	Advancement Requirements
Utility Plant Trainee or Utility Plant Technician	Master Utility Plan Technician	Supervisor of Utility Plant Operations	Work Experience & OJT; Top positions may require Associate or Bachelor's degree.
Maintenance Worker	Maintenance Technician	Maintenance Supervisor	Work Experience & OJT; Top positions may require Associate or Bachelor's degree.
Computer Tech. or Jr. Analyst/Support Specialist	Computer Support Specialist or Analyst	IT Manager or Senior Analyst or Network Administrator	Advancement is typically tied to continuing education & work experience; some positions may require Associate or Bachelor's degree.
Customer Service Representative	Dispatcher	Supervisor	Work Experience & OJT
Machinery Maintenance Workers	Industrial Machinery Mechanic	Crew Leader or Supervisor	Work Experience & OJT

## Community Support and Resources

The **Workforce Investment Board** has identified the Utilities industry as one of its local industry sectors with the greatest potential for growth/expansion and an abundance of jobs that pay good wages or include career ladders which lead to higher salaries. The WIB is funding two initiatives in the Utilities Industry Sector. An award of \$250,000 was provided to establish the Regional Economic Development Institute (REDI) located at Trade Tech Campus. Multiple partners are involved and the project is developing short-term training that will facilitate placements in utility related occupations.

Another award of \$50,000 was granted to multiple community colleges, WorkSource Centers, and partners to leverage funding and educate individuals about the wide range of careers in the utilities industry.

### The Los Angeles Infrastructure Academy

This Academy was designed through a joint effort between the Office of Los Angeles Mayor Antonio Villaraigosa and the Los Angeles Department of Water and Power.

The one-year program is designed for high school juniors, seniors, and recent graduates and is delivered on college campuses. Students meet all-day for two days per week during the summer, twice a week after-school during the school year, and occasional Saturdays and weekends. The curriculum, which was designed in close collaboration with industry and labor partners, emphasizes the three areas that students need to secure entry into a good job: workforce readiness, academic preparation, and industry exposure.

Download the [fact sheet](#) about the program or access more information on their website: [www.infrastructureacademy.org](http://www.infrastructureacademy.org).

### The Los Angeles Unified School District (LAUSD)

LAUSD has identified the area of Energy and Utilities as one of its key industry sectors to focus on for career academies and small learning communities. Career Technical Education Pathways are identified in four areas:

- Electromechanical Installation and Maintenance
- Energy and Environmental Technology
- Public Utilities
- Residential and Commercial Energy and Utilities

**Local Unions** and Apprenticeship programs are key partners:

- IBEW Local 11 offers a 5-year electrical workers' apprenticeship program in partnership with the Electrical Training Institute. [www.laett.com](http://www.laett.com)
- National Electrical Contractors Association. [www.necanet.org](http://www.necanet.org)
- IBEW Local 18 /LADWP Joint Training Institute. [jti.ladwp.com](http://jti.ladwp.com)
- Piping Industry Progress Education and Trust Fund (PIPE). [www.pipe.org/home](http://www.pipe.org/home)

## Training and Education Model Programs

Following is a sampling of programs that address some of the training and educational needs of Los Angeles Utility employers and can serve as models in developing Los Angeles Community Colleges' own programs.

### **Regional Economic Development Institute (REDI).**

REDI is a career and technical education applied research, training, and technical assistance center based at Los Angeles Trade-Technical College. REDI's mission is to strengthen the regional economy through the design, delivery, and dissemination of state-of-the-art workforce development, vocational, and basic skills education and training programs.

The Institute works closely with the Department of Water and Power, LAUSD, and the Los Angeles Infrastructure Academy to develop programs in this industry. Colleges are encouraged to partner with this consortium. [www.lattc.edu/dept/lattc/REDI](http://www.lattc.edu/dept/lattc/REDI)

**San Diego City Community College** offers apprenticeship programs in multiple areas including: Lineman, Electric Meter Tester, and Electric Repair Shop Mechanic.

[www.sdcity.edu/degrees/apprenticeship](http://www.sdcity.edu/degrees/apprenticeship)

**East Los Angeles Skills Center** is a full-time Employment Preparation and Training Center operated by the Los Angeles Unified School District's Division of Adult and Career Education. They provide vocational training in multiple areas and offer an Electrical Powerline Mechanic Trainee program. [www.elasc.org](http://www.elasc.org)

**City of Oceanside (CA) Internal technicians training program:** The City of Oceanside is a full-service city with its own utilities department and over 100,000 residents and over 1,000 city employees. The City recently developed its own internal training program to train technicians and line workers for supervisory and management positions. The director of personnel at the City, Brian Kammerer, was responsible for developing an internal training program that focuses on developing management and first line supervisory skills.

This program was implemented in 2006 and focuses on many of the skill sets that were identified in the training technicians to supervisors assessment, including communication skills (verbal and written), project management skills, and the ability to understand the big picture business of the municipality. This program would serve as a nice model for Los Angeles.

**Lane Community College, Energy Management Program:** Lane Community College located in Eugene, Oregon, has offered associate degree programs in energy efficiency since 1980. In 2003 the college introduced a program in renewable energy. Currently the college offers a two year Associate degree of applied science in energy management (focused on energy efficiency) and a renewable energy technician degree. In the near future the energy management department will begin offering other associate degree programs, including water conservation and collection as well as a degree in sustainability focused on resource conservation management.

### **Curriculum**

The two-year associate of applied science degree in energy management includes courses in mathematics, physics, building and design, and English as well as the courses in energy and electrical engineering. The more traditional academic courses include:

- Intermediate Algebra
- Fundamentals of Physics
- English Composition: Exposition and introduction to argument
- Technical writing (English)

Some of the energy management courses include:

- Introduction to Sustainability
- Residential/Light Commercial Energy Analysis
- Air Conditioning Systems Analysis
- Energy Investment Analysis
- Energy Accounting

The renewable energy technician degree program has many of the same requirements as the energy management degree with a larger focus on building skills and a greater understanding of electrical theory. More information on this program can be found in the Clean Technology report produced by the LA/OC Regional Consortium and LATTTC Regional Economic Development Institute.

## Conclusion and Recommendations

The Utilities Industry is going through major changes and will be especially affected by impending retirements and ever-evolving requirements for renewable energy and new technology integration. There is an opportunity for the community colleges to better prepare individuals to enter this industry. That being said, given the current economic climate, the community colleges should leverage what is being done in the community and partner with existing collaborations.

A few of the ways colleges can do this include:

- Creating exam preparation courses and development plans for prospective employees;
- Developing education pathways for technicians and line workers to become supervisors and managers;
- Providing technical know-how to the next generation of skilled workers;
- Supporting and expanding the engineer pool.

### **Training & Education Assessment**

Utility employers in Los Angeles indicated four distinct training and educational needs for their current and expected workforce:

**Preparation for Comprehensive exams:** A recent evaluation of applicants who took the initial comprehensive exam for Metropolitan Water District's apprentice program revealed that less than 25 percent of the 638 individuals who took the exam successfully passed. Much of this was tied to the mathematics and quantitative analysis section that makes up a healthy portion of the test. Other municipalities and utilities that offer these types of exams seldom have in-person preparation courses that allow potential applicants to improve their opportunities for success. These comprehensive exams become even more important when you consider that many of the utilities are unionized, and entry-level positions are often the only way for individuals to get hired by utilities for many job classifications.

The community colleges should consider working with the utilities to offer assessment and preparation courses that provide individuals an assessment of their strengths and weaknesses as it relates to the key areas that are being tested; after the assessment is completed, the college could help the individual develop a personalized training program that focuses on their weaknesses to provide an efficient and effective preparation program.

The skill sets that employers indicated should be emphasized for this type of training and education include:

1. **Math and quantitative analysis:** The need to improve basic applied math skills is probably the single most important thing to be done to increase the number of successful applicants of utilities comprehensive exams. This includes understanding fractions and basic statistics, as well as some introductory algebra and geometry.
2. **Basic construction skills:** Employers have indicated that as more and more high schools cut shop and craft classes, a larger percentage of applicants have little or no experience working with basic tools.

3. Basic understanding of engineering and mechanical concepts: These exams often include an assessment of mechanical aptitude including understanding gears, levers, and very basic applied physics.

**Training technicians and line workers to become supervisors and managers:** One of the most significant challenges facing regional utility employers from the looming retirement of baby boomers is the ability to develop the next generation of leaders within these organizations. Supervisors and managers within utilities need to have the experience and expertise that can often only be developed by working for a given utility, and yet there is a real need to teach both the soft skills associated with becoming a manager or supervisor, as well as the ability to understand the business of municipalities and utilities.

The skill sets that employers indicated should be emphasized for this type of training and education included:

1. Verbal communication skills: the need to convey complex information to larger groups of individuals and be able to instruct others on the key information for groups to move forward on particular projects.
2. Written communication skills: the ability to write memos and summaries of findings that can be read and understood by a wider audience.
3. Project management skills: the ability to organize and oversee a project so that all details are appropriately checked while ensuring that the schedule and the budget are being followed according to a plan, or if not that the appropriate notifications are going to other individuals.
4. Understanding the business of utilities and municipal environment: unlike the unregulated private sector which is typically driven by profit seeking, both public and private utilities need to understand the big picture objectives and performance measures that are used in the regulatory environment for utilities. Technicians and line workers that are looking to advance need to understand these big picture objectives in relationship to their increasing responsibilities.

**Providing technical know-how to the next generation of skilled workers:** Certain skill sets and job classifications are changing and are in greater demand in the utilities industry. These areas of expertise should be considered when developing any new training programs or classes at the community colleges. Additional research is recommended.

1. *Heating Ventilation and Air Condition systems (HVAC).* Technicians and maintenance engineers that need to operate and maintain HVAC systems need to be updated on the new HVAC technology. This is particularly important for more building systems that are incorporating energy efficiency and renewable energy technology. Please see the HVAC Industry Scan that the Los Angeles Center of Excellence will publish summer 2008.
2. *Resource and conservation management.* Employers are demanding greater training and education into resource management whether it is in energy efficiency or water conservation planning. Future employees will be expected to have a more comprehensive understanding of resource management and the impact that different projects will have on total resource usage. These employees will also be expected to develop and implement strategies that lower resource demands. Additional research is recommended to fully explore these occupations.

**Supporting and expanding the engineering pool:** While most engineers will need education and training beyond community college, employers indicated a real need to expand the pool of individuals that are considering and/or beginning training to become engineers, as well as the pool of potential engineers that could participate in internships related to this field. The community colleges could work with regional utility employers to connect potential engineering students to relevant internships as well as developing and marketing transfer programs that put community college students in the right courses for quick advancement and transfer into universities that offer engineering degrees. One program that does this is the iSEE Architecture and Engineering Internship Program. This is a high school student training and internship program to expose and engage youth to explore architecture, engineering, and construction as career opportunities. This is done in conjunction to LAUSD's school construction and renovation program.

### **Methodology**

Data compiled for this report were drawn from external sources, including information from the California's Employment Development Department, the Bureau of Labor Statistics, Occupational Outlook Handbooks, and the Occupational Information Network (O\*Net). In addition, 12 qualitative executive interviews were completed with human resource and training managers as well as strategic managers and directors that are engaged in hiring and developing talent within the utilities industry.

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## Appendix A: How to Utilize this Report

### About Us - Description of BWPI

The Business and Workforce Performance Improvement (BWPI) initiative is focused on building the capacity of the colleges in the area of economic and workforce development to enhance their ability to deliver education and training services to businesses and workers in high growth industries, new technologies, and other clusters of opportunities.

The Centers of Excellence (COE) within BWPI provide information regarding workforce trends, increasing awareness and visibility about the colleges' economic and workforce development programs and services, and building partnerships with business and industry.

The goal is to position the colleges as THE workforce partners of choice to business and industry and ensure that college programs are current and responsive. This will contribute to the overall economic vitality of the communities in which they serve.

### How to Use This Report

The Centers of Excellence within the Business and Workforce Performance Improvement Initiative of the California Community College Economic and Workforce Development Program have undertaken Environmental Scanning to provide targeted and valuable information to community colleges on high growth industries and occupations.

This report is intended to assist the decision-making process of California community college administrators and planners in addressing local and regional workforce needs and emerging job opportunities in the workplace as they relate to college programs. The information contained in this report can be used to guide program offerings, strengthen grant applications, and support other economic and workforce development efforts. This report is designed to provide current industry data that will:

- Define potential strategic opportunities relative to an industry's emerging trends and workforce needs
- Influence and inform local college program planning and resource development
- Promote a future-oriented and market responsive way of thinking among stakeholders.

### Important Disclaimer

All representations included in this Environmental Scan product/study have been produced from a secondary review of publicly and/or privately available data and/or research reports. Efforts have been made to qualify and validate the accuracy of the data and the reported findings. The purpose of the Environmental Scan is to assist the California Community Colleges to respond to emerging market needs for workforce performance improvement. However, neither the Business and Workforce Performance Improvement Centers of Excellence, COE host college nor California Community Colleges Chancellor's Office are responsible for applications or decisions made by recipient community colleges or their representatives based upon this study including components or recommendations.

## Appendix B: Occupational Summaries

Six of the eight occupations included in the study are classified by O\*Net as “In-Demand” occupations. O\*Net classifies in-demand occupations as occupations found in national high growth industries. These industries are considered economically critical, projected to add substantial numbers of new jobs, and are being transformed by technology and innovation. Most of the summary information provided in this section was excerpted from the Bureau of Labor Statistics’ Occupational Outlook Handbook and Occupational Information Network (O\*Net).

### Computer Support Specialists (SOC 15-1041)

O\*Net In-Demand Occupation

*Sample of Reported Job Titles:* Information Technology Specialist (IT Specialist), Electronic Data Processing Auditor (EDP Auditor), Help Desk Analyst, Computer Technician, Desktop Support Technician, Office Systems Coordinator.

#### *Highlights:*

- There are many paths of entry to these occupations.
- Job prospects should be best for college graduates with relevant skills and experience; certifications and practical experience are essential for people without degrees.

*Occupational Description:* Computer support specialists in the utilities industry develop computer systems to automate utility processes; provide plant simulators for operator training; and improve operator decision making. Computer support specialists also provide technical assistance to computer system users; answer questions or resolve computer problems; and may provide assistance concerning the use of computer hardware and software, including printing, installation, word processing, electronic mail, and operating systems.

*Work Environment:* Computer support specialists work about 40 hours a week, but if their employer requires computer support over extended hours, they may be “on call” for rotating evening or weekend work. Overtime may be necessary when unexpected technical problems arise. Like other workers who type on a keyboard for long periods, computer support specialists are susceptible to eyestrain, back discomfort, and hand and wrist problems.

*Qualifications and Skills:* People interested in becoming a computer support specialist must have strong problem-solving, analytical, and communication skills because troubleshooting and helping others are vital parts of the job. The constant interaction with other computer personnel, customers, and employees requires computer support specialists to communicate effectively on paper, via e-mail, over the phone, or in person. Strong writing skills are useful in preparing manuals for employees and customers.

*Education and Training:* Due to the wide range of skills required, there are many paths of entry to a job as a computer support specialist. Training requirements for computer support specialist positions vary, but many employers prefer to hire applicants with some formal college education. A bachelor’s degree in computer science or information systems is a prerequisite for some jobs; other jobs, however, may require only a computer-related associate degree. And for some jobs, relevant computer experience and certifications may substitute for formal education.

A number of companies are becoming more flexible about requiring a college degree for support positions. In the absence of a degree, however, certification and practical experience are essential.

**Electrical Power-Line Installers and Repairers (SOC 49-9051)** **O\*Net In-Demand Occupation**

*Sample of Reported Job Titles:* Lineman, Journeyman Lineman, Electrical Lineworker, Lineworker, Power Lineman, Line Erector.

*Highlights:*

- Earnings are higher than most other occupations that do not require postsecondary education.
- A growing number of retirements should create very good job opportunities.
- Line installers and repairers often work outdoors, and conditions can be hazardous.
- Most line installers and repairers require long-term on-the-job training.

*Occupational Description:* Electrical power-line installers and repairers install and maintain the networks of power lines that go from generating plants to the customer. They install insulators, wooden poles, transformers, and light- or heavy-duty transmission towers.

Line installers and repairers must climb and maintain their balance while working on poles and towers. They lift equipment and work in a variety of positions, such as stooping or kneeling. Their work often requires that they drive utility vehicles, travel long distances, and work outdoors under a variety of weather conditions.

*Work Environment:* Line installers and repairers encounter serious hazards on their jobs and must follow safety procedures to minimize potential danger. They wear safety equipment when entering utility holes and test for the presence of gas before going underground. Electric powerline workers have the more hazardous jobs. High-voltage powerlines can instantly electrocute a worker who comes in contact with a live cable, so line installers and repairers must use electrically insulated protective devices and tools when working with such cables. Powerlines are typically higher than telephone and cable television lines, increasing the risk of severe injury due to falls. To prevent these injuries, line installers and repairers must use fall-protection equipment when working on poles or towers.

Since line installers and repairers fix damage from storms, they may be asked to work long and irregular hours. They can expect frequently to be on-call and work overtime. When performing normal maintenance and constructing new lines, line installers work more normal hours.

*Qualifications and Skills:* Line installers and repairers must be able to read instructions, write reports, and solve problems. If they deal directly with customers, they also must have good customer service skills. They should also be mechanically inclined and like working with computers and new technology.

Physical fitness is important because they must be able to climb, lift heavy objects, and do other physical activity that requires stamina, strength, and coordination. Line installers and repairers often must work at a considerable height above the ground so they cannot be afraid of heights. Normal ability to distinguish colors is necessary because wires and cables may be color-coded. In addition, they often need a commercial driver's licenses to operate company-owned vehicles, so a good driving record is important.

*Education and Training:* Line installers and repairers usually need at least a high school diploma. Employers look for people with basic knowledge of algebra and trigonometry and good reading and writing skills. Some also prefer to hire people with technical knowledge of electricity or electronics obtained through vocational programs, community colleges, or the Armed Forces.

## First-Line Supervisors or Managers of Mechanics, Installers, and Repairers (SOC 49-9051)

O\*Net In-Demand Occupation

*Sample of Reported Job Titles:* Maintenance Supervisor, Maintenance Foreman, Production Crew Supervisor, Maintenance Manager, Crew Leader, Airport Skilled Maintenance Supervisor, Electrical & Instrumentation Supervisor (E&I Supervisor), Electrical Supervisor, Facilities Manager.

### Highlights:

- Job prospects are expected to be good as many workers retire.
- A minimum of two to four years of work-related skill, knowledge, or experience is needed for this occupation.

*Occupational Description:* First-line supervisors or managers of mechanics, installers, and repairers within the utilities industry supervise and coordinate the activities of mechanics, installers, and repairers. These supervisors coordinate workload and work assignments and help to ensure a safe and productive work environment. Their work can vary depending on the work environment and the occupational duties of the workers they supervise.

### Duties often include:

- Determining schedules, sequences, and assignments for work activities, based on work priority, quantity of equipment and skill of personnel.
- Patrolling and monitoring work areas and examine tools and equipment in order to detect unsafe conditions or violations of procedures or safety rules.
- Monitoring employees' work levels and review work performance.
- Examining objects, systems, or facilities, and analyze information to determine needed installations, services, or repairs.
- Participating in budget preparation and administration, coordinating purchasing and documentation, and monitoring departmental expenditures.
- Counseling employees about work-related issues and assist employees to correct job-skill deficiencies.
- Requisitioning materials and supplies, such as tools, equipment, and replacement parts.
- Computing estimates and actual costs of factors such as materials, labor, and outside contractors.
- Interpreting specifications, blueprints, and job orders to construct templates and lay out reference points for workers.
- Conducting or arranging for worker training in safety, repair, and maintenance techniques, operational procedures, or equipment use.

*Qualifications and Skills:* The general skill sets for supervisors or managers of mechanics, installers, and repairers include mechanical and technical aptitude, ability to coordinate the work of others, leadership, communication skills, and the appropriate agency-specific knowledge of equipment, operations, and policies.

*Education and Training:* A minimum of two to four years of work-related skill, knowledge, or experience is needed for this occupation. Employees in this occupation usually need several years of work-related experience, on-the-job training, and/or vocational training. Some employers may prefer a four year bachelor's degree for this occupation.

## First-Line Supervisors or Managers Production and Operating Workers (SOC 49-9051)

O\*Net In-Demand Occupation

*Sample of reported job titles:* Production Supervisor, Manufacturing Supervisor, Shift Supervisor, Team Leader, Production Manager, Plant Manager, Assembly Supervisor, Department Manager, Converting Supervisor, Molding Supervisor.

### Highlights:

- Job prospects are expected to be good as many workers retire.
- Employees in this occupation usually need one or two years of training involving both on-the-job experience and informal training with experienced workers.

*Occupational Description:* First-line supervisors or managers of production and operating workers supervise and coordinate the activities of production and operating workers, such as inspectors, precision workers, machine setters and operators, assemblers, fabricators, and plant and system operators. Their work can vary depending on the work environment and the occupational duties of the workers they supervise.

### Duties often include:

- Enforcing safety and sanitation regulations.
- Directing and coordinating the activities of employees engaged in the production or processing of goods, such as inspectors, machine setters, and fabricators.
- Reading and analyzing charts, work orders, production schedules, and other records and reports, in order to determine production requirements and to evaluate current production estimates and outputs.
- Conferring with other supervisors to coordinate operations and activities.
- Planning and establishing work schedules, assignments, and production sequences to meet production goals.
- Inspecting materials, products, or equipment to detect defects or malfunctions.
- Demonstrating equipment operations and work and safety procedures to new employees, or assign employees to experienced workers for training.
- Observing work, and monitoring gauges, dials, and other indicators to ensure that operators conform to production or processing standards.
- Conferring with management or subordinates to resolve worker problems, complaints, or grievances.
- Interpreting specifications, blueprints, job orders, and policies and procedures for workers.

*Qualifications and Skills:* The general skill sets for supervisors or managers of production and operating workers include mechanical and technical aptitude, ability to coordinate the work of others, leadership, communication skills, and the appropriate agency-specific knowledge of equipment, operations, and policies.

*Education and Training:* Previous work-related skill, knowledge, or experience is required for this occupation. Employees in this occupation usually need one or two years of training involving both on-the-job experience and informal training with experienced workers. This occupation typically requires training in vocational schools, related on-the-job experience, or an associate's degree. Some employers may prefer a bachelor's degree.

**Industrial Machinery Mechanics (SOC 49-9041)**

O\*Net In-Demand Occupation

*Sample of Reported Job Titles:* Maintenance Mechanic, Maintenance Technician, Mechanic, Engineering Technician, Master Mechanic, Industrial Machinery Mechanic, Machine Adjuster, Overhauler, Industrial Electrician, Industrial Mechanic, Industrial Machinery Repairer, Maintenance Machinists.

*Highlights:*

- Industrial machinery mechanics usually need some education after high school plus experience working on specific machines.
- Applicants with broad skills in machine repair and maintenance should have favorable job prospects.

*Occupational Description:* Industrial machinery mechanics in the utilities industry install, repair, and maintain machinery in power generating stations, gas plants, and water treatment plants. They repair and maintain the mechanical components of generators, waterwheels, water-inlet controls, and piping in generating stations; steam boilers, condensers, pumps, compressors, and similar equipment in gas manufacturing plants; and equipment used to process and distribute water for public and industrial uses.

Industrial machinery mechanics are highly skilled workers who maintain and repair machinery in a plant or factory. To do this effectively, they must be able to detect minor problems and correct them before they become major. Machinery mechanics use technical manuals, their understanding of the equipment, and careful observation to discover the cause of the problem. Mechanics need years of training and experience to diagnose problems, but computerized diagnostic systems and vibration analysis techniques provide aid in determining the nature of the problem.

After diagnosing the problem, the industrial machinery mechanic disassembles the equipment to repair or replace the necessary parts. When repairing electronically controlled machinery, mechanics may work closely with electronic repairers or electricians who maintain the machine's electronic parts. Increasingly, mechanics are expected to have the electrical, electronics, and computer programming skills to repair sophisticated equipment on their own. Once a repair is made, mechanics perform tests to ensure that the machine is running smoothly.

Primary responsibilities of industrial machinery mechanics also often include preventive maintenance and the installation of new machinery.

*Work Environment:* In production facilities, these workers are subject to common shop injuries such as cuts, bruises, and strains. They also may work in awkward positions, including on top of ladders or in cramped conditions under large machinery, which exposes them to additional hazards. They often use protective equipment such as hardhats, safety glasses, steel-tipped shoes, hearing protectors, and belts.

Because factories and other facilities cannot afford to have machinery out of service for long periods, mechanics may be on call or assigned to work nights or weekends. Overtime is common among full-time industrial machinery mechanics; about 30 percent work over 40 hours a week.

*Qualifications and Skills:* Mechanical aptitude and manual dexterity are important for workers in this occupation. Good reading comprehension is also necessary to understand the technical manuals of a wide range of machines. And, good physical conditioning and agility are necessary because repairers sometimes have to lift heavy objects or climb to reach equipment.

*Education and Training:* Employers prefer to hire those who have taken courses in mechanical drawing, mathematics, blueprint reading, computer programming, or electronics. Entry-level machinery maintenance worker positions generally require a high school diploma, GED, or its equivalent. However, employers increasingly prefer to hire machinery maintenance workers with some training in industrial technology or an area of it, such as fluid power. Machinery maintenance workers typically receive on-the-job training lasting a few months to a year to perform routine tasks, such as setting up, cleaning, lubricating, and starting machinery. This training may be offered by experienced workers, professional trainers, or representatives of equipment manufacturers.

Industrial machinery mechanics usually need a year or more of formal education and training after high school to learn the growing range of mechanical and technical skills that they need. While mechanics used to specialize in one area, such as hydraulics or electronics, many factories now require every mechanic to have knowledge of electricity, electronics, hydraulics, and computer programming.

Workers can get this training in a number of different ways. Experience in the military repairing equipment, particularly ships, is highly valued by employers. Also, 2-year associate degree programs in industrial maintenance are good preparation. Some employers offer 4-year apprenticeship programs that combine classroom instruction with paid on-the-job-training. Other mechanics may start as helpers or in other factory jobs and learn the skills of the trade informally and by taking courses offered through their employer. Classroom instruction focuses on subjects such as shop mathematics, blueprint reading, welding, electronics, and computer training. In addition to classroom training, it is important that mechanics train on the specific machines they will repair.

**Pipelayers (SOC 47-2151)**

O\*Net In-Demand Occupation

*Sample of Reported Job Titles:* Pipe Layer, Pipelayer, Laborer, Equipment Operator, Construction Laborer, Machine Operator, Skilled Laborer

*Highlights:*

- Job opportunities should be very good, especially for workers with welding experience.
- Pipelayers comprise one of the largest and highest paid construction occupations.
- Apprenticeship programs generally provide the most comprehensive training, but many workers train in career or technical schools or community colleges.

*Occupational Description:* Pipelayers lay clay, concrete, plastic, or cast-iron pipe for storm or sanitation sewers, drains, water mains, and oil or gas lines. Before laying the pipe, pipelayers prepare and grade the trenches either manually or with machines. After laying the pipe, they weld, glue, cement, or otherwise join the pieces together.

Pipelayers work outdoors, sometime in remote areas, as they build the pipelines that connect sources of oil, gas, and chemicals with the users of these materials.

Because pipelayers frequently must lift heavy pipes, stand for long periods, and sometimes work in uncomfortable or cramped positions, they need physical strength and stamina. They also may have to work outdoors in inclement weather. In addition, they are subject to possible falls from ladders, cuts from sharp tools, and burns from hot pipes or soldering equipment.

Pipelayers engaged in construction generally work a standard 40-hour week; those involved in maintaining pipe systems, including those who provide maintenance services under contract, may have to work evening or weekend shifts and work on call. These maintenance workers may spend a lot of time traveling to and from worksites.

*Qualifications and Skills:* Applicants for union or non-union apprentice jobs must be at least 18 years old and in good physical condition. A drug test may be required. Apprenticeship committees may require applicants to have a high school diploma or its equivalent. Armed Forces training in pipelaying is considered very good preparation. In fact, people with this background may be given credit for previous experience when entering a civilian apprenticeship program. High school or postsecondary courses in shop, plumbing, general mathematics, drafting, blueprint reading, computers, and physics also are good preparation.

*Education and Training:* Most pipelayers train in career or technical schools or community colleges, and on the job through apprenticeships.

Apprenticeships—both union and non-union—consist of 4 or 5 years of paid on-the-job training and at least 144 hours of related classroom instruction per year. Classroom subjects include drafting and blueprint reading, mathematics, applied physics and chemistry, safety, and local plumbing codes and regulations. On the job, apprentices first learn basic skills, such as identifying grades and types of pipe, using the tools of the trade, and safely unloading materials. As apprentices gain experience, they learn how to work with various types of pipe and how to install different piping systems and plumbing fixtures. Apprenticeship gives trainees a thorough knowledge of all aspects of the trade. Although most pipelayers are trained through apprenticeship, some still learn their skills informally on the job.

## Power Plant Operators (SOC 51-8013)

*Sample of Reported Job Titles:* Auxiliary Operator, Control Operator, Operations and Maintenance Technician (O & M Technician), Unit Operator, Power Plant Operator, Boiler Operator, Control Center Operator, Control Room Operator, Operations and Maintenance Gas Turbine Technician, Plant Control Operator.

### *Highlights:*

- Job prospects are expected to be good as many workers retire and new plants are built.
- Most entry-level workers start as helpers or laborers, and several years of training and experience are required to become fully qualified.
- Familiarity with computers and a basic understanding of science and math is helpful for those entering the field.

*Occupational Description:* Power plant operators control, operate, and maintain machinery, including boilers, turbines, generators, and auxiliary equipment and often use control boards or semi-automatic equipment in power-generating plants.

Power plant operators control and monitor boilers, turbines, generators, and auxiliary equipment in power-generating plants. They distribute power demands among generators, combine the current from several generators, and monitor instruments to maintain voltage and regulate electricity flows from the plant. When power requirements change, operators start or stop generators and connect or disconnect them from circuits. They use computers to keep records of switching operations and loads on generators, lines, and transformers. Operators may also prepare reports of unusual incidents, malfunctioning equipment, or maintenance performed during their shift.

*Work Environment:* Operators in plants with automated control systems work mainly in a central control room and usually are called control room operators or control room operator trainees or assistants. In older plants, the controls for the equipment are not centralized; switchboard operators control the flow of electricity from a central point, while auxiliary equipment operators work throughout the plant, operating and monitoring valves, switches, and gauges.

Because electricity is provided around the clock, operators, distributors, and dispatchers usually work one of three 8-hour shifts or one of two 12-hour shifts on a rotating basis. Shift assignments may change periodically, so that all operators share less desirable shifts. Work on rotating shifts can be stressful and fatiguing because of the constant change in living and sleeping patterns.

*Qualifications and Skills:* Power plant operators generally need a combination of education, on-the-job training, and experience. Candidates with strong computer and technical skills are generally preferred.

*Education and Training:* Employers often seek recent high school graduates for entry-level operator positions. Workers with college or vocational school degrees will have more advancement opportunities.

Workers selected for training as power plant operators undergo extensive on-the-job and classroom instruction. Several years of training and experience are required for a worker to become a fully qualified control room operator. In addition to receiving initial training to become fully qualified as a power plant operator, most workers are given periodic refresher training. Refresher training usually is taken on plant simulators designed specifically to replicate procedures and situations that might be encountered at the trainee's plant.

## Water and Liquid Waste Treatment Plant and System Operators

*Sample of Reported Job Titles:* Water Treatment Plant Operator, Operator, Waste Water Operator, Process Operator, SCADA Operator (Supervisory Control and Data Acquisition Operator), Waste Water Treatment Plant Operator (WWTP Operator), Wastewater Treatment Plant Operator, Water System Operator.

### Highlights:

- Employment is concentrated in local government and private water, sewage, and other systems utilities.
- Because of a large number of upcoming retirements and the difficulty of filling these positions, job opportunities will be excellent.
- Completion of an associate degree or a 1-year certificate program increases an applicant's chances for employment and promotion.

*Occupational Description:* Water and wastewater treatment plant and system operators operate or control an entire process or system of machines, often through the use of control boards, to transfer or treat water or liquid waste.

Operators read, interpret, and adjust meters and gauges to make sure that plant equipment and processes are working properly. Operators control chemical-feeding devices, take samples of the water or wastewater, perform chemical and biological laboratory analyses, and adjust the amounts of chemicals, such as chlorine, in the water. They employ a variety of instruments to sample and measure water quality, and they use common hand and power tools to make repairs to valves, pumps, and other equipment.

Water and wastewater treatment plant and system operators increasingly rely on computers to help monitor equipment, store the results of sampling, make process-control decisions, schedule and record maintenance activities, and produce reports. In some modern plants, operators also use computers to monitor automated systems and determine how to address problems.

Occasionally, operators must work during emergencies. A heavy rainstorm, for example, may cause large amounts of wastewater to flow into sewers, exceeding a plant's treatment capacity. Emergencies also can be caused by conditions inside a plant, such as chlorine gas leaks or oxygen deficiencies. To handle these conditions, operators are trained to make an emergency management response and use special safety equipment and procedures to protect public health and the facility. During these periods, operators may work under extreme pressure to correct problems as quickly as possible. Because working conditions may be dangerous, operators must be extremely cautious.

The specific duties of plant operators depend on the type and size of the plant. In smaller plants, one operator may control all of the machinery, perform tests, keep records, handle complaints, and perform repairs and maintenance. Operators in this type of plant may have to be on-call 24 hours a day in case of an emergency. In medium-sized plants, operators monitor the plant throughout the night by working in shifts. In large plants, operators may be more specialized and monitor only one process. They might work with chemists, engineers, laboratory technicians, mechanics, helpers, supervisors, and a superintendent.

*Work Environment:* Water and wastewater treatment plant and system operators work both indoors and outdoors and may be exposed to noise from machinery and to unpleasant odors. Operators' work is physically demanding and often is performed in unclean locations; they must

pay close attention to safety procedures because of the presence of hazardous conditions, such as slippery walkways, dangerous gases, and malfunctioning equipment.

Plants operate 24 hours a day, 7 days a week. In small plants, operators may work during the day and be on-call in the evening, nights and weekends. Medium and large plants that require constant monitoring may employ workers in three 8-hour shifts. Because larger plants require constant monitoring, weekend and holiday work is generally required. Operators may be required to work overtime.

*Qualifications and Skills:* Water and wastewater treatment plant operators need mechanical aptitude and the ability to solve problems intuitively. They should also be competent in basic mathematics, chemistry, and biology. They must have the ability to apply data to formulas that determine treatment requirements, flow levels, and concentration levels. Some basic familiarity with computers also is necessary, as operators generally use them to record data. Some plants also use computer-controlled equipment and instrumentation.

*Education and Training:* A high school diploma usually is required for an individual to become a water or wastewater treatment plant operator. The completion of an associate degree or a 1-year certificate program in water quality and wastewater treatment technology increases an applicant's chances for employment and promotion because plants are becoming more complex. In some cases, a degree or certificate program can be substituted for experience, allowing a worker to become licensed at a higher level more quickly.

Trainees usually start as attendants or operators-in-training and learn their skills on the job under the direction of an experienced operator. They learn by observing and doing routine tasks such as recording meter readings, taking samples of wastewater and sludge, and performing simple maintenance and repair work on pumps, electric motors, valves, and other plant equipment. Larger treatment plants generally combine this on-the-job training with formal classroom or self-paced study programs.

*Licensure:* The Safe Drinking Water Act Amendments of 1996, enforced by the U.S. Environmental Protection Agency, specify national minimum standards for certification of public water system operators. Operators must pass an examination certifying that they are capable of overseeing water treatment operations. Mandatory certification is implemented at the State level, and licensing requirements and standards vary widely depending on the State. There are generally three to four different levels of certification, depending on the operator's experience and training. Higher levels qualify the operator to oversee a wider variety of treatment processes. Although relocation may mean having to become certified in a new jurisdiction, many States accept other States' certifications.

## Appendix C: California Community College Programs<sup>10</sup>

<b>0952.20 – Electrical</b> Installation, operation, maintenance and repair of electrical systems in buildings, including residential, commercial, and industrial electric power wiring and motors, controls, and electrical-distribution panels.				
College Name Local Title	Cert Units	Degree Units	Degree Type	Year Approved
Antelope Valley College Electrical Technology	34.00	34.00	S	2002
<b>Comment:</b> Includes fundamentals of electricity, electrical codes, residential and commercial wiring, motor controls, etc.				
Cerritos College Apprenticeship: Electrical Trades				1997
<b>Comment:</b> Apprenticeship only.				
Los Angeles Trade-Technical Electrical Construction and Maintenance	48.00	48.00	S	1970
<b>Comment:</b> A.S. degree (48) and certificate offered during day. A.A. degree (43) in "Construction Technologies, Electrical" offered at night and geared toward those working in the field.				
Los Angeles Trade-Technical Electrical Construction & Maintenance: Construction Tech	43.00	43.00	A	1970
Los Angeles Trade-Technical Electrical Cable Splicer Apprenticeship	18.00			1970
<b>Comment:</b> Apprenticeship only.				
Los Angeles Trade-Technical Voice Data Video and Fire Life Safety Technician	15.00			2006
Los Angeles Trade-Technical Electrical Const & Maint: Programmable Logic Controllers	9.00			2001
Los Angeles Trade-Technical Electrical Const & Maint: National Electrical Code	15.00			2001
Los Angeles Trade-Technical Electrical Const & Maint: Motor Control	15.00			2001
Los Angeles Trade-Technical Basic Electrical Trainee	17.00			2006
Palomar College Sound Technician Apprenticeship	48.00	48.00	A	2004
<b>Comment:</b> Sponsor; San Diego Electrical Training Trust Joint Apprenticeship Council. Installation of low voltage building systems such as access control, audio, fire/life safety, nurse call, intrusion detection, computer networks, closed circuit TV, fiber optic cable, etc.				
Palomar College Apprentice Sound & Communications Systems Installer	40.00	40.00	A	1995
<b>Comment:</b> Apprenticeship only. Mainly electrical wiring, also with some electronic equipment.				
Palomar College Apprentice Inside Wireman	56.00	56.00	A	2006
Palomar College Apprentice Electrician	56.00	56.00	A	1988

<sup>10</sup> California Community Colleges Chancellor's Office Program Inventory data.

<b>0952.20 – Electrical</b>				
Installation, operation, maintenance and repair of electrical systems in buildings, including residential, commercial, and industrial electric power wiring and motors, controls, and electrical-distribution panels.				
College Name Local Title	Cert Units	Degree Units	Degree Type	Year Approved
<b>Comment:</b> Apprenticeship only.				
San Diego City College Construction Trades - Electrical Trade Option	24.00	24.00	S	2000
<b>Comment:</b> Sponsor: Associated Builders and Contractors, San Diego.				
San Diego City College Construction Electronic Systems Technician Option	18.00	18.00	S	2006
Santiago Canyon College Apprenticeship: Industrial Electrical	30.00	30.00	B	2000
<b>Comment:</b> Apprenticeship only.				

<b>0708.20 – Computer Support</b>				
College Name Local Title	Cert Units	Degree Units	Degree Type	Year Approved
De Anza College CIS: System Support Services	45.00	45.00	A	1993
<b>Comment:</b> Includes applications, data communications and networking.				
Glendale College Computer Software Technician	32.00	32.00	S	1983
<b>Comment:</b> A blend of hardware skills and software skills.				
Glendale College Computer Support Technician	22.00			1997
<b>Comment:</b> Knowledge to troubleshoot problems or aid in user support.				
Long Beach City College Computer & Business Info Systems: Microcomp. Help Desk Tech	24.50	24.50	A	1995
<b>Comment:</b> Requires 13 unit core of business and information systems coursework.				
Ohlone College Network Tech. & Systems Admin.: Technical Support Specialist	24.00	33.00	S	2000
<b>Comment:</b> Frontline support to end-users. Degree requires programming electives and internship.				
Pasadena City College Computer Information Systems: Microcomputer Support	22.00	22.00	S	1992
<b>Comment:</b> Emphasis on applications.				
Sierra College CIS: Computer Support	22.00	22.00	B	2001
<b>Comment:</b> Emphasis on technical customer support services. Includes help desk concepts, Windows, Internet, software troubleshooting, etc. A.S. requires laboratory science.				

0934.40 – Electrical Systems and Power Transmission				
College Name Local Title	Cert Units	Degree Units	Degree Type	Year Approved
Los Angeles Trade-Technical Electrical Lineman Apprenticeship	18.00			1970
<b>Comment:</b> Apprenticeship only.				
San Bernardino Valley College Electrical Power Technology	46.00	46.00	S	1970
San Diego City College Electrical Systems and Power Transmission Lineman	30.00			1970
<b>Comment:</b> on 10/26/05 college indicated certificate was only showing as both apprenticeship and occupational. LM discovered a 2000 reference to it being both so reentered the historical approval.				
San Diego City College Electricity Lineman		30.00	S	2005
San Diego City College Electrical Control Systems	25.00			1981
<b>Comment:</b> Requires "Electricity" certificate plus 5 units specialty coursework.				
San Diego City College Electricity	25.00	25.00	S	1981
San Diego City College San Diego Gas & Electric Co. Apprenticeship	30.00	30.00	S	1981
<b>Comment:</b> Apprenticeship only.				
San Diego City College San Diego City Civil Service Communications Tech Apprentice	34.50	34.50	S	2004
<b>Comment:</b> Sponsored by City of San Diego Civil Service system. Installation, maintenance, and repair of communication equipment.				
Santiago Canyon College Apprenticeship: Power Lineman	24.00	24.00	B	2000
<b>Comment:</b> Apprenticeship only				

0934.40 – Electrical Systems and Power Transmission				
College Name Local Title	Cert Units	Degree Units	Degree Type	Year Approved
Glendale College Drafting/Electro-Mechanical Design	24.00	24.00	S	1970
Mission College Design Drafting: Electro/Mechanical	37.00	37.00	S	1991
Mission College Design Drafting: Electronic	38.00	38.00	S	1982
Orange Coast College Electro-Mechanical Design/Drafting	19.00	19.00	B	1972
Palomar College Electro-Mechanical Drafting and Design	32.00	32.00	A	1992
<b>Comment:</b> Drafting for the electronics industry.				

0934.40 – Electrical Systems and Power Transmission				
College Name Local Title	Cert Units	Degree Units	Degree Type	Year Approved
Ventura College Drafting: Electronic Drafting and Manufacturing	19.00	19.00	S	1970
<b>Comment:</b> Includes 11 unit drafting core, plus electronic drafting and electronic assembly (taken at Oxnard College).				

0958.00 – Water and Wastewater Technology				
College Name Local Title	Cert Units	Degree Units	Degree Type	Year Approved
Canyons, College of the Water Systems Technology		21.11	S	1986
<b>Comment:</b> Water distribution and wastewater program. Prepares for state certification tests.				
Citrus College Water Technology	20.00	18.00	S	1970
Los Angeles Trade-Technical Supply Water Systems Technology	22.00			1981
Los Angeles Trade-Technical Water Systems Technology: Supply Water Technology		22.00	S	1981
Mount San Antonio College Water Technology		21.00	S	1981
<b>Comment:</b> Focuses on water distribution; does not include wastewater.				
Palomar College Water Technology Education	31.00	31.00	A	1971
San Bernardino Valley College Water Supply Engineering	26.00	26.00	S	1975
<b>Comment:</b> Water supply and wastewater treatment. Degree is designed to provide coursework for Water Supply Engineering concentration with CSU Bakersfield's Environmental Resources Management baccalaureate major.				
Santiago Canyon College Water Distribution and Water Treatment Options	21.00	21.00	B	2000
<b>Comment:</b> Covers both water distribution and wastewater.				
Santiago Canyon College Wastewater/Environmental Sanitation	18.00	18.00	B	2000
<b>Comment:</b> More advanced than Water Utility Science, but covers similar topics; could lead to transfer.				