

# CALIFORNIA ENERGY EFFICIENCY SECTOR ALIGNMENT

AN ANALYSIS OF KEY OCCUPATIONS  
& EDUCATION PROGRAMS SUPPORTING  
ENERGY EFFICIENCY INDUSTRIES

*February 2012*

**emsi**

# EXECUTIVE SUMMARY

This report aims to provide a current data-driven picture of the relevant industries, occupations, and educational programs in the 19-county Pacific Gas & Electric (PG&E) service area. This information is a valuable tool to help ensure that the region's key industries have access to the right types of workers, and that these workers have received the right education/training and consequently the right skills to contribute to the economy. The information was developed to help PG&E and key stakeholder partners assess and improve preparedness of the region's energy efficiency workforce, with particular emphasis on services and products that will improve the energy efficiency of the commercial sector.

## Industries

Thirteen industries were selected by Workforce Incubator to make up the Energy Efficiency sector in this analysis. As a whole, the 13 industries are projected to grow 7%, an additional 8,908 jobs, by 2016. In comparison, the same 13 industries across all of California are expected to grow 5.1%, while all industries in the state are projected to grow 5.7%.

Of the group of key industries, engineering services is by far the strongest. It is the region's largest source of jobs in the Energy Efficiency sector, contributing 36% of the 135,779 jobs in these industries. It will also

create almost half of the sector's projected job growth. In addition, engineering services dominates the other industries in the group with over \$5 billion in exports in 2011. This is almost four times the amount of exports as the nearest industry and 65% of the overall total exports for the entire group of industries.

The key industries in this analysis generally require a skilled workforce. The three industries with the highest percentage of skilled workers in their workforce were architectural services, nonresidential electrical contractors, and nonresidential plumbing and HVAC contractors. Engineering services also requires a large number of skilled workers.

Overall, the characteristics of the 13 industries in the PG&E service area mirror the trend found in the 13 industries statewide. The industries tend to be larger, with regard to job numbers, in the counties bordering the south side of the San Francisco Bay. The four counties of San Francisco, Alameda, Contra Costa, and Santa Clara comprise 51% of all the jobs in these industries in the PG&E service area.

Table A: Sector Industries

NAICS CODE	DESCRIPTION
236210	Industrial Building Construction
236220	Commercial and Institutional Building Construction
238212	Nonresidential electrical contractors
238222	Nonresidential plumbing and HVAC contractors
333411	Air Purification Equipment Manufacturing
333412	Industrial and Commercial Fan & Blower Mfg.
333414	Heating Equipment (except Warm Air Furnaces) Mfg.
333415	Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing
335314	Relay and Industrial Control Manufacturing
541310	Architectural Services
541330	Engineering Services
541340	Drafting Services
541350	Building Inspection Services

## Educational Programs

In order to have a strong workforce a region should have the proper educational structure in place to pro-

vide the necessary training for workers to succeed. Table B displays the shortages and surpluses of graduates in each educational program area in the 19-county PG&E service area. These include the whole spectrum of program completions, from short-term certificates up to graduate education. Most differences are under 4% of the total job numbers in those occupations, indicating that large shortages or surpluses of graduates

do not currently exist in the region.

Within the region, graduates tend to come from a handful of counties: Santa Clara, Alameda, San Francisco, Sacramento, and Yolo. Demand also tends to be centered in those counties, with the exception of Yolo County, reflecting the need for workers in the Silicon Valley area and the state capital.

Graduates for several key occupations come from

**Table B: Shortages and Surpluses in the PG&E Service Area**

PROGRAM AREA	TOTAL JOBS	TOTAL NEW GROWTH	MEDIAN HOURLY WAGE	TOTAL ANNUAL OPENINGS	TOTAL GRADS	GAP/ SURPLUS
Sales & Marketing	222,171	(5,358)	\$29.51	8,206	797	(7,409)
Computer Science	234,423	19,732	\$44.06	9,948	2,789	(7,159)
Administrative Services	261,693	(11,034)	\$20.61	6,363	782	(5,581)
Accounting and Finance	149,811	7,174	\$33.16	5,846	1,520	(4,326)
Public Relations/ Advertising	25,097	1,602	\$30.03	1,154	226	(928)
General Construction	57,531	(8,253)	\$25.25	1,150	306	(844)
Human Resources	27,053	834	\$35.81	1,119	452	(667)
Industrial Mechanics	11,247	(600)	\$22.34	515	0	(515)
Carpentry	32,700	(14,505)	\$26.52	607	130	(477)
Electronics Repair Technician	23,017	(4,554)	\$21.34	622	150	(472)
Machinists	13,570	(2,295)	\$17.93	448	119	(329)
Plumbing	12,302	(3,107)	\$27.71	353	63	(290)
Quality Control	9,708	(1,185)	\$16.56	221	2	(219)
Electricians	19,255	(4,776)	\$28.23	668	520	(148)
Environmental Health Engineering	3,785	63	\$45.14	148	18	(130)
Electrical Engineering Technicians	8,325	(1,268)	\$25.34	237	149	(88)
Electromechanical Technology	3,897	(403)	\$21.60	118	45	(73)
Civil Engineering Technology	2,502	(96)	\$30.32	79	37	(42)
Environmental Engineering Tech.	754	16	\$24.52	28	0	(28)
Industrial Engineering	14,384	(212)	\$39.68	561	547	(14)
Aerospace Engineering Technology	242	(5)	\$28.94	10	0	(10)
Mechanical Engineering Technology	898	(66)	\$26.41	29	75	46
Urban Development	3,369	(14)	\$38.42	99	180	81
Architecture	9,186	(1,248)	\$29.14	273	375	102
General Engineering	4,694	(27)	\$45.04	163	340	177
Interior Design	3,783	(331)	\$19.12	188	470	282
Mechanical Engineering	18,851	(2,545)	\$44.03	648	1,018	370
Civil Engineering	19,548	(812)	\$45.21	565	1,040	475
Electrical Engineering	24,407	(2,369)	\$50.41	766	1,453	687
Energy/ HVAC Technology	8,553	(1,366)	\$25.59	200	1,347	1,147
Business Management	338,130	11,584	\$35.21	13,757	15,053	1,296
<b>TOTAL</b>	<b>1,564,884</b>	<b>(25,426)</b>	<b>\$32.10</b>	<b>55,088</b>	<b>30,003</b>	<b>(25,085)</b>

these educational hubs. For example, architectural graduates come mainly from Alameda County and UC Berkeley, with job openings centered in the South Bay area. Thirteen of the region's 19 counties have zero graduates in civil engineering. Sacramento County is the largest source of carpentry graduates in the region, while 15 of the 19 counties have no graduates in the carpentry trade. Only four counties produced graduates in plumbing in 2010, with Alameda County making up half of the supply numbers. Finally, Alameda and Santa Clara Counties supply 90% of the electrician graduates. These examples highlight the fact that much of the region's training needs are not being met locally, but depend on a handful of key programs at educational hubs in the region. While it is definitely an asset to have such strong educational centers, such a centralized system could potentially limit access to workers in more rural areas who want to enhance their training. Those pursuing a four-year degree may be willing to relocate, but for workers interested in maintaining their current position while earning an advanced certificate, having to commute to a program three counties away may be too difficult. It could be useful to consult with industry leaders as to whether they see this as an issue.

Most of the occupational groups in this analysis have experienced job losses in the last five years, likely in large part due to the recent recession. Those that have grown are mostly in the business realm: business management, accounting and finance, public relations and advertising, and human resources. Computer science has had the largest job growth since 2006. Supply has not been able to keep pace with growth, leaving a shortage of over 7,000 workers in the region each year. Half the annual openings are located in Santa Clara County, the heart of Silicon Valley. Overall, the region's educational centers are generally meeting the needs of regional employers for trained workers. If any problem areas do exist, they are slight shortages of graduates in computer science and accounting and finance.

**THE AVERAGE WAGE OF CRITICAL JOBS IN THE ENERGY EFFICIENCY SECTOR IS 40% MORE THAN ALL OTHER OCCUPATIONS IN GENERAL**

## Occupations

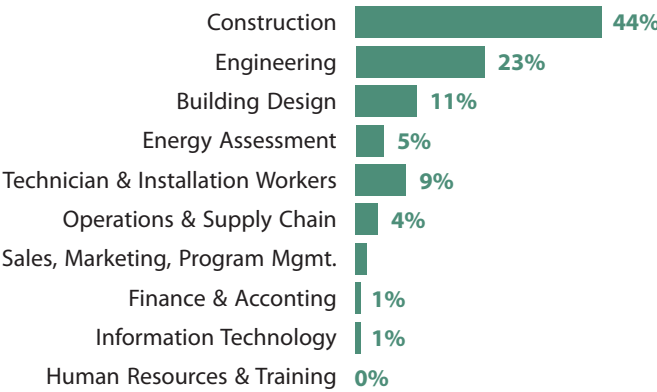
Development of the Energy Efficiency sector will be driven in large part by a strong supply of talented workers. The employees needed to sustain this sector come from a variety of fields—from construction and installation to sales and public relations. The

cutting-edge and highly technical nature of this sector requires employees with both business and scientific backgrounds.

This report analyzes 67 occupations which are organized into 10 categories. From 2006 to 2011, six of these skill groups suffered a net decline in employment in the PG&E service area across all industries. This should not be a source of alarm, however, as the growth rate of the Energy Efficiency sector over the next five years is expected to rebound well. In total, there are projected to be 2,699 annual openings in the Energy Efficiency sector for critical Energy Efficiency occupations. This

includes a blend of hands-on jobs (such as those in construction) and white-color jobs (such as those in engineering and building design). Additionally, most of this job loss occurred in industries outside of the Energy Efficiency sector, so some of the workers who

**Figure A: Distribution of Jobs in Energy Efficient Occupations in the Energy Efficiency Sector by Skill Group**



*Note: This does not include non-Energy Efficiency occupations, which make up roughly 40% of the jobs in the 13 Energy Efficient industries in the PG&E service region.*

are still unemployed as a result of the recession could be targeted for recruitment into the Energy Efficiency sector. Furthermore, the average wage of critical jobs in the Energy Efficiency sector is 40% more than all other occupations in general. This indicates that there is strong potential to draw workers in from lower-paying occupations.

Figure A illustrates the breakdown of the key occupations within the Energy Efficiency Sector. Construction and Engineering make up the lion's share of the key occupations' employment in the Energy Efficiency sector (44% and 26%, respectively). The greatest job growth in the sector in coming years will be predominately for engineers, high-level managers, and certain types of skilled craftsmen, such as plumbers and carpenters. Table C shows the top 20 Energy Efficiency occupa-

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tions within the 13 Energy Efficiency industries.

One of the challenges facing the energy Efficiency sector in coming years will be filling the void left by retiring workers from the baby-boomer generation. Within the region, it is estimated that more than half the workers in the critical Energy Efficiency occupations are 54 or older. The proportions are quite a bit higher among management and maintenance positions. Another issue is the predominance of men in these occupations. Of all employees in the critical Energy Efficiency occupations, 71% are male, which means that a large portion of the nation's workforce—women—is potentially underutilized by businesses in these industries. Regional gender trends in these occupations parallel the national energy efficiency ratios.

**Table C: In-Sector Employment for Top 20 Occupations**

SOC CODE	DESCRIPTION	2011 INDUSTRY JOBS	ANNUAL OPENINGS IN INDUSTRY	% OF ENERGY EFFICIENCY SECTOR	% OF OCCUPATION	SKILL CATEGORY
17-2051	Civil engineers	9,289	316	7%	52%	Engineering
47-2111	Electricians	10,601	294	8%	46%	Construction
17-1011	Architects, except landscape and naval	7,162	215	5%	76%	Design
47-2152	Plumbers, pipefitters, and steamfitters	5,985	132	4%	35%	Construction
11-9199	Managers, all other	2,375	109	2%	2%	Operations
47-1011	First-line supervisors/managers of construction trades and extraction workers	4,920	94	4%	18%	Construction
47-2031	Carpenters	6,800	82	5%	13%	Construction
11-1021	General and operations managers	2,521	81	2%	3%	Energy Assessment
11-9021	Construction managers	4,067	73	3%	17%	Energy Assessment
17-2199	Engineers, all other	2,297	64	2%	17%	Engineering
17-2141	Mechanical engineers	1,881	60	1%	22%	Engineering
49-9021	Heating, air conditioning, and refrigeration mechanics & installers	1,982	59	1%	27%	Tech & Install
11-9041	Engineering managers	2,277	59	2%	16%	Engineering
47-4011	Construction and building inspectors	1,581	46	1%	33%	Construction
47-2211	Sheet metal workers	1,721	45	1%	31%	Tech & Install
13-1051	Cost estimators	1,785	42	1%	19%	Construction
17-2071	Electrical engineers	1,489	42	1%	17%	Engineering
11-9021	Construction managers	4,067	41	3%	17%	Construction
13-2011	Accountants and auditors	893	32	1%	1%	Finance
13-1199	Business operation specialists, all other	853	29	1%	1%	Energy Assessment

Within the Energy Efficiency sector are many opportunities to develop and advance the current workforce. Entry and mid-level positions, such as customer service representatives, team assemblers, and maintenance and repair workers, are a tremendous source of prospective talent that already exists in house. Opportunities for advancement within the maintenance and installation skill group are also abundant. For instance, mid-level maintenance workers can move from earning an average of \$19 per hour to an average of \$32 by increasing their management skills and their knowledge of production and processing.

If the Energy Efficiency sector seeks to recruit from other industries, the best option is usually to draw workers with the same occupational classification. Multiple industries provide possibilities for recruiting. Four of the most compatible industries are in the real estate sector, with more than 71,000 compatible jobs available in categories such as sales, operations, and finance. Many residential contracting industries are still reeling from the housing bust, and are projected to continue their struggle over the next five years. This could be a key source of construction workers for the energy efficiency industry. The same could be true of agricultural workers. Computer operators and postmasters and mail superintendents could also become entry-level workers for the operations skills group. And the insurance industry hosts numerous occupations that could be transferred into the sales, marketing, and program management skills group, including insurance underwriters and brokerage clerks.

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## Conclusion

The industries in the Energy Efficiency sector have a positive economic outlook in the next five years. As these industries look to grow, they can look to significant educational centers to provide them with well-trained young workers. They can also provide training to raw talent in house or pursue lower-paid or dislocated workers from other industries that have laid off more employees in the recent recession. Utilizing these staffing and educational resources will assist these industries in strong economic growth.

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## About EMSI

EMSI provides economic data, analysis, and consulting services to workforce, education, and economic development professionals throughout the nation. Since 1995, EMSI has delivered high-quality, cost-effective services that promote economic growth, institutional change, and intelligent use of human, physical, and financial resources.

EMSI gathers and harmonizes data from nearly 90 state and federal sources, creating a comprehensive and current database that is unsurpassed for its breadth and detail. Industry, workforce, and demographic data are available at the state, county, and ZIP code levels. By combining dozens of data sources, EMSI can fill gaps in individual sources, such as those due to suppressions and missing proprietors, yielding a composite database that exploits the strengths of each source. The EMSI database is updated quarterly with the latest information from the Current Employment Statistics database.

# INTRODUCTION

as well as career pathway opportunities between key occupations. The analysis then compares the key occupations to the number of relevant graduates from local educational institutions, in order to determine whether the educational structure of the region is in place to support the occupational needs of the Energy Efficiency sector.

Pacific Gas & Electric (PG&E) is focused on improving the energy efficiency of commercial buildings in its 19-county service area. A key part of making such an initiative successful is understanding how well equipped the local labor market is in meeting the current and near-term projected demand of regional energy sector employers. PG&E has chosen 13 specific industries which it believes to have the greatest impact on the overall outcome of its efforts to improve efficiency. The workforce analysis undertaken here aims to provide a current data-driven picture of the relevant industries, occupations, and educational programs in order to assist PG&E in ensuring that the region's resources are aligned so that its key industries have access to qualified workers, and that these workers have received appropriate education/training and therefore have the right skills to contribute to the region's energy efficiency sector.

The analysis begins with an assessment of the key trends in the Energy Efficiency industry sector in the 19-county PG&E service area. It weighs the strengths and weaknesses of industries, using factors such as size, exports, growth (past and projected), and the comparative advantage of the industries in the region. Next, the analysis examines the key occupations within those industries. This involves consideration of the number of jobs, wages, and the amount of education/training/experience required for job candidates. It also determines the knowledge, skills, and abilities (KSAs) that are most important to those occupations,



# CHAPTER 1: INDUSTRY ANALYSIS

## Introduction

Data offer valuable insights into the successes and struggles of industries in today’s economy. This chapter examines both the historical and the projected performance of the region’s industries. The analysis looks at a number of characteristics of each industry: size and growth; projected growth; competitive effects; export orientation; average wage; and workforce skills. These are described in depth in Appendix A.

Each of these metrics provides a different perspective of industry performance for 13 six-digit industry codes, as classified by North American Industry Classification System (NAICS) categories, which make up the Energy Efficiency sector in this report.

## Jobs

Of the group of key energy efficiency industries, engineering services is the largest source of jobs in the region. It contributes 48,222 jobs, which is nearly 36% of the 135,779 jobs provided by the 13 industries. It has twice the number of jobs as the second largest industry, commercial and institutional building construction, and is projected to continue to have strong growth in

the next five years.

All the top producers lost jobs due to the economic downturn and the plunge in the commercial building real estate market. These 13 industries in particular lost a total of 16,835 jobs in the 19-county region, and 44,953 across the state as a whole. The trends of loss and growth in this region are similar in the rest of the state.

As a whole, the Energy Efficiency sector industries are projected to grow by 7%, or 8,908 jobs, by 2016. The top five industries will create 9,532 jobs, while the bottom eight will lose 624 jobs. Engineering services will create almost half of the new jobs. The second highest new job creation occurs in the nonresidential plumbing and HVAC contractors industry. These two performers will create 74% of all new jobs for this group of 13 industries in the region.

### Regional Competitiveness

Growth can be broken down into three component causes. The “national growth effect” is growth that can be attributed to the overall growth of the entire U.S. economy; the “industrial mix effect” is growth that can be attributed to positive trends in the specific industry

Table 1.1: Sector Industries

NAICS CODE	DESCRIPTION
236210	Industrial Building Construction
236220	Commercial and Institutional Building Construction
238212	Nonresidential electrical contractors
238222	Nonresidential plumbing and HVAC contractors
333411	Air Purification Equipment Manufacturing
333412	Industrial and Commercial Fan and Blower Manufacturing
333414	Heating Equipment (except Warm Air Furnaces) Manufacturing
333415	Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing
335314	Relay and Industrial Control Manufacturing
541310	Architectural Services
541330	Engineering Services
541340	Drafting Services
541350	Building Inspection Services

**Table 1.2: Job Numbers in the Key Industries in the PG&E Service Area**

NAICS CODE	DESCRIPTION	2011 JOBS	2011-2016 PROJECTED GROWTH	2011-2016 % JOB CHANGE	% OF TOTAL JOBS IN THE REGION	AVERAGE INDUSTRY EARNINGS
236210	Industrial Building Construction	2,333	(567)	-24%	1.72%	\$102,677
236220	Commercial and Institutional Building Construction	23,464	1,012	4%	17.28%	\$100,009
238212	Nonresidential electrical contractors	23,147	370	2%	17.04%	\$82,207
238222	Nonresidential plumbing and HVAC contractors	18,354	2,277	12%	13.52%	\$87,230
333411	Air Purification Equipment Manufacturing	127	(50)	-39%	0.09%	\$58,189
333412	Industrial and Commercial Fan and Blower Manufacturing	43	(22)	-50%	0.03%	\$84,492
333414	Heating Equipment (except Warm Air Furnaces) Mfg.	546	(135)	-25%	0.40%	\$109,098
333415	Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Mfg.	858	59	7%	0.63%	\$88,867
335314	Relay and Industrial Control Manufacturing	887	28	3%	0.65%	\$98,340
541310	Architectural Services	14,063	1,524	11%	10.36%	\$79,277
541330	Engineering Services	48,222	4,349	9%	35.51%	\$103,234
541340	Drafting Services	1,979	(220)	-11%	1.46%	\$25,278
541350	Building Inspection Services	1,776	284	16%	1.31%	\$60,738
<b>TOTAL</b>		<b>135,799</b>	<b>8,908</b>	<b>6.6%</b>		

**Table 1.3: Sources of Regional Job Change, 2006–2011**

NAICS CODE	DESCRIPTION	JOB CHANGE DUE TO NATIONAL GROWTH EFFECT	JOB CHANGE DUE TO INDUSTRIAL MIX EFFECT	JOB CHANGE DUE TO REGIONAL COMPETITIVENESS EFFECT
541330	Engineering Services	(259)	351	(2399)
236220	Commercial and Institutional Building Construction	(148)	(4911)	(366)
238212	Nonresidential electrical contractors	(142)	(3347)	(998)
238222	Nonresidential plumbing and HVAC contractors	(100)	(1668)	686
541310	Architectural Services	(84)	(3072)	764
236210	Industrial Building Construction	(19)	(431)	(936)
541340	Drafting Services	(13)	(481)	(69)
541350	Building Inspection Services	(8)	86	156
335314	Relay and Industrial Control Manufacturing	(4)	(16)	216
333415	Air-Conditioning & Warm Air Heating Equipment and Commercial & Industrial Refrigeration Equipment Mfg.	(4)	(122)	270
333414	Heating Equipment (except Warm Air Furnaces) Mfg.	(1)	(39)	331
333411	Air Purification Equipment Manufacturing	(1)	(8)	(31)
333412	Industrial and Commercial Fan and Blower Mfg.	(0)	(5)	(16)

at a national level; and lastly the “regional competitiveness effect” is growth that cannot be explained by either overall or industry-specific trends, and can thus be attributed to a competitive effect in the region.<sup>1</sup>

Past job changes in the region’s key industries ap-

pear to be driven mostly by factors within the industries themselves, and are not specific to the counties in the PG&E service area. Despite the recession, some of the industries gained jobs—or rather, did not lose as many jobs as expected—because of their competitiveness effect. Architectural services, for example, lost an estimated 84 jobs due to currents in the overall national economy, and 3,072 jobs due to the health

<sup>1</sup> A region’s competitive advantage could be partially due to local policy initiatives as well as any number of things unique to the region. The data, however, shed no light on causation.

of the architectural service industry as a whole. But because of its local strength, the region was able to keep 764 jobs that would have been lost as a result of the other two forces.

#### Exports

An export-based economy enriches regions by bringing in outside wealth to stimulate growth. In the PG&E service area, engineering services dominates the other industries in the group with over \$5 billion in exports—almost four times the amount as the nearest industry, and 65% of the total exports. The second largest industry is architectural services. Together, these top two industries account for over 80% of all exports. Their strong exports bring new resources into the region and increase the region’s economic growth.

#### Skilled Workers

The key industries reviewed in this analysis generally require a skilled workforce.<sup>2</sup> The three industries with the highest percentage of skilled workers in their workforce were architectural services, nonresidential electrical contractors, and nonresidential plumbing and HVAC contractors. These three industries provide 41% of the jobs across the region. Engineering services has only the seventh-highest percentage of skilled workers, but as it is the largest overall source of jobs in the group of key industries, its need for skilled workers is almost equal to that of the top three. The majority of jobs in these industries require well-trained workers.

#### Variations Across Counties

From an industry perspective, PG&E’s service region is very indicative of the state. The characteristics of the 13 industries in the 19-county region matched closely with that of the 13 industries statewide. However, variations do exist.

In most individual counties as well as the PG&E service region, engineering services is the strongest performing industry. It contributes the most jobs (49%), has the highest industry average wage (\$36.68 per hour), and the largest volume of exports. The only

<sup>2</sup> Skilled workers are defined as those in occupations that O\*NET places in Job Zone 3 or higher. The job zones, levels 1–5, rate the level of skills required to complete the tasks common to the occupation.

**Table 1.4: Exports by Industry**

NAICS CODE	DESCRIPTION	EXPORTS (K)
541330	Engineering Services	\$5,533,687
541310	Architectural Services	\$1,389,242
236220	Commercial and Institutional Building Construction	\$460,682
238212	Nonresidential electrical contractors	\$340,164
238222	Nonresidential plumbing and HVAC contractors	\$290,605
541350	Building Inspection Services	\$153,695
333415	Air-Conditioning & Warm Air Heating Equipment and Commercial & Industrial Refrigeration Equipment Mfg.	\$102,532
333414	Heating Equipment (except Warm Air Furnaces) Manufacturing	\$84,414
335314	Relay and Industrial Control Mfg.	\$73,700
541340	Drafting Services	\$70,257
236210	Industrial Building Construction	\$47,413
333411	Air Purification Equipment Mfg.	\$5,850
333412	Industrial and Commercial Fan and Blower Manufacturing	\$2,933

**Table 1.5: Percentage of Skilled Workers Employed in Industries**

NAICS CODE	DESCRIPTION	2011 JOBS	% SKILLED WORKERS IN INDUSTRY
541310	Architectural Services	14,063	75%
238212	Nonresidential electrical contractors	23,147	73%
238222	Nonresidential plumbing and HVAC contractors	18,354	62%
236220	Commercial and Institutional Building Construction	23,464	53%
236210	Industrial Building Construction	2,333	53%
541340	Drafting Services	1,979	49%
541350	Building Inspection Services	1,776	48%
541330	Engineering Services	48,222	47%
335314	Relay and Industrial Control Manufacturing	887	21%
333411	Air Purification Equipment Manufacturing	127	15%
333414	Heating Equipment (except Warm Air Furnaces) Mfg.	546	15%
333415	Air-Conditioning & Warm Air Heating Equipment and Commercial & Industrial Refrigeration Equipment Mfg.	858	15%
333412	Industrial and Commercial Fan and Blower Mfg.	43	14%

county where engineering services is not an extremely large component of the industries' regional effects was El Dorado County.

Overall, the industries contribute 135,799 jobs to the region's economy. More than 95% of jobs are found in five industries—engineering services, commercial and institutional building construction, nonresidential electrical contractors, nonresidential plumbing and HVAC contractors, and architectural services. As illustrated in Table 1.6, four of the 19 counties produce the majority of the jobs and seven counties produce over 75% of the jobs.

Across all 19 counties, the growth in building inspection services is expected to be 13%. In Contra Costa and San Francisco, however, job growth in this industry is expected to be 24% and 42%, respectively, roughly two and three times the region's projected percentage growth.

From a job growth standpoint, Kern County stands out, as it gained jobs in the sector between 2006 and

Figure 1.1: Employment and Projections – Top 5 Industries

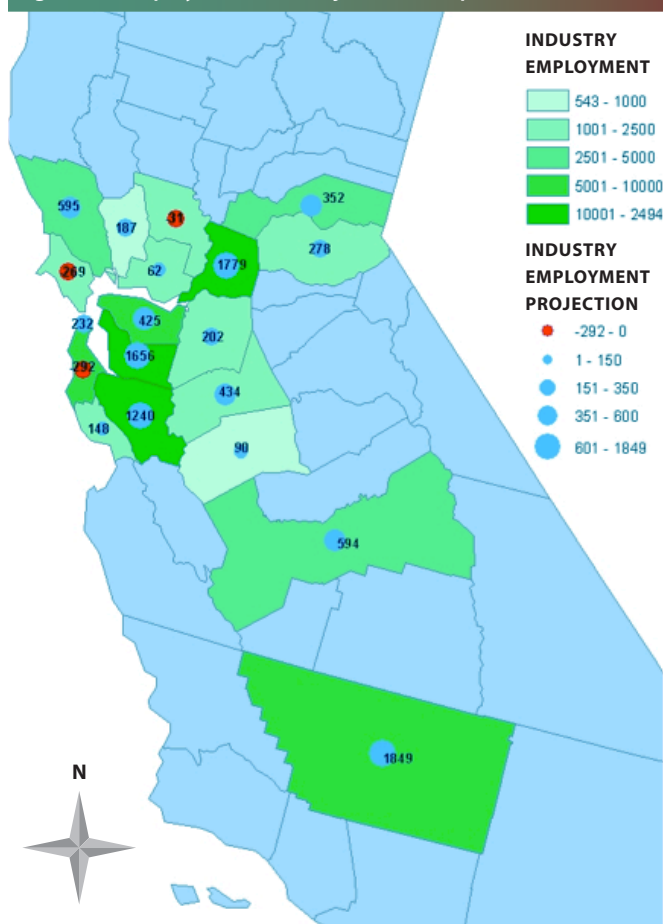


Table 1.6: Job Growth by County

COUNTY	2011 JOBS	06-11 JOB CHANGE	11-16 JOB CHANGE
Alameda	19,814	(352)	1,559
Contra Costa	11,208	(514)	383
El Dorado	2,222	(507)	306
Fresno	5,229	(1,325)	572
Kern	7,418	384	1,828
Marin	2,647	(437)	(293)
Merced	588	(192)	81
Napa	1,224	(353)	248
Placer	3,750	(1,182)	342
Sacramento	15,111	(772)	1,681
San Francisco	15,526	(3,868)	244
San Joaquin	2,646	(1,542)	213
San Mateo	8,275	(1,032)	(341)
Santa Clara	26,728	(915)	1,015
Santa Cruz	1,955	(305)	146
Solano	2,235	(895)	(53)
Sonoma	4,685	(818)	558
Stanislaus	2,887	(907)	428
Yolo	1,649	(1,302)	(11)
<b>TOTAL</b>	<b>135,799</b>	<b>(16,385)</b>	<b>8,905</b>

2011, and also has a projected job growth increase of 25%. Half of that job growth in Kern County will occur in engineering services. Sacramento, Alameda, and Santa Clara Counties are also projected to add over 1,000 jobs in these industries over the next five years.

Only Alameda, Santa Clara, Sacramento, and Kern Counties are expected to overcome the job losses from the recent economic downturn by 2016. Yolo, Solano, and Marin Counties are all projected to experience additional jobs losses from 2011 to 2016.

## CHAPTER 2: EDUCATIONAL GAP ANALYSIS

In order to have a strong workforce a region should have the proper educational structure in place to provide the necessary training for workers to succeed. A gap analysis highlights the areas where the educational system is either producing too many or too few trained graduates for the staffing needs of local employers. The two main metrics used in the production of an educational gap analysis are average annual job openings and 2010 program completers. These are used to represent occupational demand and workforce supply. “Annual openings” refer to the number of job openings that will be available to workers in the geographic area within a one-year time period. The measure includes the projected numbers of new and replacement jobs in an occupation. New jobs are entirely new positions that will become available due to economic growth, and replacement jobs are positions that become available due to events such as retirement, firings, out-migration, and other events. “Program completers,” or graduates, refer to the number of individuals within the geographic area who completed programs that train workers to enter the occupational group being analyzed.

Since average annual openings and 2010 completers are used as representative measurements of supply and demand, the difference between the two metrics represents the anticipated training gap or surplus of workers for each program. The key figure labeled “Gap/Surplus” is either a deficit or an oversupply of trained workers. A shortage of trained workers shows up as a negative number, indicating that the number of

completers produced in the latest academic year is not sufficient to meet the needs of the regional economy. Further information on methodology can be found in Appendix B.

There are, however, additional issues to keep in mind when examining the data. California has a vast, multi-level education system which serves the entire state. The University of California system in particular draws students from across the nation and around the world, as does Stanford University. It is highly likely that not all graduates stay within the region, the state, or even the nation. Consequently, surpluses within a county or even the PG&E service area may be smaller than they appear, while shortages could be larger than the data indicate.

A second issue has the opposite effect. Due to the recent recession, California has a larger-than-usual number of people looking for work, and these unemployed workers compete for the annual openings in their field along with new graduates. Where there is a surplus, the unemployed will make that surplus even larger, while where there is a shortage they will help to fill the gap. While the data are not available to quantify these effects, they are still important considerations to keep in mind.

A third issue that arises is that of apprenticeships. The graduate numbers in this analysis come from the U.S. Department of Education’s Integrated Postsecondary Education Data System, which does not include formal apprenticeship programs. However, data provided by the U.S. Department of Labor<sup>3</sup> show that this does not have an overly large impact on California. The largest apprenticeship programs in the state in 2010 were for electricians (1,015) and plumbers (286).

Table 2.1 displays the shortages and surpluses in each program area in the 19-county PG&E service area. Most differences are under 4% of the total job numbers in those occupations, indicating that large shortages and surpluses do not currently exist.

Within the region, graduates tend to come from a handful of counties: Santa Clara (Stanford University, San Jose State University), Alameda (UC Berkeley), San Francisco (UC San Francisco, San Francisco

<sup>3</sup> Registered Apprenticeship Partners Information Management Data System (RAPIDS), 2010.

**Table 2.1: Shortages and Surpluses in the PG&E Service Area**

PROGRAM AREA	TOTAL JOBS	TOTAL NEW GROWTH	MEDIAN HOURLY WAGE	TOTAL OPENINGS	TOTAL GRADS	GAP/ SURPLUS
Sales & Marketing	222,171	(5,358)	\$29.51	8,206	797	(7,409)
Computer Science	234,423	19,732	\$44.06	9,948	2,789	(7,159)
Administrative Services	261,693	(11,034)	\$20.61	6,363	782	(5,581)
Accounting and Finance	149,811	7,174	\$33.16	5,846	1,520	(4,326)
Public Relations/ Advertising	25,097	1,602	\$30.03	1,154	226	(928)
General Construction	57,531	(8,253)	\$25.25	1,150	306	(844)
Human Resources	27,053	834	\$35.81	1,119	452	(667)
Industrial Mechanics	11,247	(600)	\$22.34	515	0	(515)
Carpentry	32,700	(14,505)	\$26.52	607	130	(477)
Electronics Repair Technician	23,017	(4,554)	\$21.34	622	150	(472)
Machinists	13,570	(2,295)	\$17.93	448	119	(329)
Plumbing	12,302	(3,107)	\$27.71	353	63	(290)
Quality Control	9,708	(1,185)	\$16.56	221	2	(219)
Electricians	19,255	(4,776)	\$28.23	668	520	(148)
Environmental Health Engineering	3,785	63	\$45.14	148	18	(130)
Electrical Engineering Technicians	8,325	(1,268)	\$25.34	237	149	(88)
Electromechanical Technology	3,897	(403)	\$21.60	118	45	(73)
Civil Engineering Technology	2,502	(96)	\$30.32	79	37	(42)
Environmental Engineering Technology	754	16	\$24.52	28	0	(28)
Industrial Engineering	14,384	(212)	\$39.68	561	547	(14)
Aerospace Engineering Technology	242	(5)	\$28.94	10	0	(10)
Mechanical Engineering Technology	898	(66)	\$26.41	29	75	46
Urban Development	3,369	(14)	\$38.42	99	180	81
Architecture	9,186	(1,248)	\$29.14	273	375	102
General Engineering	4,694	(27)	\$45.04	163	340	177
Interior Design	3,783	(331)	\$19.12	188	470	282
Mechanical Engineering	18,851	(2,545)	\$44.03	648	1,018	370
Civil Engineering	19,548	(812)	\$45.21	565	1,040	475
Electrical Engineering	24,407	(2,369)	\$50.41	766	1,453	687
Energy/ HVAC Technology	8,553	(1,366)	\$25.59	200	1,347	1,147
Business Management	338,130	11,584	\$35.21	13,757	15,053	1,296
<b>TOTAL</b>	<b>1,564,884</b>	<b>(25,426)</b>	<b>\$32.10</b>	<b>55,088</b>	<b>30,003</b>	<b>(25,085)</b>

State), Sacramento (25 institutions), and Yolo (UC Davis). Demand also tends to be centered in those counties, reflecting the need for workers in the Silicon Valley area and the state capital.

Some of the largest shortages in the region appear to exist in the sales and marketing and administrative service program areas. However, in these cases the data may not accurately reflect what is happening on the

ground. Demand may be being met by outside sources. In sales and marketing, the data show that not even 10% of the annual openings are filled by graduates in relevant educational programs. This suggests that graduates in other majors may be meeting employers' demand. A similar issue may be present in administrative services, or these jobs may be taken by workers with no higher education, as many positions require









## CHAPTER 3: OCCUPATION ANALYSIS

Development of the Energy Efficiency sector will be driven not only by demand and regional competitive advantages but also by a strong supply of talented workers. The employees needed to sustain this sector come from a variety of fields—from construction and installation to sales and public relations. The cutting-

edge and highly technical nature of this sector requires more employees with business and scientific backgrounds than workers in the traditional energy sector.

This chapter focuses on the occupations that are critical to the Energy Efficiency sector. This list of 67 occupations was developed by Workforce Incubator for PG&E, and is organized into 10 categories according to each occupation's type of business and the main duties of its workers. Specific goals in this chapter are to (1) quantify the critical Energy Efficiency workers in the PG&E service area, including those working in energy and those working in other industries; (2) report employment changes among these occupations over the past five years, and project employment over the next five years; (3) indicate which special knowledge, skills, and abilities the critical Energy Efficiency workers need; (4) display potential career pathways within the Energy Efficiency sector; and (5) explore career transition opportunities from declining occupations and industries into the Energy Efficiency Sector.

*Table 3.1: Summary of Critical Energy Efficiency Skill Groups Across All Industries*

CATEGORY	2006 JOBS	2011 JOBS	2016 JOBS	06-'11 CHANGE	06-'11 % CHANGE	11-'16 CHANGE	11-'16 % CHANGE	PROJECTED ANNUAL OPENINGS	CURRENT HOURLY EARNINGS
Energy Assessment	253,236	250,590	266,429	(2,646)	(1%)	15,839	6%	8,746	\$37.39
Technician & Installation Workers	212,616	187,701	189,163	(24,915)	(12%)	1,462	1%	4,756	\$20.91
Sales, Marketing, Program Mgt.	191,358	179,860	190,715	(11,498)	(6%)	10,855	6%	7,068	\$31.10
Construction	208,897	157,820	164,649	(51,077)	(24%)	6,829	4%	4,246	\$28.96
Operations & Supply Chain	128,204	137,054	148,253	8,850	7%	11,199	8%	5,808	\$24.78
Engineering	100,657	96,415	99,085	(4,242)	(4%)	2,670	3%	3,116	\$48.57
Finance & Accounting	82,127	91,318	101,188	9,191	11%	9,870	11%	3,547	\$28.38
Information Technology	65,065	69,866	78,240	4,801	7%	8,374	12%	3,168	\$32.21
Building Design	21,388	19,757	21,160	(1,631)	(8%)	1,403	7%	734	\$27.53
Human Resources & Training	8,404	8,768	9,627	364	4%	859	10%	396	\$33.82
<b>Total</b>	<b>1,241,671</b>	<b>1,174,062</b>	<b>1,242,028</b>	<b>(67,609)</b>	<b>(5%)</b>	<b>67,966</b>	<b>6%</b>	<b>41,092</b>	<b>\$31.04</b>

*Note: Grand total does not equal the sum of all rows because some occupations are present in multiple categories*

**Energy Efficient Occupational Employment Across All Industries**

This section focuses on the overall employment of these occupations across all 1,019 NAICS codes, while the following section focuses on the employment for these occupations just within the 13 NAICS codes that compose the Energy Efficiency sector in this analysis. Starting with the overall employment data for these key occupations across all 1,019 NAICS codes first provides an overview of how these occupations have fared recently, and how they are projected to change, outside of the energy efficiency context. This is important because some occupations may be declining on the whole, but increasing within the energy industry, or vice versa. These macro-level changes may indicate career transition options from industries or occupa-

tions that are declining into areas that are growing.

A summary that includes recent employment change, projected employment, projected annual openings and current annual earnings in all industries for the Energy Efficiency occupation groups is shown in Table 3.1. Detailed data for each occupational group are shown in Appendix D.

There are several points to note about these data. First, six of the 10 skill groups experienced a net decline in employment between 2006 and 2011. In total more than 67,000 jobs, or 5%, were lost in these categories. Those workers who are still unemployed as a result of the recession may be targeted for recruitment into the Energy Efficiency sector. Second, the average wages of critical jobs in the Energy Efficiency sector industries are 40% higher than in the same occupations



in other industries. This indicates that there is strong potential to draw workers in from lower-paying occupations. Third, the meager overall projected growth rates within several key skill groups, such as construction (4%) and engineering (3%), mean that there will be many skilled workers from these categories who may be available to work in other industries.

### County-by-County Occupational Analysis

Table 3.2 and the following maps display how employment among all of the critical Energy Efficiency occupations has changed in each of the region's counties between 2006 and 2011, as well as how it is projected to change between 2011 and 2016. Figure 3.1 and Table 3.2 highlight the counties that are likely to have the highest number of people looking for work in these fields.

The recession took its toll on Energy Efficiency occupations within the region, with some counties more

heavily affected than others. Three of the counties with the largest population—Alameda, Sacramento and Contra Costa—all lost significant amounts of workers. Conversely, Santa Clara, the most populous county in the region, contracted by only 1% among critical Energy Efficiency occupations. Looking forward, however, projections are optimistic for most counties within the area, particularly for the Bay Area counties.

Occupational growth of the top engineering occupations is projected to occur predominately in Sacramento and Kern Counties, whereas Santa Clara County is anticipated to lose a small fraction of its current large supply of engineers. Employment for architects, which declined sharply during the recession, is projected to increase within nearly all counties in the region. The changes in these occupations are illustrated in Figures 3.3 and 3.4.

**Table 3.2: Total Energy Efficiency Employment and Employment Change by County**

COUNTY NAME	2006 JOBS	2011 JOBS	2016 JOBS	06-'11 CHANGE	06-'11 % CHANGE	11-'16 CHANGE	11-'16 % CHANGE
Alameda	171,068	157,912	165,857	(13,156)	(8%)	7,945	5%
Contra Costa	87,945	79,464	83,118	(8,481)	(10%)	3,654	5%
El Dorado	16,006	14,533	16,431	(1,473)	(9%)	1,898	13%
Fresno	55,846	50,389	53,575	(5,457)	(10%)	3,186	6%
Kern	45,412	45,153	49,433	(259)	(1%)	4,280	9%
Marin	30,058	29,096	31,106	(962)	(3%)	2,010	7%
Merced	10,016	9,003	9,650	(1,013)	(10%)	647	7%
Napa	13,566	12,309	13,518	(1,257)	(9%)	1,209	10%
Placer	32,294	28,031	31,077	(4,263)	(13%)	3,046	11%
Sacramento	134,423	121,059	128,504	(13,364)	(10%)	7,445	6%
San Francisco	120,580	124,627	132,860	4,047	3%	8,233	7%
San Joaquin	35,623	31,348	33,329	(4,275)	(12%)	1,981	6%
San Mateo	87,069	85,442	90,528	(1,627)	(2%)	5,086	6%
Santa Clara	260,853	257,894	266,073	(2,959)	(1%)	8,179	3%
Santa Cruz	21,261	19,918	20,718	(1,343)	(6%)	800	4%
Solano	26,058	22,387	25,430	(3,671)	(14%)	3,043	14%
Sonoma	46,355	43,161	45,523	(3,194)	(7%)	2,362	5%
Stanislaus	28,089	24,507	26,070	(3,582)	(13%)	1,563	6%
Yolo	19,150	17,829	19,230	(1,321)	(7%)	1,401	8%
<b>Total</b>	<b>1241671</b>	<b>1174062</b>	<b>1242028</b>	<b>(67,609)</b>	<b>(5%)</b>	<b>67,966</b>	<b>6%</b>

Figure 3.3: County-by-County Employment & Projections for Top 5 Engineering Occupations

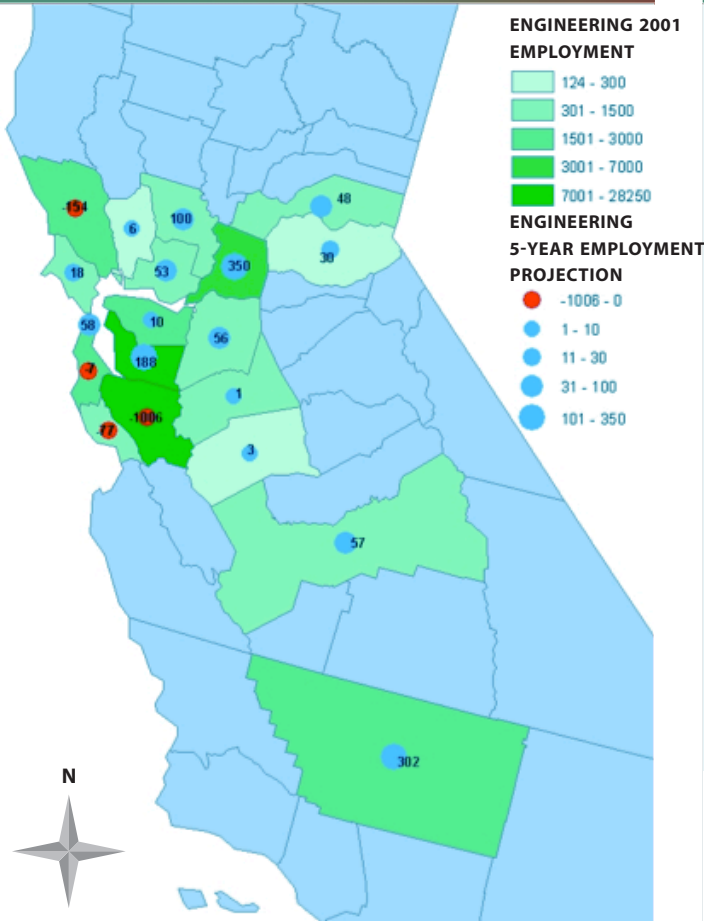
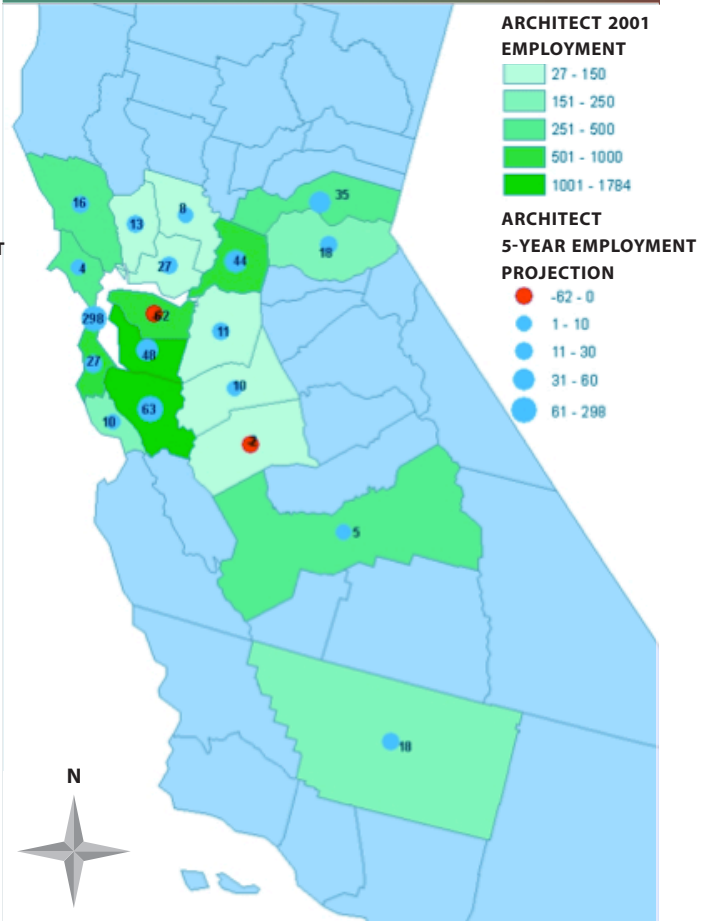


Figure 3.4: County-by-County Employment & Projections for Architects



## Occupational Employment within the Energy Efficiency Sector

The previous section provided an outline of how employment is changing for the critical Energy Efficiency occupations in all industries across the region. This section focuses on the employment opportunities for the critical occupations just within the 13 industries in the Energy Efficiency sector. Examining employment just within the sector can provide guidance by showing which occupational types make up the largest proportion of jobs in the Energy Efficiency sector, revealing the “niche” positions that could be harder to staff, and indicating the number of annual openings expected to be available in each skill category and occupation within the sector. In addition, it highlights the number of workers from the same occupational classifications who are currently working in other industries but

Table 3.3: Energy Efficiency Occupations within the Energy Efficiency Sector by Skill Category

CATEGORY	2011 INDUSTRY JOBS	ANNUAL OPENINGS IN INDUSTRY	% OF TOTAL KEY OCCUPATIONS IN INDUSTRY
Construction	35,858	1,010	44%
Engineering	18,969	607	23%
Building Design	8,447	269	10%
Energy Assessment	3,942	136	5%
Technician & Installation Workers	7,632	204	9%
Operations & Supply Chain	3,239	140	4%
Sales, Marketing, Program Mgt.	1,152	42	1%
Finance & Acctg.	936	34	1%
Information Tech.	844	37	1%
Human Resources & Training	55	3	0%
<b>Grand Total</b>	<b>81,074</b>	<b>2,699</b>	<b>n/a</b>

Note: Grand total does not equal the sum of all rows because some occupations are present in multiple categories

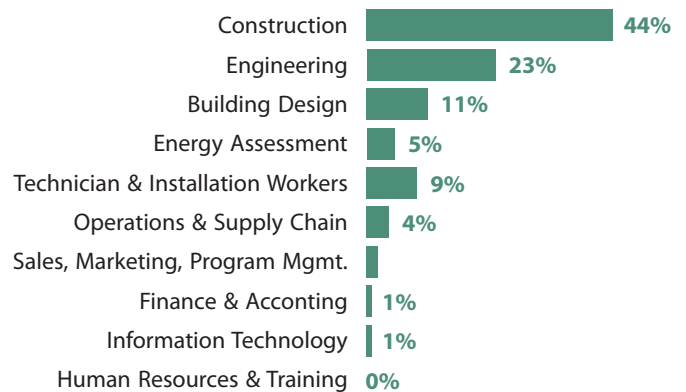
**Table 3.4: In-Sector Employment for Top 20 Occupations**

SOC CODE	DESCRIPTION	2011 INDUSTRY JOBS	ANNUAL OPENINGS IN INDUSTRY	% OF ENERGY EFFICIENCY SECTOR	% OF OCCUPATION	SKILL CATEGORY
17-2051	Civil engineers	9,289	316	7%	52%	Engineering
47-2111	Electricians	10,601	294	8%	46%	Construction
17-1011	Architects, except landscape and naval	7,162	215	5%	76%	Design
47-2152	Plumbers, pipefitters, and steamfitters	5,985	132	4%	35%	Construction
11-9199	Managers, all other	2,375	109	2%	2%	Operations
47-1011	First-line supervisors/managers of construction trades and extraction workers	4,920	94	4%	18%	Construction
47-2031	Carpenters	6,800	82	5%	13%	Construction
11-1021	General and operations managers	2,521	81	2%	3%	Energy Assessment
11-9021	Construction managers	4,067	73	3%	17%	Energy Assessment
17-2199	Engineers, all other	2,297	64	2%	17%	Engineering
17-2141	Mechanical engineers	1,881	60	1%	22%	Engineering
49-9021	Heating, air conditioning, and refrigeration mechanics and installers	1,982	59	1%	27%	Tech & Install
11-9041	Engineering managers	2,277	59	2%	16%	Engineering
47-4011	Construction and building inspectors	1,581	46	1%	33%	Construction
47-2211	Sheet metal workers	1,721	45	1%	31%	Tech & Install
13-1051	Cost estimators	1,785	42	1%	19%	Construction
17-2071	Electrical engineers	1,489	42	1%	17%	Engineering
11-9021	Construction managers	4,067	41	3%	17%	Construction
13-2011	Accountants and auditors	893	32	1%	1%	Finance
13-1199	Business operation specialists, all other	853	29	1%	1%	Energy Assessment

who could be targeted for positions in the Energy Efficiency sector.

Two categories featured throughout this section require a bit more explanation. “Percentage of energy efficiency sector” shows the proportion of total employment within the sector that is attributable to each skill category. For example, per Table 3.4, civil engineering makes up 7% of the jobs in the Energy Efficiency sector. This measurement is helpful for determining the occupations that make up the largest share of the sector. The “percentage of occupation” category shows the proportion of jobs within that occupation code that are staffed within the energy efficiency sector. Therefore, 23% of all construction jobs are found in the Energy Efficiency industries. This measurement is helpful for determining how saturated each occupation is within the Energy Efficiency sector. Some SOC codes with relatively low employment can have a very high percentage of occupation, indicating that this occupation is particularly unique to the sector.

**Figure 3.5: Distribution of Jobs in the Energy Efficient Occupations in the Energy Efficiency Sector by Skill Group**



Note: This chart displays the breakdown of the 67 key occupations in the Energy Efficiency sector only. The industries do contain occupations outside of those in this analysis, which account for roughly 40% of the jobs in the sector overall.

As illustrated in Figure 3.5, construction and engineering make up the lion’s share of the key occupations’ employment in the Energy Efficiency sector

(44% and 23%, respectively). These occupations are also widely employed across all industries, which means there are vast opportunities to recruit trained workers from businesses outside the Energy Efficiency sector.

In total, there are projected to be 2,699 annual openings in the Energy Efficiency sector for critical Energy Efficiency occupations. This includes a blend of hands-on jobs (such as those in construction) and white-color jobs (such as those in engineering and building design). A high proportion of building design workers are employed within the Energy Efficiency sector (43%). Developing talent for these high in-sector positions will depend more on postsecondary education and training within the Energy Efficiency sector than on drawing workers from other industries. Skill categories such as information technology and human resources and training, on the other hand, are far more prevalent in other industries, which means the potential for recruitment from less thriving industries is strong. Table 3.4 shows that the greatest talent needs for the sector in coming years will be predominately for engineers, high-level managers, and skilled craftsmen such as plumbers and electricians.

### Demographic Characteristics of Key Occupations in the Energy Efficiency Sector

This section highlights some of the educational and demographic characteristics of workers in the Energy Efficiency sector. It will discuss key issues facing the critical occupations in aggregate, as well as some unique to a few of the particular occupations. Detailed data on each occupation are contained in Appendix D.

One of the greatest challenges of the energy industry in coming years will be filling the void left by workers from the baby-boomer generation who are soon to retire. In total, more than half of workers in the critical Energy Efficiency occupations are 54 or older. The proportions are higher among management and maintenance positions.

A second workforce issue is that the energy industry is predominately composed of men. Among the critical Energy Efficiency occupations, 71% of workers are male. This means that a large portion of the nation's workforce is potentially underutilized by businesses

Figure 3.6: Distribution of Critical Energy Efficiency Workers by Age Group (thousands)

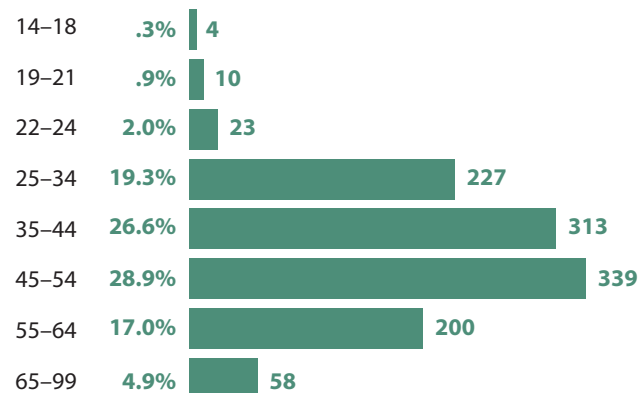


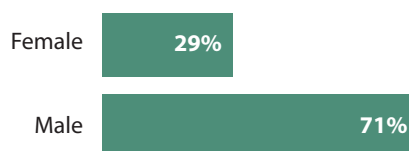
Table 3.5: Top Five Occupations with Highest Proportion of Workers Under 45

SOC	TITLE	% UNDER 45	NUMBER UNDER 45
43-4051	Customer service representatives	69%	44,679
13-1199	Business operation specialists, all other	52%	35,880
47-2031	Carpenters	62%	31,520
15-1081	Network systems and data communications analysts	77%	19,892
15-1041	Computer support specialists	65%	16,955

Table 3.6: Top Five Occupations with Highest Proportion of Workers Over 45

SOC	TITLE	% OVER 45	NUMBER OVER 45
11-9199	Managers, all other	63%	59,914
11-1021	General and operations managers	54%	46,899
13-1111	Management analysts	65%	45,207
13-2011	Accountants and auditors	54%	37,281
49-9042	Maintenance and repair workers, general	59%	27,274

Figure 3.7: Distribution of Critical Energy Efficiency Workers by Gender



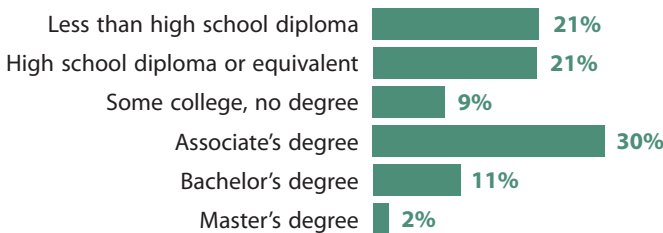
**Table 3.7: Top Five Occupations with Highest Proportion of Females**

SOC	TITLE	NUMBER OF FEMALE WORKERS	% OF FEMALE WORKERS
13-1199	Business operation specialists, all other	43,351	62%
43-4051	Customer service representatives	43,012	67%
13-2011	Accountants and auditors	41,309	60%
51-2022	Electrical and electronic equipment assemblers	5,483	54%
13-1073	Training and development specialists	5,291	70%

**Table 3.8: Top Five Occupations with Highest Proportion of Males**

SOC	TITLE	NUMBER OF MALE WORKERS	% OF MALE WORKERS
11-9199	Managers, all other	68,931	72%
11-1021	General and operations managers	61,647	71%
47-2031	Carpenters	50,041	99%
13-1111	Management analysts	43,713	62%
49-9042	Maintenance and repair workers, general	43,451	94%

**Figure 3.8: Distribution of Workers by Highest Level of Educational Attainment**



in these industries. Some occupations in the group buck these trends by having a relatively young workforce, such as carpenters. Others have a higher proportion of women than men, such as business operation specialists.

Middle-skill jobs compose a large component of the employment opportunities in the Energy Efficiency sector. Roughly 30% of all jobs in this group require an associate's degree, which is drastically higher than the national average of 9%. However, there are also many

jobs in the Energy Efficiency sector that do not require college education. This could provide an opportunity for many workers who do not have college degrees to start at entry-level positions but work their way up to higher paying positions.

## Critical Knowledge, Skills, and Abilities for Energy Efficiency Occupations

Determining the key knowledge, skills, and abilities (KSAs) for an occupational group is an essential step in developing a successful pipeline of talent. These data can help pinpoint the KSAs most critical to each type of skill group so that businesses in the Energy Efficiency sector can (1) locate and recruit workers with such skills; (2) identify areas of focus when businesses are training employees for new positions; and (3) narrow their search for recruits to only those workers who are most compatible with the critical occupations.

EMSI used the O\*NET database to identify key competencies that are in demand in the critical energy efficiency occupations. The O\*NET database is a source of occupational data and information developed by the U.S. Department of Labor's Employment and Training Administration. The system provides both qualitative and quantitative descriptions of over 800 occupation classifications. Based on real-world data, the information is collected through ongoing surveys of an occupation's worker population and occupation experts. As previously mentioned, the occupations have been classified according to skill groups. Bunching the occupations in this way allowed EMSI to analyze the groups according to average group scores and percentile rankings. Two groups—construction and sales, marketing & program management—have been further sub-divided into two groups, according to the knowledge, skills, and ability profiles of those occupations.

Table 3.9 shows the KSAs that are most critical to each of the skill groups. The tables include both the



**Table 3.9: Top KSAs by Skill Group**

SKILL GROUP	KNOWLEDGE	GROUP		SKILLS	GROUP		ABILITIES	GROUP	
		GROUP AVG.	AVG. PER-CENTILE		GROUP AVG.	AVG. PER-CENTILE		GROUP AVG.	AVG. PER-CENTILE
Construction (Building)	BUILDING AND CONSTRUCTION	67	95	INSTALLATION	58	80	GROSS BODY EQUILIBRIUM	42	95
Construction (Management)	BUILDING AND CONSTRUCTION	73	99	SYSTEMS ANALYSIS	44	<70	NUMBER FACILITY	46	<70
Engineering	ENGINEERING & TECHNOLOGY	84	95	SYSTEMS ANALYSIS	60	90	MATHEMATICAL REASONING	58	90
Building Design	DESIGN	79	95	COMPLEX PROBLEM SOLVING	69	75	ORIGINALITY	61	90
Energy Assessment	ADMINISTRATION & MANAGEMENT	64	90	SYSTEMS EVALUATION	58	80	MATHEMATICAL REASONING	49	75
Technician & Installation	MECHANICAL	64	80	INSTALLATION	54	70	FINGER DEXTERITY	49	<70
Operations & Supply Chains	ECONOMICS AND ACCOUNTING	48	90	MGT. OF FINANCIAL RESOURCES	51	70	MATHEMATICAL REASONING	47	70
Sales, Marketing, Program Mgt. (Admin.)	SALES AND MARKETING	78	99	NEGOTIATION	59	75	SPEECH RECOGNITION	58	85
Sales, Marketing, Program Mgt. (Clerical)	CUSTOMER AND PERSONAL SERVICE	79	80	SERVICE ORIENTATION	61	<70	SPEECH RECOGNITION	62	95
Finance & Accounting	ECONOMICS AND ACCOUNTING	76	99	MANAGEMENT OF FINANCIAL RESOURCES	71	95	NUMBER FACILITY	63	95
Information Technology	TELECOMMUNICATIONS	61	99	PROGRAMMING	47	95	INFORMATION ORDERING	56	75
Human Resources & Training	EDUCATION AND TRAINING	91	95	SYSTEMS EVALUATION	54	75	MEMORIZATION	45	80

group average and the group average percentile ranking. Although O\*NET is a great source for quantifying KSAs, the numbers attached to each competency can at times seem abstract. It is difficult, for instance, to determine what a worker with a score of 90 in sales & marketing does more effectively than a worker with a score of 80. The group average percentile, on the other hand, simply shows the percentage of occupations that scores equal to or lower than the group average. For instance, the engineering group has a 95 in engineering & technology, which means that they are more knowledgeable about such topics than 95% of all other types of occupations.<sup>4</sup> More detailed data

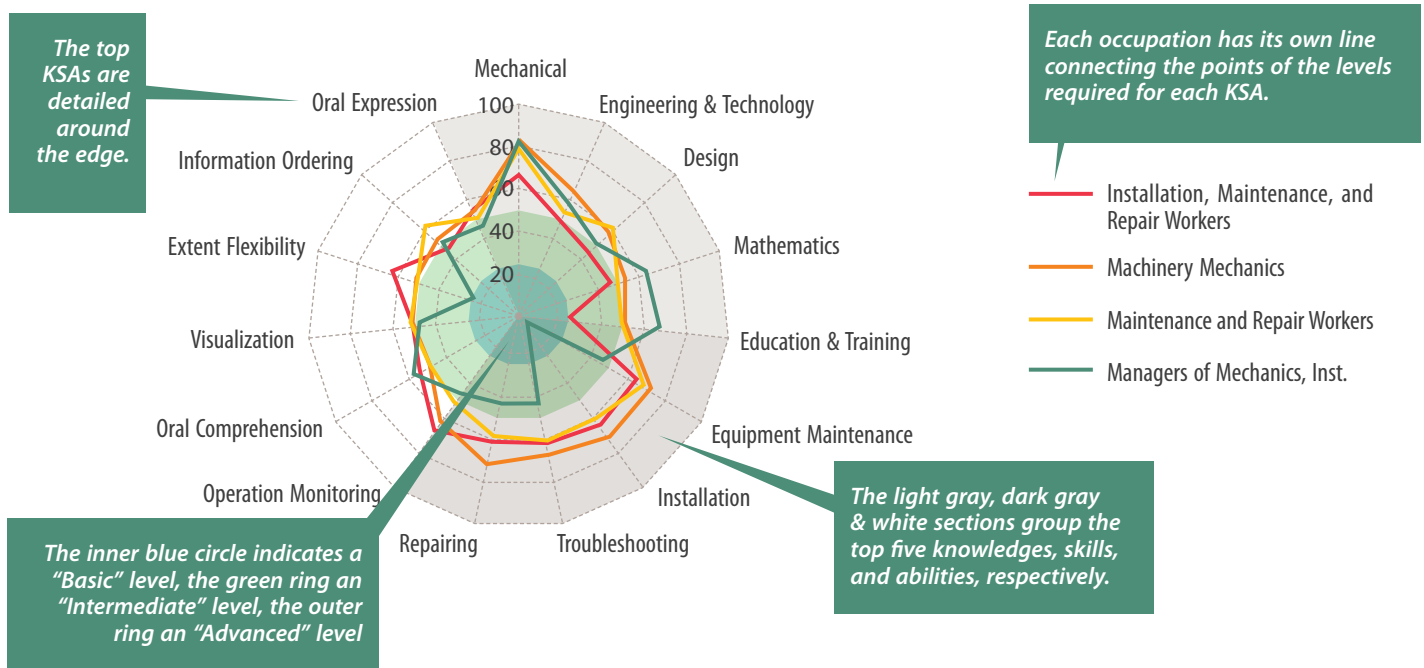
are available in Appendix D.

While engineering & technology and design are key knowledge areas for all construction occupations, they are more important for management construction occupations than building construction occupations. In fact, for the management construction group, workers are more knowledgeable in engineering & technology and design than 90% of all other types of occupations. But for the building construction group, installation figures much more prominently.

In the engineering group, design and mathematics are the key knowledge areas (aside from engineering and technology), while computers & electronics are also at the top of the list. The occupations in this group also rank high in the systems analysis skill area as compared to all other occupations (in the 90th percentile) and systems evaluation (80th percentile). For

<sup>4</sup> This is different than saying that they are more knowledgeable than 95% of all workers. Since engineering makes up a relatively small proportion of the national workforce, they are probably in a higher percentile in terms of total workers.

Figure 3.9: EXAMPLE Radar Chart for Manufacturing Maintenance Specialists



the building design group, complex problem solving and originality are the top skill and ability areas. These occupations are also more knowledgeable in fine arts than 80% of all types of occupations.

Administration & management, building & construction, and clerical knowledge are key KSAs for occupations in the energy assessment group. These workers also rank high in systems evaluation/analysis and management of financial resources.

The most important knowledge areas for the technician and installation group are mechanical and engineering and technology. Workers in this group are more skilled in repairing than 75% of all types of occupations.

For workers in the operations and supply chain group, the economics & accounting knowledge area figures prominently as compared to all other types of occupations (in the 90th percentile), while mathematics is a key knowledge area for the occupation group itself.

### Occupational Transitions

Ensuring sustainable growth for the Energy Efficiency sector requires finding talented workers to fill job openings. The career pathways strategy has succeeded for workforce developers and businesses that wish

to retain their best workers and encourage upward mobility within the industry sector and/or company. With this strategy the sector focuses on increasing the KSAs of its existing workers, rather than finding new employees outside the industry. The searching and retraining involved in outside recruitment can cost a company both time and money, whereas ensuring that employees are involved in a career pathway approach potentially reduces both types of costs.

In this report, KSA data are displayed in radar charts, which display the top 15 KSAs for each group of occupations. Knowledge competencies occupy the upper right-hand areas of the radar chart, while skills are found in the lower right portion, and abilities on the left-hand portion. The shaded areas in the center indicate specific levels of competencies. Competencies are considered “intermediate” at a level measured between 25 and 50. Measurements greater than 50 are considered “advanced” competencies.

Not all occupations from the group are contained in each radar chart. This is because not all of the critical Energy Efficiency occupations have an apparent career pathway. This could be because the occupation is normally associated with a postsecondary program that trains precisely for that occupation, or it could be because the occupations that form the career pathway

were not among the 67 selected for this analysis. Those that do display an apparent career pathway are highlighted here via a radar chart and a table with labor market data pertaining to those occupations.

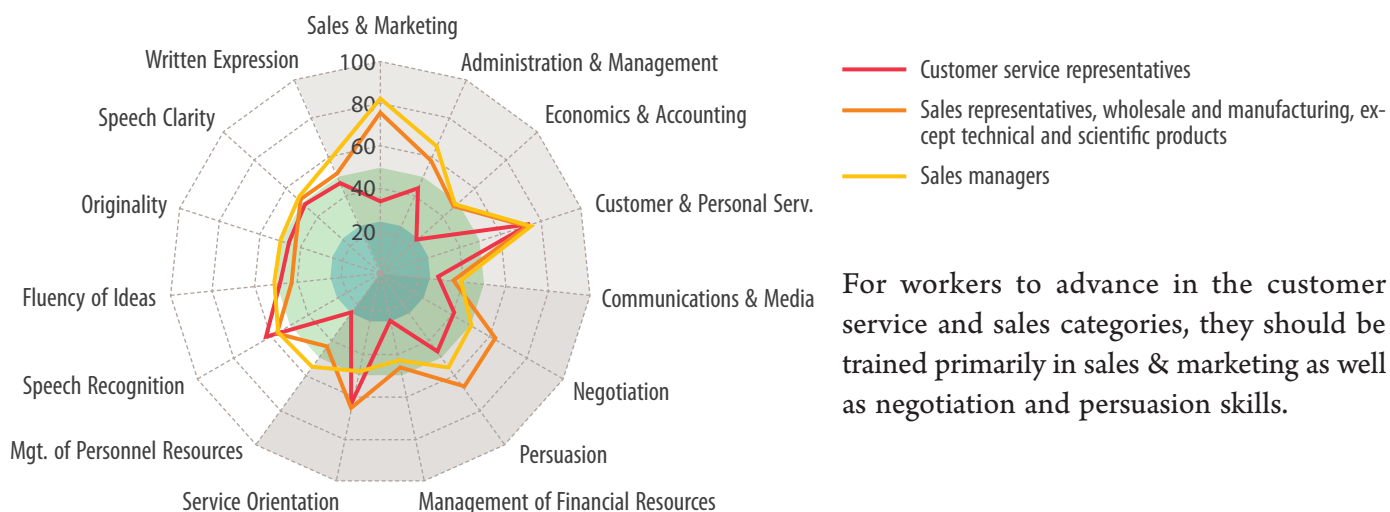
Career pathway opportunities are apparent when a number of factors come together in just the right way. First, the occupations must share a similarity in required KSAs. Yet there should also be a noticeable disparity in certain competencies, which indicates that workers at the beginning of the pathway must increase their aptitude in certain categories in order to move forward on that career path. Second, the associated labor market data must indicate that the worker would

be advancing in earnings and educational/training level.<sup>5</sup>

Within the Energy Efficiency sector, multiple opportunities exist to develop and advance the current workforce. Entry and mid-level positions (such as customer service representatives, team assemblers, and maintenance and repair workers) are a tremendous source for cultivating talent that already exists in-house.

<sup>5</sup> In some cases the proceeding step on a career pathway does not offer both higher average earnings and a greater average educational level. Since the data are based on averages, they do not always ideally portray the advancing nature of the pathways.

Figure 3.10: Career Pathway Option for Customer Service and Sales Workers

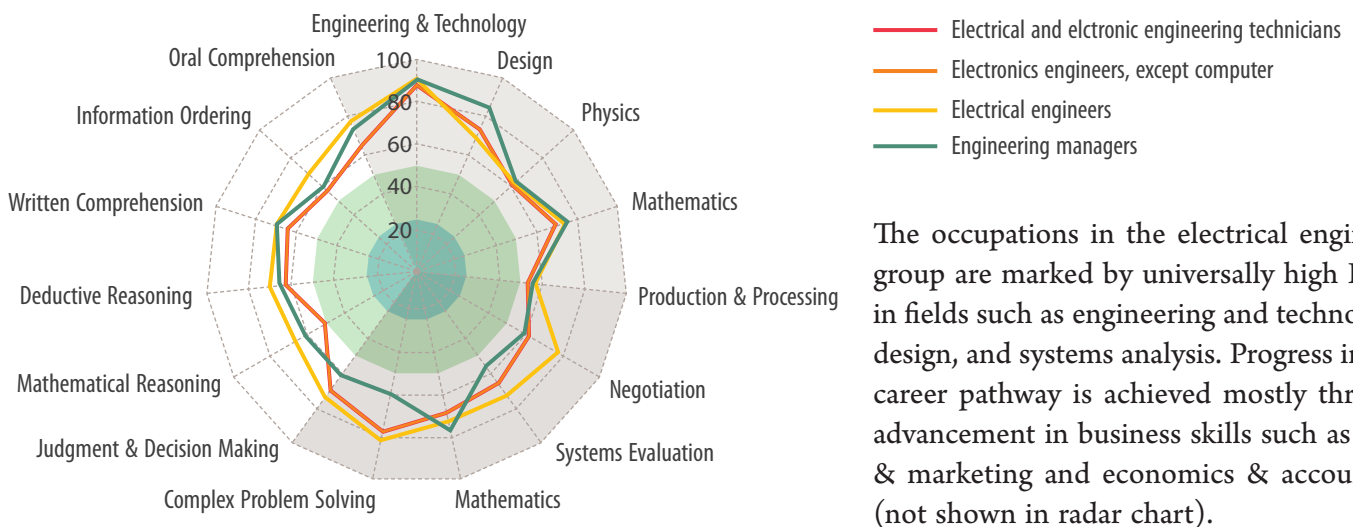


For workers to advance in the customer service and sales categories, they should be trained primarily in sales & marketing as well as negotiation and persuasion skills.

Table 3.10: Labor Market Data for Customer Service and Sales Workers

	43-4051	41-4012	11-2022
DATA CATEGORY	CUSTOMER SERVICE REPRESENTATIVES	SALES REPRESENTATIVES, WHOLESALE AND MFG., EXCEPT TECHNICAL AND SCIENTIFIC PRODUCTS	SALES MANAGERS
In-Sector Annual Openings	6	9	4
Current Median Hourly Earnings	\$17.66	\$27.90	\$47.36
Average Educational Level	MT OJT	MT OJT	Deg. + exp.

Figure 3.11: Career Pathway Option for Electrical Engineers

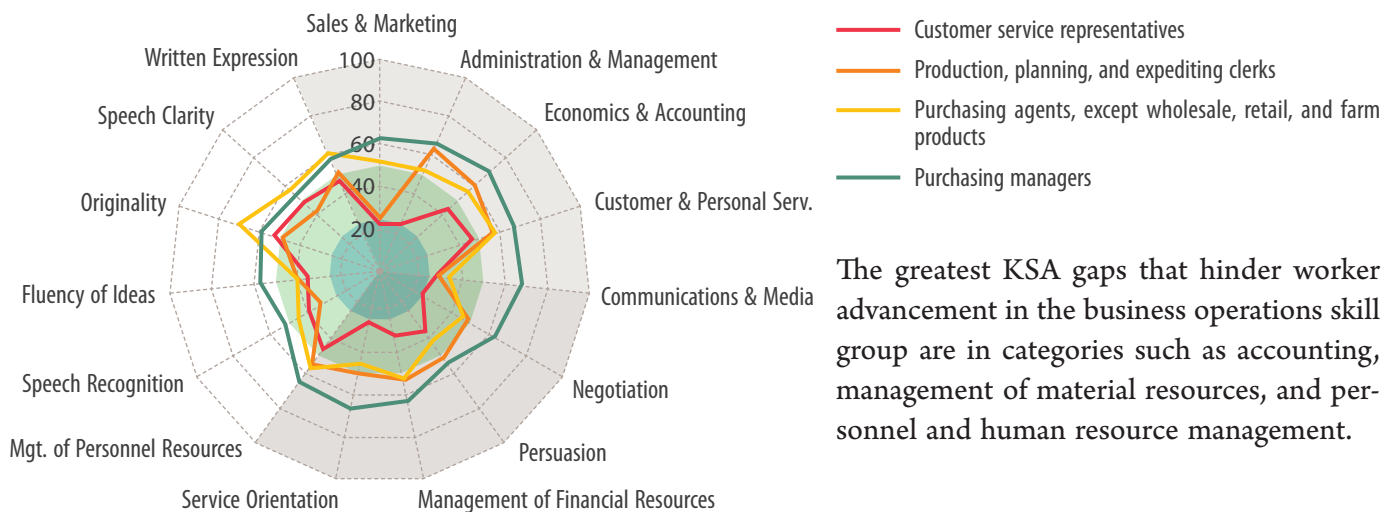


The occupations in the electrical engineers group are marked by universally high KSAs in fields such as engineering and technology, design, and systems analysis. Progress in this career pathway is achieved mostly through advancement in business skills such as sales & marketing and economics & accounting (not shown in radar chart).

Table 3.11: Labor Market Data for Electrical Engineers Career Pathway

	17-3023	17-2071	17-2072	11-9041
<b>DATA CATEGORY</b>	<b>ELECTRICAL AND ELECTRONIC ENGINEERING TECHNICIANS</b>	<b>ELECTRICAL ENGINEERS</b>	<b>ELECTRONICS ENGINEERS, EXCEPT COMPUTER</b>	<b>ENGINEERING MANAGERS</b>
In-Sector Annual Openings	12	43	18	63
Current Median Hourly Earnings	\$28.04	\$47.22	\$47.60	\$67.98
Average Educational Level	Assoc.	Bach.	Bach.	Deg. + exp.

Figure 3.12: Career Pathway Option for Business Operations Workers



The greatest KSA gaps that hinder worker advancement in the business operations skill group are in categories such as accounting, management of material resources, and personnel and human resource management.

Table 3.12: Labor Market Data for Business Operations Workers Career Pathway

	43-4051	43-5061	13-1023	11-3061
<b>DATA CATEGORY</b>	<b>CUSTOMER SERVICE REPRESENTATIVES</b>	<b>PRODUCTION, PLANNING, &amp; EXPEDITING CLERKS</b>	<b>PURCHASING AGENTS, EXCEPT WHOLESALE, RETAIL, &amp; FARM PRODUCTS</b>	<b>PURCHASING MANAGERS</b>
In-Sector Annual Openings	6	7	13	3
Current Median Hourly Earnings	\$17.66	\$23.11	\$28.26	\$46.30
Average Educational Level	MT OJT	ST OJT	Exp. in field	Deg. + exp.

Figure 3.13: Career Pathway Option for Construction Management

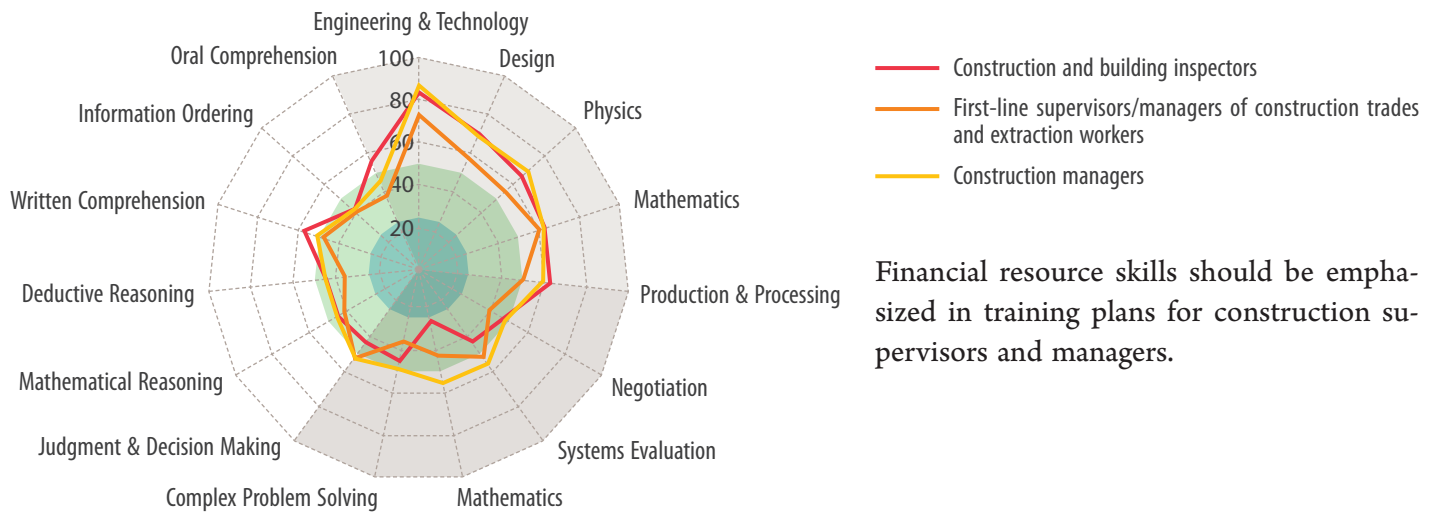


Table 3.13: Labor Market Data for Construction Management Career Pathway

	47-4011	47-1011	11-9021
DATA CATEGORY	CONSTRUCTION AND BUILDING INSPECTORS	FIRST-LINE SUPERVISORS/MANAGERS OF CONSTRUCTION TRADES & EXTRACTION WORKERS	CONSTRUCTION MANAGERS
In-Sector Annual Openings	46	94	41
Current Median Hourly Earnings	\$29.04	\$32.81	\$30.93
Average Educational Level	Exp. in field	Exp. in field	Bach.

Figure 3.14: Career Pathway Option for Manufacturing

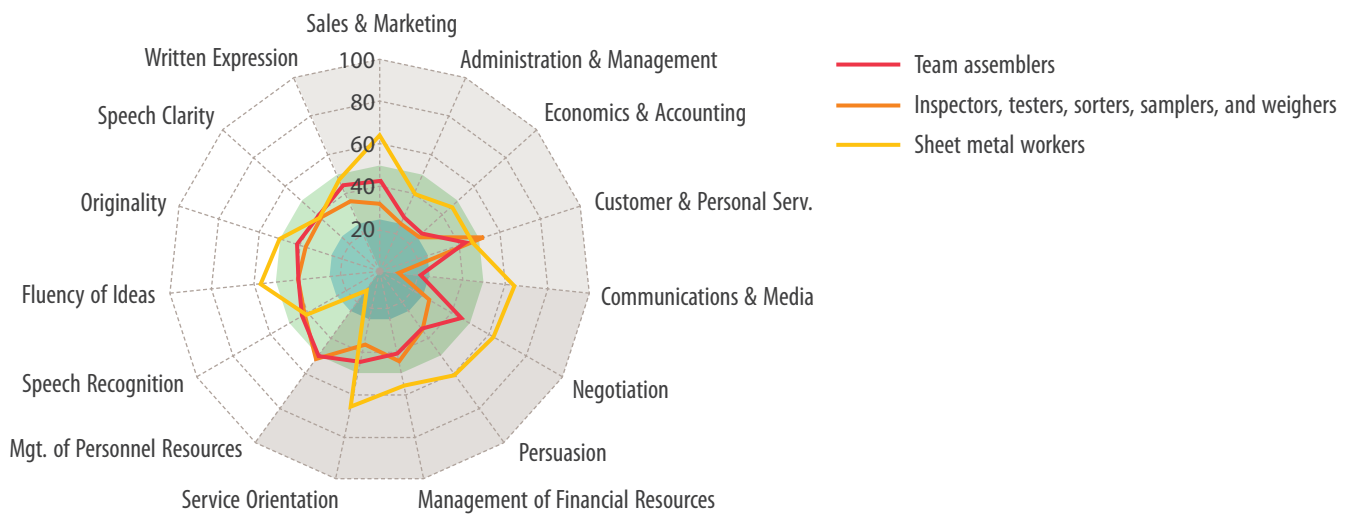


Table 3.14: Labor Market Data for Manufacturing

	51-2092	51-9061	47-2211
DATA CATEGORY	TEAM ASSEMBLERS	INSPECTORS, TESTERS, SORTERS, SAMPLERS, AND WEIGHERS	SHEET METAL WORKERS
In-Sector Annual Openings	9	10	36
Current Median Hourly Earnings	\$13.57	\$16.56	\$26.99
Average Educational Level	MT OJT	MT OJT	LT OJT

Figure 3.15: Career Pathway Option for Maintenance & Installation

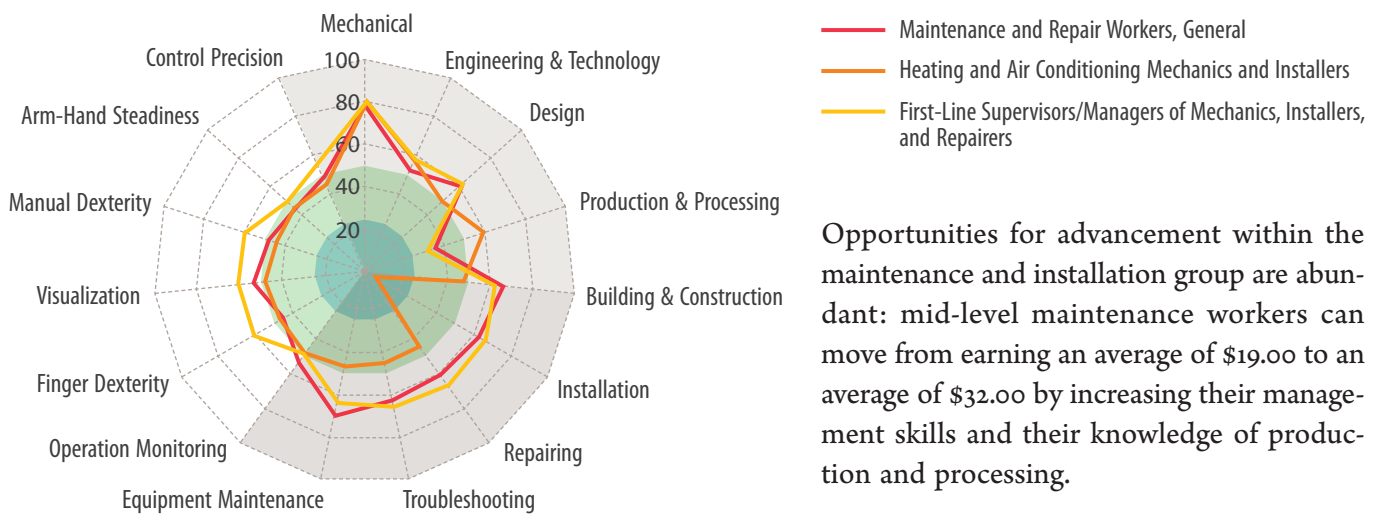


Table 3.15: Labor Market Data for Maintenance & Installation

	49-9042	49-9021	49-1011
DATA CATEGORY	MAINTENANCE AND REPAIR WORKERS, GENERAL	HEATING, AIR CONDITIONING, AND REFRIGERATION MECHANICS & INSTALLERS	FIRST-LINE SUPERVISORS/MANAGERS OF MECHANICS, INSTALLERS, AND REPAIRERS
In-Sector Annual Openings	8	37	12
Current Median Hourly Earnings	\$19.00	\$24.76	\$32.49
Average Educational Level	MT OJT	LT OJT	Exp. in field

### Career Transitions from Outside of the Industry Sector

Finding workers within the industry group is not always a feasible option, particularly in high-growth industries where companies' demand for workers is sometimes far greater than supply. Additionally, the highly technical nature of some of the critical occupations, such as engineers, designers, and business executives, can make career pathways very difficult to implement. In some cases, therefore, recruiting workers from other industries is the best option.

As discussed in the section examining employment across all industries, drawing workers with the same occupational classification is usually the best option. The reasons for this are rather intuitive; a civil engineer who works in bridge construction is likely to have many of the same capabilities as a civil engineer who helps build energy infrastructure. It may become necessary to consider transitioning workers from other occupation types into the critical occupations.

Table 3.16 displays 20 of the most compatible occupations with the critical Energy Efficiency occupations.

These have been selected based on high compatibility using EMSI's proprietary compatibility index, which compares the KSAs required in two different occupations.<sup>6</sup> An ideal use of the compatibility index is to compare the KSAs required in an occupation that is declining in demand with the KSAs for an occupation that is growing in demand. For this report, EMSI considered non-energy sector occupations that would be compatible and be considered in decline; in other words, where workers would consider switching to a different sector. Each occupation on this list is either growing at a far slower than average rate or not displaying an adequate regional competitive advantage to retain all of its current workers.<sup>7</sup>

<sup>6</sup> The compatibility index is based on the aptitude level and importance scores of each occupation. The index calculates the closest matches of each occupation against all other occupations in order to determine the best career transition matches.

<sup>7</sup> The competitive effect category measures this factor. Negative competitive effects indicate that employment is contracting more rapidly than the national average, or that employment is not expanding as rapidly as the national average. In either case, the implication is that the region does not possess a competitive advantage for that occupation.

The table does not indicate exactly which occupation would be the best candidate for transitioning into, because most of the occupations on this list can transition into multiple occupations in that category. However, in most cases the ideal transition would be to an entry-level position within the skill group, unless the transitioning worker has management or technical experience.

Based on the compatible occupations determined above, Table 3.17 lists the industries that have the highest number of workers that are compatible with the key Energy Efficiency occupations. In order to focus primarily on workers who are most likely to make career transitions, this list has been limited to those industries that are either shrinking, or else growing too slowly to retain all its workers.

Four of the most compatible industries are in the real estate sector. In total, this equates to more than 71,000 compatible jobs available in categories such as sales, operations, and finance. Many residential

contracting industries are still reeling from the housing bust, and are projected to continue their struggle over the next five years. The three industries shown in Table 3.17 host more than 52,000 compatible jobs. These could be a key source of construction workers for the energy efficiency industry. Opportunities also exist to collect new employees for construction trades from agriculture and production positions. Occupations like miscellaneous agricultural workers possess many of the same skills, but have seen a decline in their industry.

Entry-level workers for the operations skills group can be found in largely declining occupational categories such as computer operators and postmasters and mail superintendents. Meanwhile, the insurance industry hosts numerous occupations that could be transferred into the sales, marketing, and program management skills group, including insurance underwriters and brokerage clerks.

**Table 3.16: Most Compatible Occupations for Career Transitions**

SOC CODE	DESCRIPTION	GROUP	2011-2016 CHANGE	% CHANGE	COMPETITIVE EFFECT
45-209A	Miscellaneous agricultural workers	Construction	(2,575)	(2%)	(2,015)
51-1011	First-line supervisors/mgrs. of production & operating workers	Construction	(389)	(2%)	35
43-9051	Mail clerks and mail machine operators, except postal service	Tech & Install	(375)	(8%)	(70)
43-9011	Computer operators	Operations	(355)	(6%)	35
53-7063	Machine feeders and offbearers	Tech & Install	(305)	(16%)	(33)
13-2053	Insurance underwriters	Sales	(268)	(8%)	(245)
43-4011	Brokerage clerks	Sales	(157)	(8%)	(111)
43-4141	New accounts clerks	Sales	(103)	(6%)	(87)
43-9041	Insurance claims and policy processing clerks	Sales	(68)	(1%)	(259)
43-9022	Word processors and typists	Sales	(66)	(1%)	(84)
11-9131	Postmasters and mail superintendents	Operations	(39)	(11%)	(17)
53-1031	First-line supervisors/managers of transportation and material-moving machine and vehicle operators	Operations	(26)	0%	81
47-2071	Paving, surfacing, and tamping equipment operators	Construction	(9)	0%	(97)
43-4131	Loan interviewers and clerks	Sales	33	0%	(235)
11-3071	Transportation, storage, and distribution managers	Energy Assess.	39	1%	(60)
47-2141	Painters, construction and maintenance	Construction	65	0%	(617)
11-3049	Human resources managers, all other	HR	121	3%	(40)
11-9051	Food service managers	Energy Assess.	1,594	6%	(1,621)
43-3031	Bookkeeping, accounting, and auditing clerks	Finance	4,330	5%	(601)

**Table 3.17: Most Compatible Industries for Career Transitions**

NAICS	INDUSTRY	HIGHLY COMPATIBLE JOBS IN INDUSTRY	INDUSTRY CHANGE 2011-2016 <sup>1</sup>	% OF COMPATIBLE JOBS IN INDUSTRY	CATEGORY
5312	Offices of Real Estate Agents and Brokers	30,824	(6,234)	25.0%	Operations & Sales
5313	Activities Related to Real Estate	27,601	(4,191)	24.9%	Operations
8111	Automotive Repair and Maintenance	23,395	(8,164)	50.5%	Tech & Install
2383	Building Finishing Contractors	21,952	(37,151)	36.8%	Construction
2389	Other Specialty Trade Contractors	16,395	(13,216)	39.2%	Construction
2361	Residential Building Construction	14,176	(31,505)	25.3%	Construction
5411	Legal Services	12,205	(2,688)	18.2%	Sales
5241	Insurance Carriers	11,626	(14,632)	31.7%	Sales & Operations
5412	Accounting, Tax Preparation, Bookkeeping, and Payroll Services	10,327	3,542	15.4%	Finance
5311	Lessors of Real Estate	10,276	(2,774)	13.1%	Sales
2381	Foundation, Structure, and Building Exterior Contractors	9,697	(28,259)	27.9%	Construction & Tech. & Install
2382	Building Equipment Contractors	8,756	(18,115)	11.9%	Construction & Tech. & Install
5221	Depository Credit Intermediation	7,583	(11,704)	12.7%	Sales; Operations & Finance
8114	Personal & Household Goods Repair & Maintenance	6,808	(5,590)	36.7%	Tech & Install
7211	Traveler Accommodation	5,901	(2,441)	9.2%	Operations
5231	Securities and Commodity Contracts Intermediation and Brokerage	5,830	1,571	23.0%	Finance
4921	Couriers and Express Delivery Services	5,249	(4,833)	22.4%	Tech & Install
5511	Management of Companies and Enterprises	3,673	5,335	4.2%	Finance & IT
5313	Activities Related to Real Estate	1,809	(4,191)	1.7%	Finance
3341	Computer and Peripheral Equipment Manufacturing	1,607	4,205	3.2%	IT



## APPENDIX A: INDUSTRY METRIC DEFINITIONS

**Size and Historical Growth:** Measures the past performance of an industry sector, identifies whether industries have been growing/declining/emerging, and determines the rate of change.

**Future Growth Projection:** Incorporates historical growth and performance with additional factors and expectations of growth/decline at a larger geographic scale (i.e., state, nation-wide, and even global expectations). Industry projection rates are based off of California state projections and adjusted to current employment estimates. Projections do not include consideration of policy changes.

**Industry Concentration (Location Quotient):** The location quotient variable is a comparative statistic used to calculate relative employment concentration of a given industry against the average employment of the industry in a larger geography (e.g., nation). Industries with a higher location quotient (usually greater than 1.2) indicate that a region/state has a comparative advantage or specialization in the production of that good or service.

**Industry Competitiveness Effect (Shift Share Analysis):** A standard method of regional economic analysis that attempts to separate regional job growth into its component causes. The three main causes identified are the “national growth effect,” which is regional growth that

can be attributed to the overall growth of the entire U.S. economy; the “industrial mix effect,” which is regional growth that can be attributed to positive trends in the specific industry or occupation at a national level; and the “regional competitiveness effect,” which is growth that cannot be explained by either overall or industry-specific trends. A positive value indicates that a local industry has a competitive advantage compared to the nation. Note: Positive shift share values do not explain why an industry has a competitive advantage; they can show only that there are potential factors that contribute to the industry’s ability to outperform the national average rate of growth/decline.

**Export Orientation:** This variable can be measured in multiple ways. Through the development of an input-output model, metrics estimating export amounts can be calculated for each six-digit NAICS code. Since employment levels vary significantly between industries, production output and export amounts also vary. To account for this and provide a comparable metric, the percentage of exports per job was calculated. Industries that predominately export their product bring new money into the economy, which in turn drive many other local sectors and service providers. Furthermore, export-oriented industries that require less labor input per unit of output can generate significant amounts of new dollars for an economy through job and output growth. Identifying these sectors helps bring a stronger understanding of the economic benefits gained from targeted sector strategies.

**Job Multiplier Effects:** A jobs multiplier indicates how important an industry is to regional job creation. For example, a jobs multiplier of 3 would mean that for every job created by that industry, 2 other jobs would be created in other industries (for a total of 3 jobs). Higher job multipliers in industries that are associated with higher average wages tend to have larger positive impacts on an economy.

**Earnings Multiplier Effects:** An earnings multiplier indicates the level of additional earnings associated with the addition one new dollar of earnings to an industry in an economy. This variable is important in understanding how targeted investment in an industry

(especially higher-paying industries) affects the overall quality of jobs created.

**Industry Average Wage:** This metric is calculated on the wages of occupations typically employed in an industry. This provides a perspective on the quality of jobs within a given industry, answering the question of whether the industry typically provides family-sustaining wages.

**Excess Demand:** Measured using an input-output model, excess demand can also be viewed as regional/ state imports. The metric describes how much of a good or service is purchased from outside the area and can indicate the area's inability to produce its own supply. The consulting team cautions against over-interpreting this variable, as cross-hauling (inter-regional and interstate trade) does exist due to specialization in other areas. However, if a region or state has a high level of industry requirements and is only producing a small portion of output to meet those requirements with the remaining amount being imported, then an opportunity may exist to further develop that particular industry. This would be considered a demand-driven industry development approach.

**Workforce Compatibility:** The metric in this analysis is important to provide an understanding of the capability of a region or state's workforce to fill the labor needs within a given industry, especially the higher-skilled labor needs (measured using O\*NET job zone codes 3 and higher). Compatibility is derived from a proprietary dataset developed by emsi, which utilizes measured O\*NET occupational competencies to identify similarities in skill sets. Workforce compatibility is broken into two variables. The first variable determines the percentage of employment in a sector that is considered skilled. The second variable determines the percent of the region's workforce that is highly compatible (90% compatibility or greater) to the sector's skilled labor. For example, if half of an industry's labor needs are high-skill workers and a third of the regional workforce can fill those labor needs, we would conclude that the industry is a good fit for the region's workforce capabilities.

# APPENDIX B: FURTHER METHODOLOGY FOR EDUCATIONAL GAP ANALYSIS

## **Program-to-Occupation Mapping**

The program-to-occupation relationships used in this report were built around the key energy efficient occupations identified by Workforce Incubator, using mappings based on those from the National Center for Education Statistics. EMSI used the 2000 Standard Occupation Classification system for this analysis rather than the more recent 2010 system. While this

provides much more detailed and in depth data on the whole, some new and developing fields, such as green occupations, are not captured in detail.

Openings were weighted by the percentage of workers in that occupation that had any education beyond a high school degree. This effectively focused on the section of the labor market that is open to program completers. The breakdown of education level by occupation comes from the Employment Projections Program, U.S. Department of Labor, U.S. Bureau of Labor Statistics.

## **Key Assumptions**

In order to produce a gap analysis, EMSI has made certain assumptions where data are either not available or where the cost of obtaining the information is too high. The reader should be aware of these assumptions so that in circumstances where the assumptions are more tenuous, it is understood why the information may not be as valid. Table B.1 contains a list of these assumptions, along with a statement of the circumstances where this assumption may not reflect reality as appropriately.

**Table B.1: Assumptions and Potential Weaknesses of the Gap Analysis**

ASSUMPTION	POTENTIAL WEAKNESS
1) The amount of in-migrating and out-migrating that occurs after students complete their programs is assumed to be relatively similar, both in terms of the number of people and in the skills sets of those people.	1 & 2) Tenuous in areas that do not import and export a relatively similar amount of graduates (i.e. “college towns,” or major metropolitan areas).
2) It is assumed that students who complete programs within the region are highly likely to find employment within that same area, and that students who complete programs outside of the area are not as likely to find employment within the region.	
3) After students receive a degree or certification, it is assumed that they will pursue a career in that field and that they will not pursue a degree in another field.	3) Tenuous in fields that have high transferability of skills, such as the liberal arts or sales.
4) Associate degrees and career and technical certificates that are within the same fields are assumed to lead to the same types of occupations.	4) Tenuous in fields that have a distinct hierarchical arrangement or strict certification requirements.
5) Occupational projections represent the actual “demand” for workers in that field.	5) Tenuous regarding occupations that have high employer demand, and low interest within the workforce, such as welders or mechanics.
6) The distance that students travel from their colleges to the location of their jobs after graduation is the same across educational levels and educational programs.	6) Tenuous regarding specialized programs that draw students from across the state or region. This is more prevalent among four-year programs.

## APPENDIX C: DATA SOURCES

To find the program completers for all colleges in the region, EMSI used data from the Integrated Postsecondary Educational System (IPEDS), which are publicly available through the National Center for Educational Statistics. For the purposes of this report, completers are individuals who complete either a degree-earning or certificate-earning program in the given academic year.

To find current and projected occupational employment, EMSI used its own proprietary database of regional economic data. These estimates are derived from the Bureau of Labor Statistics' (BLS) Occupational Employment Statistics (OES), the Census Bureau's American Community Survey (ACS), the BLS Employment Projections Program, National Industry-Occupation Matrix (NIOEM), and finally from EMSI's own industry employment data which are derived for a host of BLS, Census, and Bureau of Economic Analysis (BEA) datasets. Projections do not include the impacts of potential policy changes, as it is difficult to predict either enactment or methods of implementation. The following is a comprehensive account of EMSI's data sources:

CD Light, LLC, d.b.a. ZipInfo.com. ZIPList5 Plus Zip Code Data.  
 —. ZipInfo.com. Database on-line. Available from <http://www.zipinfo.com>; Internet (accessed May 2005).

### **U.S. Census Bureau.**

- . American Community Survey, 2005-2007 3-Year Estimates.
- . County Business Patterns (CBP) Employment Reports.
- . Current State Demographic data.
- . Current County Demographic data.
- . Decennial Census Reports.
- . National Population Report.
- . Nonemployer Statistics Reports.
- . Projected State Demographic data.
- . State Population Total Reports.

### **U.S. Department of Commerce, Bureau of Economic Analysis.**

- . Regional Economic Information Systems (REIS). Local Area Personal Income.
- . Regional Economic Information Systems (REIS). County Demographic data.
- . Regional Economic Information Systems (REIS). Employment & Earnings Reports.
- . State Personal Income Employment and Earnings Reports.

### **U.S. Department of Education, National Center for Education Statistics.**

- . Integrated Postsecondary Education Data System Institutional Characteristics Survey. Database online. Available from <http://nces.ed.gov/Ipeds/ic.asp>;
- . Integrated Postsecondary Education Data System Faculty Salaries Data. Database on-line. Available from <http://nces.ed.gov/Ipeds/facultysalaries.asp>;
- . Integrated Postsecondary Education Data System Fall Staff Data. Database on-line. Available from <http://nces.ed.gov/Ipeds/fallstaff.asp>;
- . Occupation to CIP (Classification of Instructional Programs).
- . Public Elementary/Secondary School Universe Survey Data. Database on-line. Available from <http://nces.ed.gov/ccd/pubschuniv.asp>;

### **U.S. Department of Labor, Bureau of Labor Statistics.**

- . Current Employment Statistics.

- . Current Year National Occupation Matrix.
- . National Current Industry data.
- . National Projected Industry data.
- . National Replacement Jobs data.
- . Projected National Occupation Matrix.
- . Quarterly Census of Employment and Wages  
(also known as ES-202 Covered Employment  
& Wages Data).

***Wisconsin Department of Workforce Development,  
Bureau of Workforce Information.***

***U.S. Department of Health and Human Services,  
Centers for Disease Control and Prevention, National  
Center for Health Statistics.***

- . Health, United States, 2004.

# APPENDIX D: DETAILED OCCUPATION DATA

## Detailed Employment Data Across All Industries

Table D.1: Employment for Energy Assessment Occupations

SOC CODE	DESCRIPTION	2011 JOBS	06-'11 CHANGE	06-'11 % CHANGE	11-'16 CHANGE	11-'16 % CHANGE	PROJECTED ANNUAL OPENINGS	CURRENT HOURLY EARNINGS	ED LEVEL
11-9021	Construction managers	24,628	(5,027)	(17%)	1,363	6%	468	\$30.93	Bach.
13-1199	Business operation specialists, all other	69,668	508	1%	3,808	5%	2,309	\$31.47	Bach.
13-1111	Management analysts	70,004	10,480	18%	10,368	15%	3,275	\$27.20	Deg. + exp.
11-1021	General and operations managers	86,290	(8,607)	(9%)	300	0%	2,694	\$52.27	Deg. + exp.
	<b>Subtotal</b>	<b>250,590</b>	<b>(2,646)</b>	<b>(1%)</b>	<b>15,839</b>	<b>6%</b>	<b>8,746</b>	<b>\$37.39</b>	<b>n/a</b>

Table D.2: Employment for Technicians & Installation Occupations

SOC CODE	DESCRIPTION	2011 JOBS	06-'11 CHANGE	06-'11 % CHANGE	11-'16 CHANGE	11-'16 % CHANGE	PROJECTED ANNUAL OPENINGS	CURRENT HOURLY EARNINGS	ED LEVEL
17-3021	Aerospace engineering and operations technicians	316	(7)	(2%)	3	1%	9	\$28.94	Assoc.
17-3023	Electrical and electronic engineering technicians	8,414	(944)	(10%)	(225)	(3%)	197	\$28.04	Assoc.
17-3029	Engineering technicians, except drafters, all other	4,847	(24)	0%	76	2%	121	\$30.73	Assoc.
47-2211	Sheet metal workers	5,555	(2,126)	(28%)	(48)	(1%)	148	\$26.99	LT OJT
51-8021	Stationary engineers and boiler operators	1,382	(7)	(1%)	113	8%	46	\$28.83	LT OJT
47-2132	Insulation workers, mech.	457	(168)	(27%)	35	8%	23	\$22.42	MT OJT
49-1011	First-line supervisors/managers of mechanics, installers, and repairers	14,005	(1,739)	(11%)	284	2%	443	\$32.49	Exp. in field
49-2011	Computer, automated teller, and office machine repairers	8,403	(632)	(7%)	(115)	(1%)	164	\$19.06	PSV Award

SOC CODE	DESCRIPTION	2011 JOBS	06-'11 CHANGE	06-'11 % CHANGE	11-'16 CHANGE	11-'16 % CHANGE	PROJECTED ANNUAL OPENINGS	CURRENT HOURLY EARNINGS	ED LEVEL
49-2022	Telecommunications equipment installers and repairers, except line installers	11,208	(3,593)	(24%)	55	0%	290	\$27.12	LT OJT
49-2094	Electrical and electronics repairers, commercial and industrial equipment	1,837	(139)	(7%)	34	2%	47	\$30.21	PSV Award
49-9012	Control and valve installers and repairers, except mechanical door	1,128	(6)	(1%)	45	4%	30	\$23.84	MT OJT
49-9021	Heating, air conditioning, and refrigeration mechanics and installers	7,362	(1,360)	(16%)	502	7%	220	\$24.76	LT OJT
49-9041	Industrial machinery mechanics	6,745	(77)	(1%)	317	5%	179	\$26.70	LT OJT
49-9042	Maintenance and repair workers, general	46,220	(1,781)	(4%)	2,644	6%	1,240	\$19.00	MT OJT
49-9043	Maintenance workers, machinery	1,454	(68)	(4%)	48	3%	35	\$19.97	ST OJT
51-2022	Electrical and electronic equipment assemblers	10,112	(1,864)	(16%)	(872)	(9%)	187	\$15.30	ST OJT
51-2023	Electromechanical equipment assemblers	3,281	(602)	(16%)	(240)	(7%)	63	\$14.69	ST OJT
51-2091	Fiberglass laminators and fabricators	555	(170)	(23%)	(56)	(10%)	13	\$14.20	MT OJT
51-2092	Team assemblers	21,629	(3,996)	(16%)	(300)	(1%)	594	\$13.57	MT OJT
51-2093	Timing device assemblers, adjusters, and calibrators	84	(14)	(14%)	(9)	(11%)	2	\$14.89	MT OJT
51-2099	Assemblers and fabricators, all other	8,220	(2,775)	(25%)	(6)	0%	236	\$14.13	MT OJT
51-4041	Machinists	8,236	(840)	(9%)	(577)	(7%)	118	\$20.47	LT OJT
51-9061	Inspectors, testers, sorters, samplers, and weighers	16,251	(1,983)	(11%)	(246)	(2%)	351	\$16.56	MT OJT
		<b>187,701</b>	<b>(24,915)</b>	<b>(12%)</b>	<b>1,462</b>	<b>1%</b>	<b>4,756</b>	<b>\$20.91</b>	<b>n/a</b>

**Table D.3: Employment for Sales, Marketing & Program Management Occupations**

SOC CODE	DESCRIPTION	2011 JOBS	06-'11 CHANGE	06-'11 % CHANGE	11-'16 CHANGE	11-'16 % CHANGE	PROJECTED ANNUAL OPENINGS	CURRENT HOURLY EARNINGS	ED LEVEL
11-2011	Advertising and promotions managers	2,603	94	4%	130	5%	89	\$37.61	Deg. + exp.
11-2021	Marketing managers	18,073	495	3%	928	5%	575	\$60.79	Deg. + exp.
11-2022	Sales managers	23,979	(578)	(2%)	1,857	8%	888	\$47.36	Deg. + exp.
41-4011	Sales representatives, wholesale and mfg., technical and scientific products	19,434	(1,195)	(6%)	1,125	6%	685	\$41.10	MT OJT
41-4012	Sales representatives, wholesale and mfg., except technical and scientific products	42,364	(3,388)	(7%)	2,444	6%	1,485	\$27.90	MT OJT
43-4151	Order clerks	8,963	(2,351)	(21%)	(880)	(10%)	263	\$15.84	ST OJT
43-4051	Customer service reps.	64,444	(4,575)	(7%)	5,251	8%	3,083	\$17.66	MT OJT
	<b>Subtotal</b>	<b>179,860</b>	<b>(11,498)</b>	<b>(6%)</b>	<b>10,855</b>	<b>6%</b>	<b>7,068</b>	<b>\$31.10</b>	<b>n/a</b>

**Table D.4: Employment for Construction Occupations**

SOC CODE	DESCRIPTION	2011 JOBS	06-'11 CHANGE	06-'11 % CHANGE	11-'16 CHANGE	11-'16 % CHANGE	PROJECTED ANNUAL OPENINGS	CURRENT HOURLY EARNINGS	ED LEVEL
11-9021	Construction managers	24,628	(5,027)	(17%)	1,363	6%	468	\$30.93	Bach.
47-4011	Construction and building inspectors	4,731	(94)	(2%)	334	7%	164	\$29.04	Exp. in field
47-1011	First-line supervisors/managers of construction trades and extraction workers	26,686	(8,080)	(23%)	1,474	6%	814	\$32.81	Exp. in field
47-2031	Carpenters	50,775	(23,562)	(32%)	2,390	5%	1,178	\$25.60	LT OJT
13-1051	Cost estimators	9,160	(2,727)	(23%)	702	8%	347	\$33.42	Exp. in field
47-2111	Electricians	23,276	(6,152)	(21%)	(190)	(1%)	692	\$29.42	LT OJT
47-2132	Insulation Workers, Mech.	457	(168)	(27%)	35	8%	23	\$22.42	MT OJT
47-2152	Plumbers, Pipefitters, and Steamfitters	17,243	(4,531)	(21%)	635	4%	510	\$27.49	LT OJT
47-2131	Insulation Workers, Floor, Ceiling, and Wall	864	(736)	(46%)	86	10%	50	\$24.37	MT OJT
	<b>Subtotal</b>	<b>157,820</b>	<b>(51,077)</b>	<b>(24%)</b>	<b>6,829</b>	<b>4%</b>	<b>4,246</b>	<b>\$28.96</b>	<b>n/a</b>

**Table D.5: Employment for Operations & Supply Chain Occupations**

SOC CODE	DESCRIPTION	2011 JOBS	06-'11 CHANGE	06-'11 % CHANGE	11-'16 CHANGE	11-'16 % CHANGE	PROJECTED ANNUAL OPENINGS	CURRENT HOURLY EARNINGS	ED LEVEL
11-3061	Purchasing managers	3,571	(157)	(4%)	14	0%	116	\$46.30	Deg. + exp.
13-1023	Purchasing agents, except wholesale, retail, and farm products	11,939	(32)	0%	764	6%	475	\$28.26	Exp. in field
11-3011	Administrative services managers	9,767	(36)	0%	586	6%	322	\$37.78	Deg. + exp.
11-9199	Managers, all other	95,248	10,241	12%	9,354	10%	4,328	\$21.90	Exp. in field
43-5061	Production, planning, and expediting clerks	12,354	(1,288)	(9%)	56	0%	361	\$23.11	ST OJT
15-2031	Operations research analysts	4,175	122	3%	425	10%	206	\$36.65	Mast.
	<b>Subtotal</b>	<b>137,054</b>	<b>8,850</b>	<b>7%</b>	<b>11,199</b>	<b>8%</b>	<b>5,808</b>	<b>\$24.78</b>	<b>n/a</b>

**Table D.6: Employment for Engineering Occupations**

SOC CODE	DESCRIPTION	2011 JOBS	06-'11 CHANGE	06-'11 % CHANGE	11-'16 CHANGE	11-'16 % CHANGE	PROJECTED ANNUAL OPENINGS	CURRENT HOURLY EARNINGS	ED LEVEL
17-2051	Civil engineers	17,883	(697)	(4%)	1,448	8%	605	\$42.19	Bach.
17-2071	Electrical engineers	8,973	(806)	(8%)	(196)	(2%)	249	\$47.22	Bach.
41-9031	Sales engineers	10,033	(154)	(2%)	458	5%	463	\$50.02	Bach.
17-2072	Electronics engineers, except computer	12,584	(1,438)	(10%)	(296)	(2%)	347	\$47.60	Bach.
17-2081	Environmental engineers	2,368	136	6%	317	13%	112	\$42.59	Bach.
17-2112	Industrial Engineers	7,651	(26)	0%	408	5%	296	\$43.12	Bach.
17-2141	Mechanical Engineers	8,722	(289)	(3%)	120	1%	283	\$42.11	Bach.
17-2199	Engineers, All Other	13,554	(79)	(1%)	326	2%	379	\$45.04	Bach.
11-9041	Engineering Managers	14,647	(889)	(6%)	85	1%	382	\$67.98	Deg. + exp.
	<b>Subtotal</b>	<b>96,415</b>	<b>(4,242)</b>	<b>(4%)</b>	<b>2,670</b>	<b>3%</b>	<b>3,116</b>	<b>\$48.57</b>	<b>n/a</b>



**Table D.7: Employment for Finance & Accounting Occupations**

SOC CODE	DESCRIPTION	2011 JOBS	06-'11 CHANGE	06-'11 % CHANGE	11-'16 CHANGE	11-'16 % CHANGE	PROJECTED ANNUAL OPENINGS	CURRENT HOURLY EARNINGS	ED LEVEL
13-2011	Accountants and auditors	68,767	3,951	6%	6,510	9%	2,465	\$27.37	Bach.
13-2051	Financial analysts	22,551	5,240	30%	3,360	15%	1,082	\$31.48	Bach.
	<b>Subtotal</b>	<b>91,318</b>	<b>9,191</b>	<b>11%</b>	<b>9,870</b>	<b>11%</b>	<b>3,547</b>	<b>\$28.38</b>	<b>n/a</b>

**Table D.8: Employment for Information Technology Occupations**

SOC CODE	DESCRIPTION	2011 JOBS	06-'11 CHANGE	06-'11 % CHANGE	11-'16 CHANGE	11-'16 % CHANGE	PROJECTED ANNUAL OPENINGS	CURRENT HOURLY EARNINGS	ED LEVEL
15-1071	Network and computer systems administrators	18,057	869	5%	2,193	12%	740	\$40.22	Bach.
15-1081	Network systems and data communications analysts	25,800	3,589	16%	4,219	16%	1,308	\$32.35	Bach.
15-1041	Computer support specialists	26,009	343	1%	1,962	8%	1,120	\$26.52	Assoc.
	<b>Subtotal</b>	<b>69,866</b>	<b>4,801</b>	<b>7%</b>	<b>8,374</b>	<b>12%</b>	<b>3,168</b>	<b>\$32.21</b>	<b>n/a</b>

**Table D.9: Employment for Building Design Occupations**

SOC CODE	DESCRIPTION	2011 JOBS	06-'11 CHANGE	06-'11 % CHANGE	11-'16 CHANGE	11-'16 % CHANGE	PROJECTED ANNUAL OPENINGS	CURRENT HOURLY EARNINGS	ED LEVEL
17-1011	Architects, except landscape and naval	9,365	(1,272)	(12%)	589	6%	289	\$29.14	Bach.
27-1021	Commercial and industrial designers	2,644	36	1%	156	6%	113	\$21.70	Bach.
19-3051	Urban and regional planners	3,398	(14)	0%	327	10%	131	\$38.42	Mast.
27-1025	Interior designers	4,350	(381)	(8%)	331	8%	201	\$19.12	Assoc.
	<b>Subtotal</b>	<b>19,757</b>	<b>(1,631)</b>	<b>(8%)</b>	<b>1,403</b>	<b>7%</b>	<b>734</b>	<b>\$27.53</b>	<b>n/a</b>

**Table D.10: Employment for Human Resources & Training Occupations**

SOC CODE	DESCRIPTION	2011 JOBS	06-'11 CHANGE	06-'11 % CHANGE	11-'16 CHANGE	11-'16 % CHANGE	PROJECTED ANNUAL OPENINGS	CURRENT HOURLY EARNINGS	ED LEVEL
11-3042	Training and development managers	1,217	(18)	(1%)	56	5%	38	\$48.80	Deg. + exp.
13-1073	Training and development specialists	7,551	382	5%	803	11%	358	\$31.40	Bach.
	<b>Subtotal</b>	<b>8,768</b>	<b>364</b>	<b>4%</b>	<b>859</b>	<b>10%</b>	<b>396</b>	<b>\$33.82</b>	<b>n/a</b>

## In Sector Employment for Critical Energy Efficiency Occupations

**Table D.11: In-Sector Employment for Construction Occupations**

SOC CODE	DESCRIPTION	2011 INDUSTRY JOBS	ANNUAL OPENINGS IN INDUSTRY	% OF ENERGY EFFICIENCY SECTOR	% OF OCCUPATION
47-2111	Electricians	10,601	318	8%	46%
47-2031	Carpenters	6,800	163	5%	13%
47-2152	Plumbers, pipefitters, and steamfitters	5,985	180	4%	35%

SOC CODE	DESCRIPTION	2011 INDUSTRY JOBS	ANNUAL OPENINGS IN INDUSTRY	% OF ENERGY EFFICIENCY SECTOR	% OF OCCUPATION
47-1011	First-line supervisors/managers of construction trades and extraction workers	4,920	148	4%	18%
11-9021	Construction managers	4,067	73	3%	17%
13-1051	Cost estimators	1,785	68	1%	19%
47-4011	Construction and building inspectors	1,581	54	1%	33%
47-2131	Insulation workers, floor, ceiling, and wall	55	3	0%	6%
47-2132	Insulation workers, mechanical	64	3	0%	14%
	<b>Subtotal</b>	<b>35,858</b>	<b>1,010</b>	<b>26%</b>	<b>n/a</b>

*Table D.12: In-Sector Employment for Engineering Occupations*

2011 INDUSTRY JOBS	ANNUAL OPENINGS IN INDUSTRY	% OF ENERGY EFFICIENCY SECTOR	% OF OCCUPATION	% OF ENERGY EFFICIENCY SECTOR	% OF OCCUPATION
17-2051	Civil engineers	9,289	316	7%	52%
11-9041	Engineering managers	2,277	59	2%	16%
17-2199	Engineers, all other	2,297	64	2%	17%
17-2072	Electronics engineers, except computer	638	18	0%	5%
17-2071	Electrical engineers	1,489	42	1%	17%
41-9031	Sales engineers	188	9	0%	2%
17-2141	Mechanical engineers	1,881	60	1%	22%
17-2112	Industrial engineers	396	15	0%	5%
17-2081	Environmental engineers	514	25	0%	22%
	<b>Subtotal</b>	<b>18,969</b>	<b>607</b>	<b>14%</b>	<b>n/a</b>

*Table D.13: In-Sector Employment for Building Design Occupations*

SOC CODE	DESCRIPTION	2011 INDUSTRY JOBS	ANNUAL OPENINGS IN INDUSTRY	% OF ENERGY EFFICIENCY SECTOR	% OF OCCUPATION
17-1011	Architects, except landscape and naval	7,162	215	5%	76%
27-1025	Interior designers	491	23	0%	11%
27-1021	Commercial and industrial designers	310	13	0%	12%
19-3051	Urban and regional planners	484	18	0%	14%
	<b>Subtotal</b>	<b>8,447</b>	<b>269</b>	<b>6%</b>	<b>n/a</b>

*Table D.14: In-Sector Employment for Energy Assessment Occupations*

SOC CODE	DESCRIPTION	2011 INDUSTRY JOBS	ANNUAL OPENINGS IN INDUSTRY	% OF ENERGY EFFICIENCY SECTOR	% OF OCCUPATION
13-1111	Management analysts	568	26	0%	1%
11-1021	General and operations managers	2,521	81	2%	3%
13-1199	Business operation specialists, all other	853	29	1%	1%
11-9021	Construction managers	4,067	73	3%	17%
	<b>Subtotal</b>	<b>8,009</b>	<b>209</b>	<b>6%</b>	<b>n/a</b>

**Table D.15: In-Sector Employment for Technician & Installation Occupations**

SOC CODE	DESCRIPTION	2011 INDUSTRY JOBS	ANNUAL OPENINGS IN INDUSTRY	% OF ENERGY EFFICIENCY SECTOR	% OF OCCUPATION
51-2022	Electrical and electronic equipment assemblers	167	3	0%	2%
49-9042	Maintenance and repair workers, general	387	10	0%	1%
51-9061	Inspectors, testers, sorters, samplers, and weighers	502	11	0%	3%
17-3023	Electrical and electronic engineering technicians	480	12	0%	6%
51-2092	Team assemblers	332	9	0%	2%
49-2011	Computer, automated teller, & office machine repairers	43	1	0%	1%
49-9021	Heating, air conditioning, and refrigeration mechanics and installers	1,982	59	1%	27%
47-2211	Sheet metal workers	1,721	45	1%	31%
17-3029	Engineering technicians, except drafters, all other	345	9	0%	7%
49-1011	First-line supervisors/managers of mechanics, installers, and repairers	464	15	0%	3%
51-2023	Electromechanical equipment assemblers	113	2	0%	3%
49-9041	Industrial machinery mechanics	52	1	0%	1%
51-4041	Machinists	86	1	0%	1%
49-2022	Telecommunications equipment installers and repairers, except line installers	663	17	0%	6%
51-2099	Assemblers and fabricators, all other	89	2	0%	1%
49-9012	Control and valve installers and repairers, except mechanical door	20	1	0%	2%
49-2094	Electrical and electronics repairers, commercial and industrial equipment	110	3	0%	6%
47-2132	Insulation workers, mechanical	64	3	0%	14%
49-9043	Maintenance workers, machinery	16	0	0%	1%
51-8021	Stationary engineers and boiler operators	16	1	0%	1%
17-3021	Aerospace engineering and operations technicians	42	1	0%	13%
51-2093	Timing device assemblers, adjusters, and calibrators	2	0	0%	2%
51-2091	Fiberglass laminators and fabricators	-	-	0%	0%
	<b>Subtotal</b>	<b>7,696</b>	<b>207</b>	<b>6%</b>	<b>n/a</b>

**Table D.16: In-Sector Employment for Operations & Supply Chain Occupations**

SOC CODE	DESCRIPTION	2011 INDUSTRY JOBS	ANNUAL OPENINGS IN INDUSTRY	% OF ENERGY EFFICIENCY SECTOR	% OF OCCUPATION
11-9199	Managers, all other	2,375	109	2%	2%
13-1023	Purchasing agents, except wholesale, retail, and farm products	359	14	0%	3%
43-5061	Production, planning, and expediting clerks	269	8	0%	2%
15-2031	Operations research analysts	33	2	0%	1%
11-3011	Administrative services managers	119	4	0%	1%
11-3061	Purchasing managers	84	3	0%	2%
	<b>Subtotal</b>	<b>3,239</b>	<b>140</b>	<b>2%</b>	<b>n/a</b>

**Table D.17: In-Sector Employment for Sales, Marketing & Program Management Occupations**

SOC CODE	DESCRIPTION	2011 INDUSTRY JOBS	ANNUAL OPENINGS IN INDUSTRY	% OF ENERGY EFFICIENCY SECTOR	% OF OCCUPATION
43-4051	Customer service representatives	169	8	0%	0%
11-2021	Marketing managers	354	11	0%	2%
41-4011	Sales representatives, wholesale and manufacturing, technical and scientific products	188	7	0%	1%
11-2022	Sales managers	121	5	0%	1%
41-4012	Sales representatives, wholesale and manufacturing, except technical and scientific products	302	11	0%	1%
43-4151	Order clerks	18	1	0%	0%
11-2011	Advertising and promotions managers	-	-	0%	0%
	<b>Subtotal</b>	<b>1,152</b>	<b>42</b>	<b>1%</b>	<b>n/a</b>

**Table D.18: In-Sector Employment for Finance & Accounting Occupations**

SOC CODE	DESCRIPTION	2011 INDUSTRY JOBS	ANNUAL OPENINGS IN INDUSTRY	% OF ENERGY EFFICIENCY SECTOR	% OF OCCUPATION
13-2011	Accountants and auditors	893	32	1%	1%
13-2051	Financial analysts	43	2	0%	0%
	<b>Subtotal</b>	<b>936</b>	<b>34</b>	<b>1%</b>	<b>n/a</b>

**Table D.19: In-Sector Employment for Information Technology Occupations**

SOC CODE	DESCRIPTION	2011 INDUSTRY JOBS	ANNUAL OPENINGS IN INDUSTRY	% OF ENERGY EFFICIENCY SECTOR	% OF OCCUPATION
15-1081	Network systems and data communications analysts	233	12	0%	1%
15-1041	Computer support specialists	277	12	0%	1%
15-1071	Network and computer systems administrators	334	13	0%	2%
	<b>Subtotal</b>	<b>844</b>	<b>37</b>	<b>1%</b>	<b>n/a</b>

**Table D.20: In-Sector Employment for Human Resources & Training Occupations**

SOC CODE	DESCRIPTION	2011 INDUSTRY JOBS	ANNUAL OPENINGS IN INDUSTRY	% OF ENERGY EFFICIENCY SECTOR	% OF OCCUPATION
13-1073	Training and development specialists	52	2	0%	1%
11-3042	Training and development managers	3	0	0%	0%
	<b>Subtotal</b>	<b>55</b>	<b>3</b>	<b>0%</b>	<b>n/a</b>

**Table D.21: Distribution of Critical Energy Efficiency Occupations by Age Group**

SOC	TITLE	14-18	19-21	22-24	25-34	35-44	45-54	55-64	65-99	GRAND TOTAL	% OVER 45
11-9199	Managers, all other	201	217	213	10,069	24,634	28,713	20,888	10,312	95,248	63%
11-1021	General and operations managers	106	99	261	11,734	27,191	30,216	15,284	1,398	86,290	54%

SOC	TITLE	14-18	19-21	22-24	25-34	35-44	45-54	55-64	65-99	GRAND TOTAL	% OVER 45
13-1111	Management analysts	89	142	205	8,677	15,683	16,207	18,130	10,870	70,004	65%
13-2011	Accountants & auditors	25	184	1,088	14,707	15,481	17,501	13,919	5,860	68,767	54%
49-9042	Maintenance and repair workers, general	200	406	814	7,112	10,414	14,887	9,641	2,746	46,220	59%
41-4012	Sales representatives, wholesale and mfg., except technical and scientific products	107	144	1,025	7,773	11,243	12,083	7,519	2,469	42,364	52%
11-9021	Construction mgrs.	17	162	139	3,656	7,197	9,027	3,649	781	24,628	55%
13-2051	Financial analysts	9	85	124	3,550	6,532	5,819	4,561	1,870	22,551	54%
17-2051	Civil engineers	3	72	170	3,680	3,810	5,235	3,308	1,604	17,883	57%
51-9061	Inspectors, testers, sorters, samplers, and weighers	67	55	280	2,826	4,062	5,417	3,072	472	16,251	55%
49-1011	First-line supervisors/ mgrs. of mechanics, installers, and repairers	0	140	150	1,375	3,744	5,034	2,982	582	14,005	61%
17-2199	Engineers, all other	0	42	91	1,296	3,577	4,973	3,093	482	13,554	63%
11-9041	Engineering managers	0	0	49	2,334	4,158	6,181	1,861	64	14,647	55%
13-1023	Purchasing agents, except wholesale, retail, and farm products	0	103	97	1,937	2,955	3,753	2,686	408	11,939	57%
11-3011	Administrative services managers	6	86	120	678	2,213	3,666	2,413	586	9,767	68%
17-2072	Electronics engineers, except computer	0	39	109	2,023	3,772	4,238	2,119	284	12,584	53%
17-1011	Architects, except landscape and naval	0	20	155	1,221	1,709	2,583	2,142	1,535	9,365	67%
51-2022	Electrical and electronic equipment assemblers	35	78	54	1,539	2,176	4,320	1,826	85	10,112	62%
13-1051	Cost estimators	55	70	43	561	2,457	3,762	2,109	103	9,160	65%
51-4041	Machinists	8	78	97	923	1,844	3,205	1,765	315	8,236	64%
41-9031	Sales engineers	0	0	140	726	3,966	3,493	1,584	124	10,033	52%
17-2071	Electrical engineers	0	26	99	1,189	2,590	3,215	1,574	279	8,973	56%
17-3023	Electrical and electronic engineering technicians	28	84	144	1,292	2,062	3,006	1,508	289	8,414	57%
17-2141	Mechanical engineers	0	66	108	1,557	2,240	2,828	1,355	568	8,722	54%
17-2112	Industrial engineers	0	18	167	1,008	1,912	2,709	1,508	329	7,651	59%
49-9041	Industrial machinery mechanics	32	48	123	824	1,529	2,475	1,499	216	6,745	62%
47-4011	Construction and building inspectors	0	41	103	288	389	1,674	1,579	657	4,731	83%
17-3029	Engineering technicians, except drafters, all other	18	62	65	770	1,132	1,693	946	161	4,847	58%
15-2031	Operations research analysts	0	39	70	473	953	1,598	953	89	4,175	63%
11-3061	Purchasing managers	0	55	234	165	708	1,415	774	221	3,571	67%

SOC	TITLE	14-18	19-21	22-24	25-34	35-44	45-54	55-64	65-99	GRAND TOTAL	% OVER 45
27-1025	Interior designers	0	106	128	664	1,277	1,075	722	379	4,350	50%
51-2023	Electromechanical equipment assemblers	3	50	54	608	475	1,352	669	69	3,281	64%
19-3051	Urban and regional planners	0	41	116	557	815	946	752	171	3,398	55%
11-2011	Advertising and promotions managers	0	35	131	519	414	681	740	82	2,603	58%
17-2081	Environmental engineers	0	0	111	469	525	737	432	94	2,368	53%
51-8021	Stationary engineers and boiler operators	0	26	38	152	227	373	334	231	1,382	68%
49-2094	Electrical and electronics repairers, commercial and industrial equipment	0	67	138	378	322	537	320	74	1,837	51%
49-9043	Maintenance workers, machinery	0	58	61	231	238	466	259	142	1,454	60%
49-9012	Control and valve installers and repairers, except mech. door	0	34	86	126	188	378	260	57	1,128	62%
11-3042	Training and development managers	0	9	98	177	308	345	222	58	1,217	51%
13-1199	Business operation specialists, all other	172	189	1,885	16,145	17,489	18,959	12,744	2,086	69,668	48%
43-4051	Customer service representatives	661	3,714	6,780	19,854	13,671	11,746	6,533	1,486	64,444	31%
47-2031	Carpenters	293	406	2,382	13,927	14,512	13,580	4,841	833	50,775	38%
47-1011	First-line supervisors/managers of construction trades and extraction workers	19	162	351	4,931	8,049	9,133	3,533	507	26,686	49%
51-2092	Team assemblers	151	90	785	4,544	5,712	6,491	3,278	577	21,629	48%
11-2022	Sales managers	25	132	112	5,396	8,276	6,311	3,050	677	23,979	42%
41-4011	Sales reps., wholesale & mfg., technical & scientific products	69	99	265	3,907	6,027	5,454	2,856	758	19,434	47%
15-1041	Computer support specialists	102	100	75	8,440	8,237	6,552	2,410	93	26,009	35%
47-2111	Electricians	118	152	293	7,339	6,389	5,978	2,558	448	23,276	39%
11-2021	Marketing managers	0	106	146	4,077	6,516	4,612	2,101	515	18,073	40%
47-2152	Plumbers, pipefitters, and steamfitters	55	88	268	5,400	4,903	4,599	1,699	230	17,243	38%
43-5061	Production, planning, and expediting clerks	119	71	98	2,730	3,223	3,658	2,103	352	12,354	49%
15-1081	Network systems and data communications analysts	93	132	662	9,839	9,166	4,078	1,573	258	25,800	23%
15-1071	Network and computer systems admin.	33	133	100	5,217	6,934	3,981	1,500	159	18,057	31%
49-2022	Telecommunications equipment installers and repairers, except line installers	53	130	263	2,850	3,138	3,046	1,532	197	11,208	43%

SOC	TITLE	14-18	19-21	22-24	25-34	35-44	45-54	55-64	65-99	GRAND TOTAL	%
											OVER 45
51-2099	Assemblers and fabricators, all other	78	90	95	1,668	2,382	2,417	1,232	258	8,220	48%
13-1073	Training and development specialists	42	120	97	1,545	2,173	1,983	1,309	282	7,551	47%
43-4151	Order clerks	132	82	330	2,555	2,300	1,996	1,216	352	8,963	40%
49-9021	Heating, air conditioning, and refrigeration mechanics & installers	102	101	108	1,935	1,896	2,174	796	250	7,362	44%
49-2011	Computer, automated teller, and office machine repairers	147	169	159	2,333	2,420	1,924	1,064	187	8,403	38%
47-2211	Sheet metal workers	71	68	149	1,495	1,589	1,506	557	121	5,555	39%
27-1021	Commercial and industrial designers	0	49	189	401	715	648	464	177	2,644	49%
47-2131	Insulation workers, floor, ceiling, and wall	35	103	109	150	227	172	61	8	864	28%
51-2091	Fiberglass laminators and fabricators	1	37	43	121	121	126	79	26	555	42%
17-3021	Aerospace engineering and operations techs.	0	0	24	96	65	63	58	10	316	42%
47-2132	Insulation workers, mechanical	0	67	66	118	81	62	47	15	457	27%
51-2093	Timing device assemblers, adjusters, and calibrators	0	0	0	31	18	23	11	0	84	41%
	<b>Grand Total</b>	<b>3,583</b>	<b>9,677</b>	<b>23,335</b>	<b>226,883</b>	<b>313,352</b>	<b>339,091</b>	<b>200,165</b>	<b>57,975</b>	<b>1,174,062</b>	<b>51%</b>

**Table D.22: Distribution of Critical Energy Efficiency Occupations by Highest Educational Level**

SOC	TITLE	2011 JOBS	LESS	HIGH	SOME	ASSOCI-	BACH-	MASTER'S	DOC-
			THAN HS DIPLOMA	SCHOOL DIPLOMA/EQUIV.	COLLEGE, NO DEGREE	ATE'S DEGREE	ELOR'S DEGREE	DEGREE	TORAL/ PROFESS. DEGREE
11-2011	Advertising and promotions managers	2,603	1.0%	7.7%	12.5%	5.9%	59.9%	12.1%	1.0%
11-2021	Marketing managers	18,073	1.0%	9.1%	17.6%	6.7%	47.7%	16.6%	1.4%
11-2022	Sales managers	23,979	1.0%	9.1%	17.6%	6.7%	47.7%	16.6%	1.4%
11-3011	Administrative services managers	9,767	2.2%	19.3%	28.6%	12.2%	27.5%	8.6%	1.6%
11-3042	Training and development mgrs.	1,217	2.3%	12.5%	21.7%	7.4%	36.3%	17.8%	2.0%
11-3061	Purchasing managers	3,571	1.1%	11.8%	21.7%	9.1%	38.7%	15.4%	2.2%
11-9021	Construction managers	24,628	7.8%	30.8%	24.6%	8.1%	23.2%	4.8%	0.8%
11-9041	Engineering managers	14,647	0.8%	4.0%	7.7%	5.5%	45.7%	31.8%	4.5%
11-9199	Managers, all other	95,248	2.9%	15.7%	20.2%	8.1%	33.7%	16.0%	3.5%
11-1021	General and operations mgrs.	86,290	2.2%	16.9%	23.9%	8.4%	33.7%	12.4%	2.4%
13-1023	Purchasing agents, except wholesale, retail, & farm products	11,939	2.0%	20.7%	27.9%	10.8%	30.0%	7.6%	0.9%
13-1051	Cost estimators	9,160	3.6%	25.0%	30.3%	11.1%	26.5%	3.0%	0.4%

SOC	TITLE	2011 JOBS	LESS THAN HS DIPLOMA	HIGH SCHOOL DIPLOMA/EQUIV.	SOME COLLEGE, NO DEGREE	ASSOCIATE'S DEGREE	BACHELOR'S DEGREE	MASTER'S DEGREE	DOCTORAL/PROFESS. DEGREE
13-1073	Training and development specialists	7,551	1.6%	13.7%	22.9%	9.2%	37.7%	13.2%	1.8%
13-1111	Management analysts	70,004	0.6%	6.0%	12.5%	5.0%	40.4%	28.8%	6.8%
13-1199	Business operation specialists, all other	69,668	1.9%	15.5%	23.1%	11.6%	32.3%	12.9%	2.7%
13-2011	Accountants and auditors	68,767	0.3%	5.3%	8.9%	10.5%	55.6%	17.0%	2.4%
13-2051	Financial analysts	22,551	0.9%	4.4%	10.1%	2.7%	44.6%	31.0%	6.2%
15-1041	Computer support specialists	26,009	1.0%	12.5%	29.4%	16.0%	33.1%	7.2%	0.9%
15-1071	Network and computer systems administrators	18,057	0.7%	8.4%	25.2%	15.5%	39.0%	10.2%	1.0%
15-1081	Network systems and data communications analysts	25,800	0.7%	8.1%	21.6%	13.5%	42.8%	12.1%	1.2%
15-2031	Operations research analysts	4,175	0.6%	6.6%	18.4%	7.8%	40.0%	23.0%	3.6%
17-1011	Architects, except landscape and naval	9,365	0.3%	1.9%	4.8%	4.8%	51.6%	28.0%	8.6%
17-2051	Civil engineers	17,883	0.3%	3.5%	5.8%	6.0%	56.4%	23.9%	4.2%
17-2071	Electrical engineers	8,973	0.2%	4.1%	9.2%	8.9%	50.1%	22.5%	5.0%
17-2072	Electronics engineers, except computer	12,584	0.2%	4.1%	9.2%	8.9%	50.1%	22.5%	5.0%
17-2081	Environmental engineers	2,368	0.5%	4.5%	4.8%	3.7%	46.7%	33.4%	6.4%
17-2112	Industrial engineers	7,651	0.3%	8.1%	13.5%	10.2%	49.2%	16.6%	2.1%
17-2141	Mechanical engineers	8,722	0.3%	5.2%	10.1%	11.3%	51.1%	19.5%	2.4%
17-2199	Engineers, all other	13,554	0.3%	3.8%	7.8%	7.8%	48.3%	25.8%	6.3%
17-3021	Aerospace engineering and operations technicians	316	3.7%	23.5%	33.1%	22.7%	14.1%	2.3%	0.5%
17-3023	Electrical and electronic engineering technicians	8,414	3.7%	23.5%	33.1%	22.7%	14.1%	2.3%	0.5%
17-3029	Engineering technicians, except drafters, all other	4,847	3.7%	23.5%	33.1%	22.7%	14.1%	2.3%	0.5%
19-3051	Urban and regional planners	3,398	0.0%	0.9%	3.2%	3.4%	35.6%	52.5%	4.5%
27-1021	Commercial and industrial designers	2,644	2.7%	13.0%	19.3%	14.1%	42.5%	7.1%	1.1%
27-1025	Interior designers	4,350	2.7%	13.0%	19.3%	14.1%	42.5%	7.1%	1.1%
41-4011	Sales representatives, wholesale and manufacturing, technical and scientific products	19,434	3.0%	18.6%	23.2%	8.1%	39.8%	6.6%	0.7%
41-4012	Sales representatives, wholesale and manufacturing, except technical and scientific products	42,364	3.0%	18.6%	23.2%	8.1%	39.8%	6.6%	0.7%
41-9031	Sales engineers	10,033	0.9%	5.0%	15.6%	8.3%	54.6%	14.7%	1.0%
43-4051	Customer service representatives	64,444	4.5%	30.5%	32.5%	10.9%	18.4%	2.8%	0.4%
43-4151	Order clerks	8,963	9.6%	37.8%	28.1%	8.7%	13.3%	2.0%	0.5%
43-5061	Production, planning, and expediting clerks	12,354	3.2%	27.2%	31.2%	11.1%	21.3%	5.5%	0.5%
47-1011	First-line supervisors/managers of construction trades and extraction workers	26,686	15.5%	42.8%	24.6%	6.6%	8.8%	1.4%	0.4%
47-2031	Carpenters	50,775	24.6%	43.8%	19.1%	5.2%	6.1%	0.9%	0.3%



SOC	TITLE	2011 JOBS	LESS THAN HS DIPLOMA	HIGH SCHOOL DIPLOMA/EQUIV.	SOME COLLEGE, NO DEGREE	ASSOCIATE'S DEGREE	BACHELOR'S DEGREE	MASTER'S DEGREE	DOCTORAL/PROFESS. DEGREE
47-2111	Electricians	23,276	9.0%	40.1%	30.4%	12.9%	6.4%	0.9%	0.4%
47-2131	Insulation workers, floor, ceiling, and wall	864	30.9%	44.7%	16.2%	2.5%	5.3%	0.2%	0.1%
47-2132	Insulation workers, mechanical	457	30.9%	44.7%	16.2%	2.5%	5.3%	0.2%	0.1%
47-2152	Plumbers, pipefitters, and steamfitters	17,243	19.4%	46.8%	23.2%	6.2%	3.5%	0.5%	0.3%
47-2211	Sheet metal workers	5,555	15.6%	49.8%	23.6%	6.8%	3.5%	0.6%	0.1%
47-4011	Construction and building inspectors	4,731	3.1%	27.0%	32.7%	12.8%	21.4%	2.7%	0.4%
49-1011	First-line supervisors/managers of mechanics, installers, and repairers	14,005	8.2%	38.3%	29.5%	11.9%	10.0%	1.9%	0.3%
49-2011	Computer, automated teller, and office machine repairers	8,403	2.7%	20.0%	33.0%	21.6%	19.5%	2.9%	0.3%
49-2022	Telecommunications equipment installers and repairers, except line installers	11,208	3.7%	31.7%	34.1%	17.4%	11.3%	1.6%	0.1%
49-2094	Electrical and electronics repairers, commercial and industrial equipment	1,837	2.7%	35.0%	31.9%	19.8%	9.3%	1.1%	0.2%
49-9012	Control and valve installers and repairers, except mech. door	1,128	9.5%	43.5%	29.7%	11.3%	5.3%	0.5%	0.3%
49-9021	Heating, air conditioning, and refrigeration mechs. and installers	7,362	13.1%	42.8%	26.9%	11.8%	4.5%	0.6%	0.3%
49-9041	Industrial machinery mechanics	6,745	11.7%	43.8%	26.2%	12.0%	5.6%	0.5%	0.2%
49-9042	Maintenance and repair workers, general	46,220	14.2%	42.8%	26.0%	10.3%	5.6%	0.8%	0.3%
49-9043	Maintenance workers, machinery	1,454	13.0%	43.0%	27.3%	11.6%	4.5%	0.3%	0.3%
51-2022	Electrical and electronic equipment assemblers	10,112	22.5%	48.1%	17.4%	6.2%	4.9%	0.8%	0.2%
51-2023	Electromechanical equipment assemblers	3,281	22.5%	48.1%	17.4%	6.2%	4.9%	0.8%	0.2%
51-2091	Fiberglass laminators & fabricators	555	21.6%	48.6%	19.3%	5.4%	4.4%	0.5%	0.2%
51-2092	Team assemblers	21,629	21.6%	48.6%	19.3%	5.4%	4.4%	0.5%	0.2%
51-2093	Timing device assemblers, adjusters, and calibrators	84	21.6%	48.6%	19.3%	5.4%	4.4%	0.5%	0.2%
51-2099	Assemblers & fabricators, all other	8,220	21.6%	48.6%	19.3%	5.4%	4.4%	0.5%	0.2%
51-4041	Machinists	8,236	11.1%	49.2%	26.7%	9.2%	3.2%	0.3%	0.2%
51-8021	Stationary engineers and boiler operators	1,382	7.1%	42.4%	30.5%	8.8%	8.9%	2.0%	0.3%
51-9061	Inspectors, testers, sorters, samplers, and weighers	16,251	12.7%	40.3%	24.4%	9.1%	10.7%	2.4%	0.4%

## Detailed KSA Tables

**Table D.23: Top KSAs for Building Construction Occupations**

KNOWLEDGE	GROUP AVG.	GROUP AVG. PER-CENTILE	SKILLS	GROUP AVG.	GROUP AVG. PER-CENTILE	ABILITIES	GROUP AVG.	GROUP AVG. PER-CENTILE
Building and Construction	67	95	Installation	58	80	Gross Body Equilibrium	42	95
Design	56	80	Repairing	51	<70	Gross Body Coordination	40	80
Transportation	40	70	Management of Personnel Resources	52	<70	Extent Flexibility	54	80
Engineering and Technology	52	70	Equipment Maintenance	50	<70	Stamina	39	80
Mechanical	58	<70	Quality Control Analysis	49	<70	Dynamic Strength	37	80

**Table D.24: Top KSAs for Management Construction Occupations**

KNOWLEDGE	GROUP AVG.	GROUP AVG. PER-CENTILE	SKILLS	GROUP AVG.	GROUP AVG. PER-CENTILE	ABILITIES	GROUP AVG.	GROUP AVG. PER-CENTILE
Building and Construction	73	99	Systems Analysis	44	<70	Number Facility	46	<70
Engineering and Technology	66	90	Management of Personnel Resources	47	<70	Mathematical Reasoning	45	<70
Design	61	90	Management of Financial Resources	41	<70	Visualization	50	<70
Mathematics	66	75	Systems Evaluation	43	<70	Time Sharing	40	<70
Public Safety and Security	52	70	Negotiation	48	<70	Flexibility of Closure	46	<70

**Table D.25: Top KSAs for Engineering Occupations**

KNOWLEDGE	GROUP AVG.	GROUP AVG. PER-CENTILE	SKILLS	GROUP AVG.	GROUP AVG. PER-CENTILE	ABILITIES	GROUP AVG.	GROUP AVG. PER-CENTILE
Engineering and Technology	84	95	Systems Analysis	60	90	Mathematical Reasoning	58	90
Design	75	95	Systems Evaluation	57	80	Deductive Reasoning	67	90
Physics	61	95	Mathematics	72	75	Written Comprehension	69	85
Mathematics	72	85	Complex Problem Solving	69	70	Information Ordering	61	90
Production and Processing	51	75	Judgment and Decision Making	67	<70	Oral Comprehension	71	90
Computers and Electronics	66	75				Category Flexibility	57	85
						Visualization	58	85
						Oral Expression	70	85
						Fluency of Ideas	56	80
						Originality	56	80
						Written Expression	64	80
						Problem Sensitivity	60	75

**Table D.26: Top KSAs for Building Design Occupations**

KNOWLEDGE	GROUP		SKILLS	GROUP		ABILITIES	GROUP	
	GROUP AVG.	AVG. PER-CENTILE		GROUP AVG.	AVG. PER-CENTILE		GROUP AVG.	AVG. PER-CENTILE
Design	79	95	Complex Problem Solving	69	75	Originality	61	90
Building and Construction	58	90	Operations Analysis	59	75	Fluency of Ideas	58	85
Fine Arts	29	80	Persuasion	64	70	Visualization	61	90
Engineering and Technology	57	75	Coordination	73	70	Deductive Reasoning	63	80
Sales and Marketing	48	75	Negotiation	56	<70	Information Ordering	57	80
Administration and Management	58	75						
Clerical	62	75						
Mathematics	65	75						

**Table D.27: Top KSAs for Energy Assessment Occupations**

KNOWLEDGE	GROUP		SKILLS	GROUP		ABILITIES	GROUP	
	GROUP AVG.	AVG. PER-CENTILE		GROUP AVG.	AVG. PER-CENTILE		GROUP AVG.	AVG. PER-CENTILE
Administration and Management	64	90	Systems Evaluation	58	80	Mathematical Reasoning	49	75
Economics and Accounting	47	85	Management of Financial Resources	57	80	Number Facility	49	75
Building and Construction	56	90	Systems Analysis	55	80	Fluency of Ideas	50	<70
Personnel and Human Resources	54	85	Management of Personnel Resources	52	<70	Written Expression	59	<70
Sales and Marketing	53	85	Management of Material Resources	49	<70	Deductive Reasoning	58	<70
Clerical	63	75						

**Table D.28: Top KSAs for Technician & Installation Occupations**

KNOWLEDGE	GROUP		SKILLS	GROUP		ABILITIES	GROUP	
	GROUP AVG.	AVG. PER-CENTILE		GROUP AVG.	AVG. PER-CENTILE		GROUP AVG.	AVG. PER-CENTILE
Mechanical	64	80	Installation	54	70	Finger Dexterity	49	<70
Engineering and Technology	48	<70	Repairing	56	75	Visualization	49	<70
Design	42	<70	Troubleshooting	57	<70	Manual Dexterity	46	<70
Production and Processing	42	<70	Equipment Maintenance	55	<70	Arm-Hand Steadiness	46	<70
Building and Construction	34	<70	Operation Monitoring	50	<70	Control Precision	46	<70

**Table D.29: Top KSAs for Operations & Supply Chain Occupations**

KNOWLEDGE	GROUP		SKILLS	GROUP		ABILITIES	GROUP	
	GROUP AVG.	AVG. PER-CENTILE		GROUP AVG.	AVG. PER-CENTILE		GROUP AVG.	AVG. PER-CENTILE
Economics and Accounting	48	90	Management of Financial Resources	51	70	Mathematical Reasoning	47	70
Production and Processing	58	85	Systems Evaluation	52	<70	Number Facility	48	75
Admin. and Mgt.	62	85	Operations Analysis	59	70	Deductive Reasoning	57	<70
Mathematics	66	75	Management of Material Resources	50	70	Category Flexibility	51	<70
Personnel and Human Resources	48	75	Mathematics	66	75	Written Expression	58	<70

**Table D.30: Top KSAs for Administrative Sales, Marketing, Program Management Occupations**

KNOWLEDGE	GROUP		SKILLS	GROUP		ABILITIES	GROUP	
	GROUP AVG.	AVG. PER-CENTILE		GROUP AVG.	AVG. PER-CENTILE		GROUP AVG.	AVG. PER-CENTILE
Sales and Marketing	78	99	Negotiation	59	75	Speech Recognition	58	85
Admin. and Mgt.	62	80	Persuasion	65	70	Fluency of Ideas	53	75
Economics and Accounting	42	80	Management of Financial Resources	49	<70	Originality	51	<70
Customer and Personal Service	76	75	Service Orientation	61	<70	Speech Clarity	55	<70
Communications and Media	43	<70	Management of Personnel Resources	51	<70	Written Expression	56	<70

**Table D.31: Top KSAs for Clerical Sales, Marketing, Program Management Occupations**

KNOWLEDGE	GROUP		SKILLS	GROUP		ABILITIES	GROUP	
	GROUP AVG.	AVG. PER-CENTILE		GROUP AVG.	AVG. PER-CENTILE		GROUP AVG.	AVG. PER-CENTILE
Customer and Personal Service	79	80	Service Orientation	61	<70	Speech Recognition	62	95
Clerical	60	70	Reading Comprehension	64	<70	Memorization	38	<70
Sales and Marketing	42	<70	Active Listening	63	<70	Speed of Closure	40	<70
Telecommunications	24	<70	Writing	54	<70	Flexibility of Closure	46	<70
Econ. & Accounting	27	<70	Time Management	55	<70	Perceptual Speed	41	<70

**Table D.32: Top KSAs for Finance & Accounting Occupations**

KNOWLEDGE	GROUP		SKILLS	GROUP		ABILITIES	GROUP	
	GROUP AVG.	AVG. PER-CENTILE		GROUP AVG.	AVG. PER-CENTILE		GROUP AVG.	AVG. PER-CENTILE
Economics and Accounting	76	99	Management of Financial Resources	71	95	Number Facility	63	95
Mathematics	76	90	Systems Evaluation	63	90	Math. Reasoning	59	90
Law and Government	59	90	Judgment and Decision Making	75	85	Deductive Reasoning	66	90
Clerical	70	85	Programming	35	80	Flexibility of Closure	50	70
English Language	68	75	Mathematics	76	75	Written Compr.	63	<70
			Operations Analysis	62	80			
			Systems Analysis	60	90			
			Time Management	71	75			

**Table D.33: Top KSAs for Information Technology Occupations**

KNOWLEDGE	GROUP		SKILLS	GROUP		ABILITIES	GROUP	
	GROUP AVG.	AVG. PER-CENTILE		GROUP AVG.	AVG. PER-CENTILE		GROUP AVG.	AVG. PER-CENTILE
Tele-communications	61	99	Programming	47	95	Information Ordering	56	75
Computers and Electronics	82	95	Systems Analysis	56	80	Number Facility	45	<70
Engineering and Technology	48	<70	Systems Evaluation	55	75	Written Comprehension	60	<70
Clerical	55	<70	Troubleshooting	57	<70	Memorization	39	<70
Customer and Personal Service	63	<70	Operation Monitoring	50	<70	Deductive Reasoning	57	<70

**Table D.34: Top KSAs for Human Resources & Training Occupations**

KNOWLEDGE	GROUP		SKILLS	GROUP		ABILITIES	GROUP	
	GROUP AVG.	AVG. PER-CENTILE		GROUP AVG.	AVG. PER-CENTILE		GROUP AVG.	AVG. PER-CENTILE
Education and Training	91	95	Systems Evaluation	54	75	Memorization	45	80
Personnel and Human Resources	66	95	Learning Strategies	66	<70	Speech Clarity	60	80
Sociology and Anthropology	60	95	Systems Analysis	49	<70	Oral Expression	66	70
Sales and Marketing	58	90	Management of Personnel Resources	51	<70	Originality	52	<70
English Language	75	90	Management of Financial Resources	44	<70	Fluency of Ideas	51	<70
Administration and Management	63	85						
Communications and Media	53	85						
Clerical	68	85						
Philosophy and Theology	39	80						
Therapy and Counseling	42	75						