



Electric Power Generation

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Electric Power Generation (EPG) covers all utility and non-utility employment across electric generating technologies, including fossil fuels, nuclear, and renewable energy technologies. Also included in the employment totals are any firms engaged in facility construction, turbine and other generation equipment manufacturing, and wholesale parts distribution for all electric generation technologies.

TRENDS

- 2018 Job Loss.** In 2018, the Electric Power Generation sector dropped 8,258 jobs, declining by almost 1 percent to a total of 875,585 jobs.
- Technology Shifts.** Advanced natural gas added the most new jobs, 4,500, while solar contracted, losing 8,000 jobs. Other technologies that grew included wind, combined heat and power, and geothermal. Nuclear and coal declined.
- 2019 Expectations.** Electric Power Generation employers anticipated 7.1 percent job growth in 2019, with most of the increase expected in renewable construction.

-0.9%

Electric Power
Generation job growth
in 2018

7.1%

EPG employers predict
7.1% job growth in
2019

SNAPSHOT OF EMPLOYMENT

Figure 28.

Electric Power Generation Sector – Employment by Industry, 2017-2018

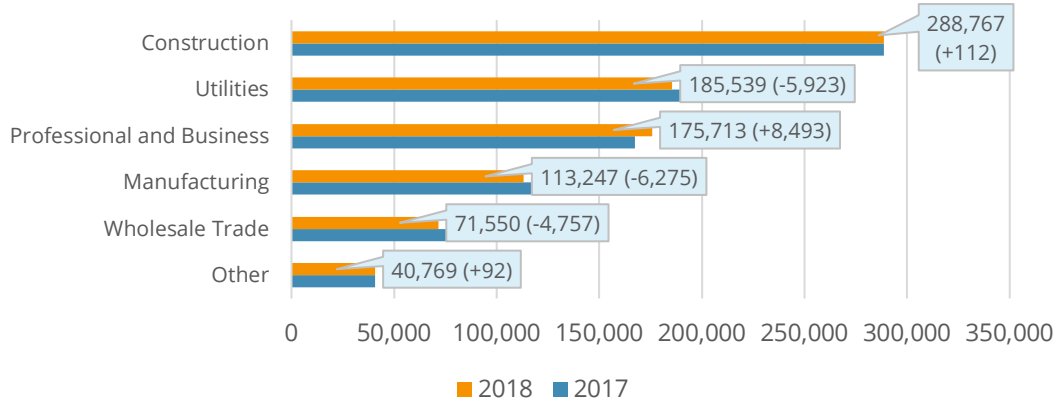
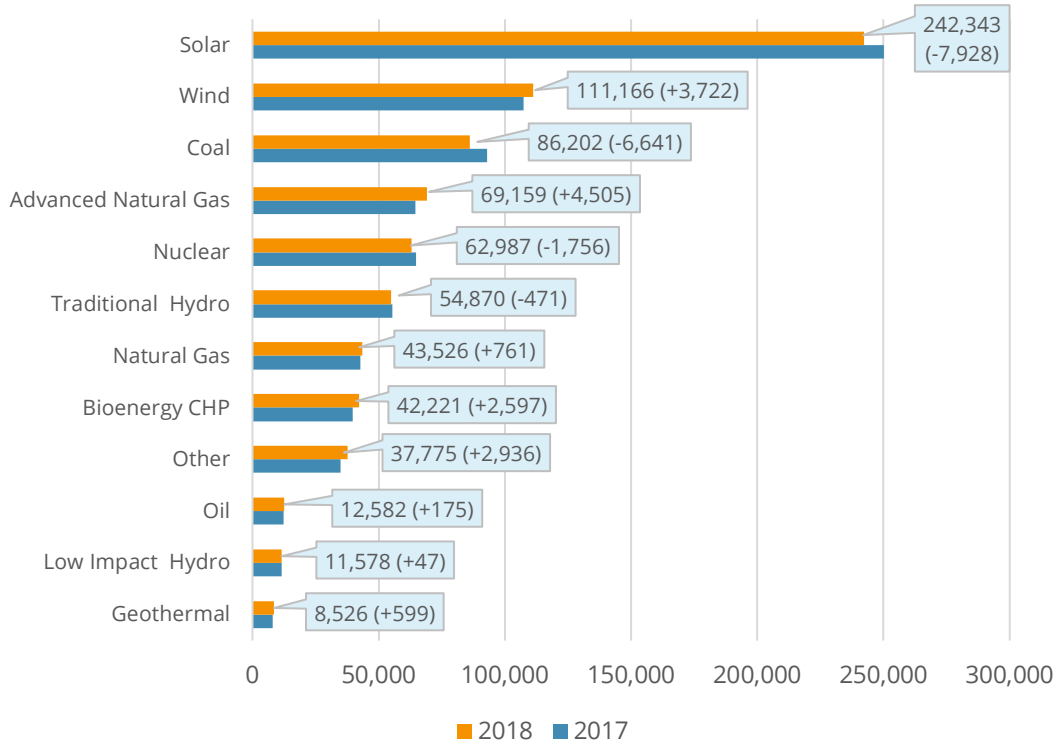


Figure 29.

Electric Power Generation Sector – Employment by Detailed Technology Application, 2017-2018²⁸



²⁸ Text, charts, and tables in the 2019 report include revised 2017 employment totals for advanced and traditional natural gas generation based on additional available data from the Energy Information Administration.

KEY TAKEAWAYS

- While solar EPG has the most jobs overall, the utility sector of the Electric Power Generation sector is dominated by natural gas, coal, and nuclear power, which produce over 80 percent of the nation’s electricity.
- Natural gas and advanced natural gas, combined—with over 112,000 jobs—have exceeded coal, both in employment and gigawatts produced.
- Solar and wind are number one and two in the construction industry with 177,000 and 37,000 jobs respectively. Natural gas was third with 10,000.

Table 18.

Electric Power Generation Sector — Employment by Detailed Technology Application and Industry, Q2 2018²⁹

	Total	Utilities	Construction	Manufacturing	Wholesale Trade	Professional Services	Other Services
Majority-Time							
Solar	242,343	3,295	122,026	33,726	23,938	36,293	23,064
Employment							
Wind	111,166	6,231	36,706	26,490	11,783	27,058	2,898
Coal	86,202	45,795	8,639	1,079	5,935	23,749	1,005
Adv Nat Gas	69,159	41,780	9,378	2,771	4,824	9,505	900
Nuclear	62,987	46,809	2,195	1,875	2,531	9,491	86
Trad Hydro	54,870	17,480	8,850	14,415	5,821	8,070	234
Natural Gas	43,526	17,242	10,337	3,582	3,072	8,165	1,128
Other	37,775	1,610	18,564	3,718	2,177	11,008	698
CHP	29,245	1,673	4,241	2,058	3,805	17,274	195
Concentrated	25,411	-	20,361	1,224	1,433	2,073	320
Bio	12,976	2,029	5,644	1,107	558	3,199	439
Oil	12,582	479	-	5,851	1,922	4,180	149
Low Hydro	11,578	-	1,876	3,463	2,023	4,144	72
Geo	8,526	1,116	5,016	298	339	1,727	29
TOTAL	1,117,927	188,834	410,791	146,972	95,487	212,005	63,834

²⁹ Majority-time solar employment includes all employees who spend 50 percent or more of their time on solar-related work. An additional 92,649 employees spent less than 50 percent of their time on solar. The category of industry employment differs slightly from several categories used by The Solar Foundation to classify employment (installation and development, operations and maintenance, sales and distribution, manufacturing, and other).

HIRING DIFFICULTY

- **85 percent of construction employers in electric power generation** reported that it was somewhat difficult or very difficult to hire new employees, with 30 percent reporting that it was very difficult.
- **76 percent of manufacturing employers** reported that it was either somewhat difficult or very difficult to hire new employees.
- **In contrast, only 63 percent of utility employers in electric power generation** reported that it was either somewhat difficult or very difficult to hire new employees, and only 19 percent reported that it was very difficult.

HIGHEST-DEMAND OCCUPATIONS IN ELECTRIC POWER GENERATION

With significant growth in 2018 and predicted growth of over 6,000 new jobs in 2019, electric power generation employers have identified below the occupations that each industry sector is having the greatest difficulty in filling.

Table 19.
Electric Power Generation Sector — Reported Occupations with Hiring Difficulty by Industry, Q4 2018

Utilities	Construction	Manufacturing	Wholesale Trade, Distribution, and Transport	Professional and Business Services	Other
Technicians or mechanical support (49%)	Installation workers (34%)	Engineers/scientists (44%)	Sales, marketing, or customer service representatives (45%)	Management (directors, supervisors, vice presidents) (36%)	Technicians or mechanical support (39%)
Electrician/construction laborers (31%)	Sales, marketing, or customer service representatives (31%)	Sales, marketing, or customer service representatives (23%)	Management (directors, supervisors, vice presidents) (19%)	Engineers/scientists (33%)	Management (directors, supervisors, vice presidents) (23%)
Engineers/scientists (23%)	Electrician/construction laborers (29%)	Management (directors, supervisors, vice presidents) (16%)	Technicians or mechanical support (19%)	Sales, marketing, or customer service representatives (16%)	Engineers/scientists (23%)

Spotlight: “For a utility, a cyber-attack doesn’t just hurt us; it can turn out the lights for everybody.”

Jim Somborovich, Senior Director of Cyber Security, Xcel Energy

“The reliability of the electricity system underpins virtually every sector of the modern U.S. economy,” said the most recent Quadrennial Energy Review from the U.S. Department of Energy.

Xcel Energy serves parts of eight states, providing electricity to 3.6 million customers and natural gas service to 2 million customers. In response to questions on the changing utility workforce, Jim Somborovich, Senior Director of Cyber Security at Xcel, spoke of the rapid growth of cyber employment. “Two years ago, it was me and 25 others. At the end of this year, we will have tripled our cyber workforce.”

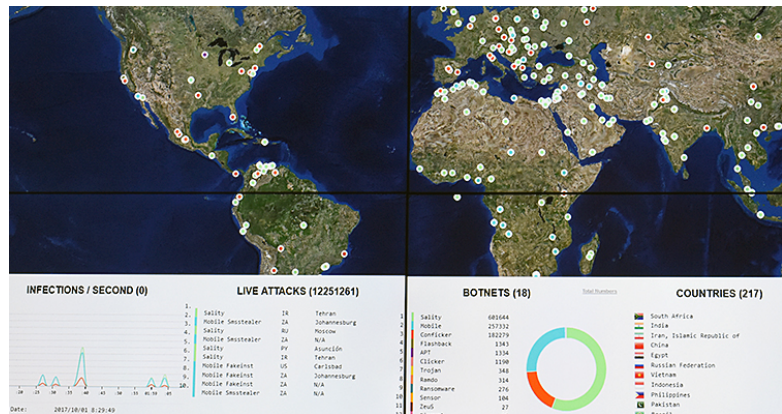
“Cyber skills are in high demand throughout the economy and we’ve had to grow in a negative unemployment environment for cyber. Some positions are harder than others to fill, so we have adopted several different strategies.

“We have gone after really junior people with the intent to train them ourselves. For these hires we’ve developed a 4-to-6-week training program and are preparing a skills assessment tool to help with their eligibility for promotions.

“We’ve also concentrated on recruiting exiting service members. Xcel has an excellent record with 10% of all new hires coming from the military. In cyber that number is 19%.

“One of our most important challenges is protecting the grid. For those positions we need people with both operational technology (OT) experience as well as IT experience. We have moved people internally with significant OT experience into cyber and used them to train our IT cyber specialists and vice versa.

“The demand for cyber is mindboggling. Remember, that for a utility a cyber attack doesn’t just hurt us; it can turn out the lights for everybody.”



ELECTRIC POWER GENERATION MIX

The electric power generation mix in the United States continues to evolve, accelerated by the transition from coal-fired power plants to natural gas and the increase in lower carbon sources of power generation.³⁰ This transition has involved a significant build-out of new power generation facilities in the United States.

Figure 31 shows net generation of electricity from utility-scale (i.e., one megawatt or greater) facilities in all sectors of the U.S. economy. Electricity generation from coal sources declined by 39 percent between 2006 and 2017, while electricity generation from natural gas increased by 56 percent and from solar by over 10,000 percent—from 508,000 MWh to nearly 53,000,000 MWh. As noted, this solar growth only includes utility-scale facilities, as reliable data on smaller distributed facilities, such as rooftop systems, was not available until recently. In 2017, distributed solar PV generation increased 23 percent nationwide, while estimated total solar PV generation—both utility-scale and distributed generation—increased nationwide by 27 percent.³¹

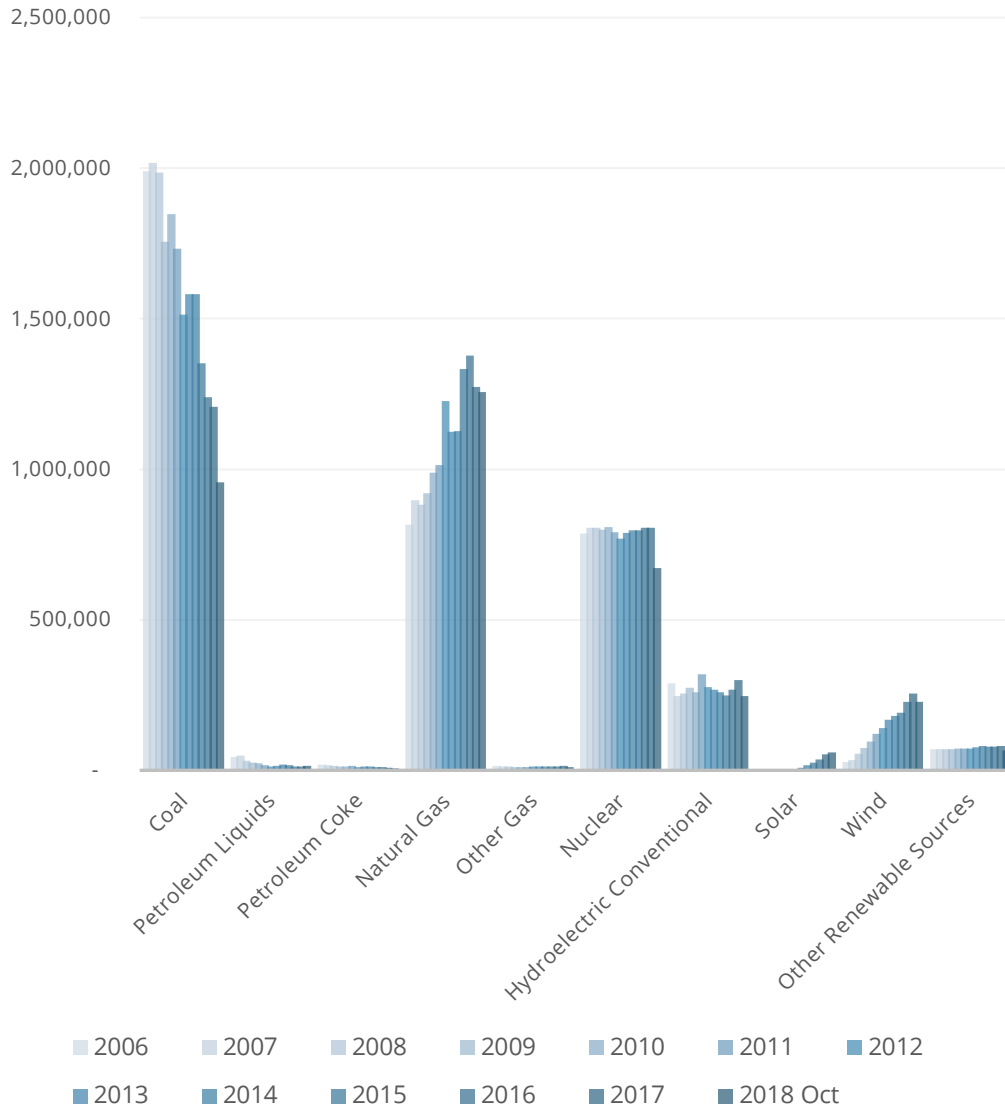
The shifts in electric generation sources over the last several years are mirrored in the sector's changing employment profile, as the share of natural gas, solar, wind, and CHP have increased. It is important to note, however, that the majority of U.S. electrical generation continues to come from fossil fuels (coal, oil, and natural gas). In addition, under latest EIA modeling in the Annual Energy Outlook 2018, in 2050 fossil fuels will still account for 78.5 percent of total U.S. energy production for all uses in the transportation, industrial, and building sectors.³²

³⁰ Coal is a combustible black or dark brown rock consisting mainly of carbonized plant matter, found mainly in underground deposits and widely used as fuel. Natural gas is a flammable gas, consisting largely of methane and other hydrocarbons, occurring naturally underground (often in association with petroleum) and used as fuel.

³¹ EIA, *Electric Power Monthly*, March 23, 2018, Table 1.1.A., https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_1_01_a. Data on distributed solar generation from annual totals for 2016 and 2017 for Small Scale Generation: Estimated Solar Photovoltaic and data on total solar PV from annual totals for 2016 and 2017 for Generation from Utility and Small Scale Facilities: Estimated Total Solar Photovoltaic.

³² EIA, *Annual Energy Outlook 2018*, February 2018, Table A1, <https://www.eia.gov/outlooks/aeo/data/browser/#/?id=1-AEO2018®ion=0-0&cases=ref2018&start=2016&end=2050&f=A&linechart=ref2018-d121317a.6-1-AEO2018~ref2018-d121317a.3-1-AEO2018~ref2018-d121317a.4-1-AEO2018~ref2018-d121317a.5-1-AEO2018&ctype=linechart&sourcekey=0>. Data in table for production in 2050 of crude oil and lease condensate, natural gas plant liquids, dry natural gas, and coal, combined and taken as a percentage of total production.

Figure 31.
Change in Net Generation of Electricity by Energy Source (Thousand MWh), 2006-2018



Electric Power Generation employment was 875,585 jobs in 2018, down nearly 1 percent from the previous year’s 883,842 workers³³, but employers report a projected 6.5 percent growth in 2019. Most of these new jobs are reported in the construction industry and are comprised of employees installing and building generation capacity additions.

³³ This number has been revised to account for 2016 coal generation employment in NAICS 4238, Machinery, Equipment, and Supplies Merchant Wholesalers.

ELECTRIC POWER GENERATION WORKFORCE CHARACTERISTICS

The largest component (33 percent) of the Electric Power Generation workforce is construction, underscoring the importance of the construction industry to maintaining our electrical system. Construction is followed by sizable groups of utility workers (21 percent) and professional service employees (20 percent). Manufacturing is also a significant component, with almost 13 percent.

Figure 32.

Electric Power Generation Sector — Employment by Industry, Q2 2018

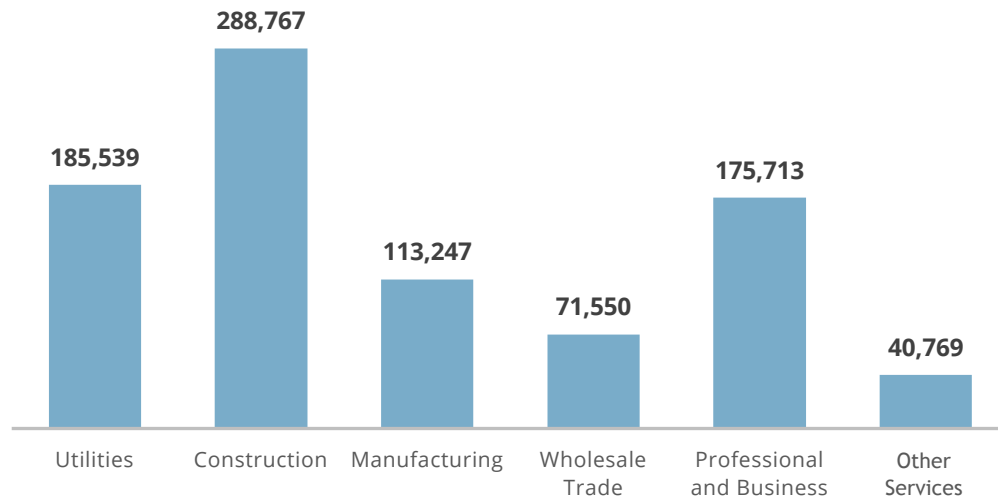
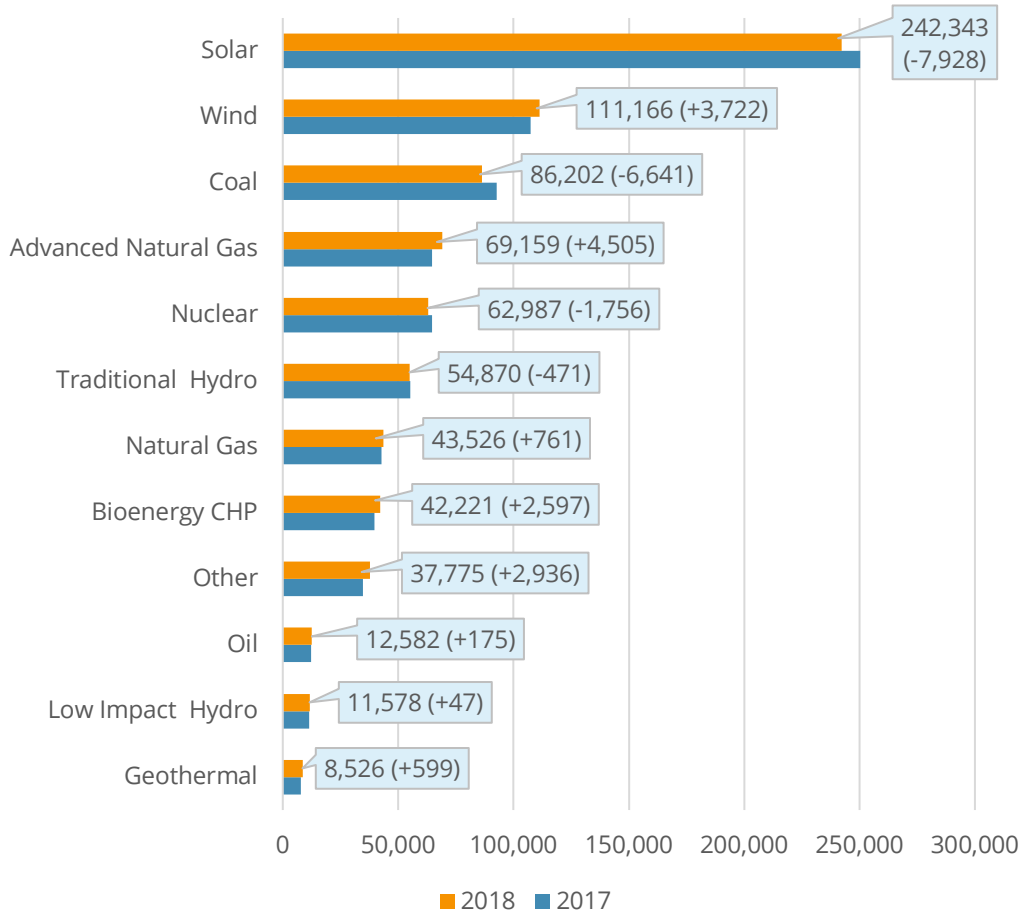


Figure 33.
Electric Power Generation Sector —
Employment by Detailed Technology Application, 2017-2018³⁴



Construction, the largest segment of Electric Power Generation employment, anticipates more than 8.5 percent growth in 2019, while the next largest segments, utilities and professional services, predict 3.9 percent and almost 7.5 percent increases, respectively.

³⁴ Text, charts, and tables in the 2019 report include revised 2017 employment totals for advanced and traditional natural gas generation based on additional available data from the Energy Information Administration.

Figure 36.
Electric Power Generation Sector —
Expected Employment Growth by Industry (Q4 2018 – Q4 2019)

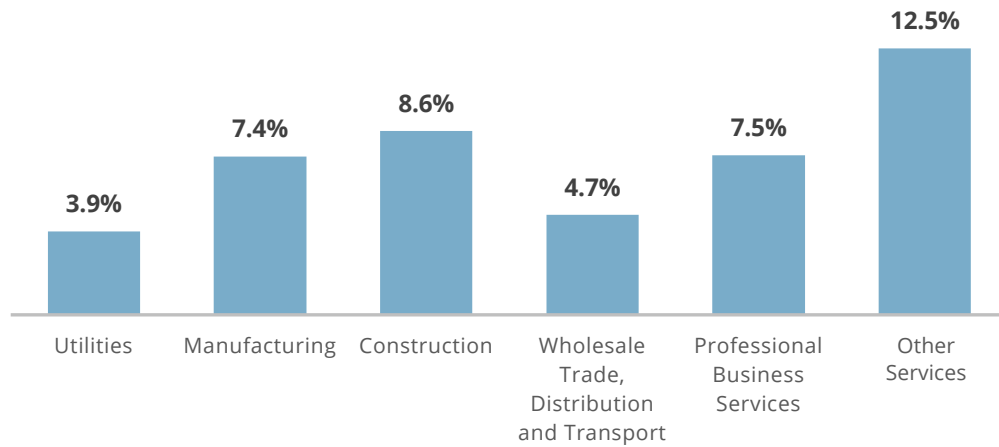
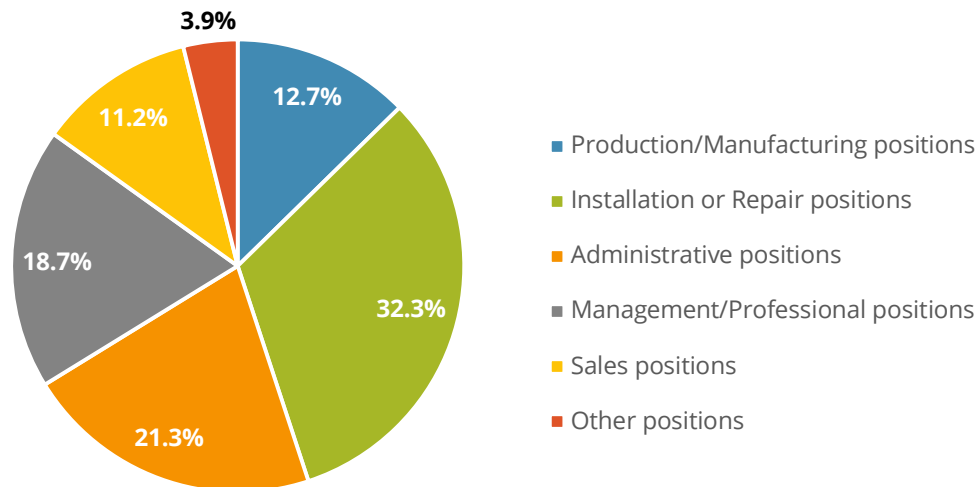


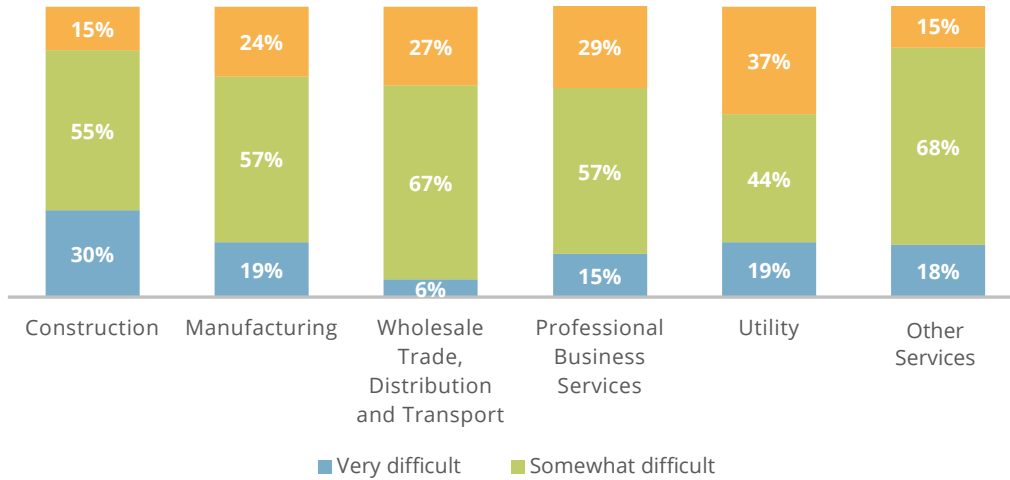
Figure 35.
Electric Power Generation Sector — Occupational Distribution, Q4 2018



Almost one-third (32 percent) of employment in Electric Power Generation in 2018 was within installation or repair positions. Management/professional positions (21 percent) and administrative positions (19 percent) each comprised around one-fifth of Electric Power Generation employment.

In 2018, construction firms reported the greatest hiring difficulty among industry sectors in Electric Power Generation, with 85 percent of companies indicating it was either somewhat difficult (55 percent) or very difficult (30 percent) to find new employees. Utilities and professional service employers reported comparable figures for these two categories of 63 percent and 72 percent, respectively. Utilities have consistently been more successful at hiring new employees.

Figure 37.
Electric Power Generation Sector —
Hiring Difficulty by Industry, Q4 2018



Electric Power Generation employers mentioned lack of experience, training, or technical skills as the number one reason for reported hiring difficulty over the previous year across all industry sectors.

Table 20.
Electric Power Generation Sector — Reasons for Hiring Difficulty by
Industry, Q4 2018

Utilities	Construction	Manufacturing	Wholesale Trade, Distribution, and Transport	Professional and Business Services	Other
Lack of experience, training, or technical skills (40%)	Lack of experience, training, or technical skills (50%)	Lack of experience, training, or technical skills (46%)	Lack of experience, training, or technical skills (44%)	Lack of experience, training, or technical skills (50%)	Lack of experience, training, or technical skills (67%)
Location (30%)	Difficulty finding industry-specific knowledge, skills, and interest (20%)	Competition/small applicant pool (25%)	Difficulty finding industry-specific knowledge, skills, and interest (29%)	Difficulty finding industry-specific knowledge, skills, and interest (28%)	Location (20%)
Difficulty finding industry-specific knowledge, skills, and interest (21%)	Competition/small applicant pool (18%)	Location (20%)	Location (21%)	Competition/small applicant pool (20%)	Competition/small applicant pool (17%)

Electric Power Generation employers reported that technicians or mechanical support, sales, installation workers, engineers, marketing, or customer service representatives, and management were among the most difficult positions to hire for over the course of 2018.

Table 21.
Electric Power Generation Sector —
Reported Occupations with Hiring Difficulty by Industry, Q4 2018

Utilities	Construction	Manufacturing	Wholesale Trade, Distribution, and Transport	Professional and Business Services	Other
Technicians or mechanical support (49%)	Installation workers (34%)	Engineers/scientists (44%)	Sales, marketing, or customer service representatives (45%)	Management (directors, supervisors, vice presidents) (36%)	Technicians or mechanical support (39%)
Electrician/construction laborers (31%)	Sales, marketing, or customer service representatives (31%)	Sales, marketing, or customer service representatives (23%)	Management (directors, supervisors, vice presidents) (19%)	Engineers/scientists (33%)	Management (directors, supervisors, vice presidents) (23%)
Engineers/scientists (23%)	Electrician/construction laborers (29%)	Management (directors, supervisors, vice presidents) (16%)	Technicians or mechanical support (19%)	Sales, marketing, or customer service representatives (16%)	Engineers/scientists (23%)

In 2018, the Electric Power Generation sector employed fewer women than the national workforce average. However, Electric Power Generation is racially more diverse than the workforce as a whole and exceeds the national average for Hispanic or Latino, and Asian employees. Electric Power Generation had only 14 percent of its employees over age 55 in 2018, far below the national average. Electric Power Generation exceeded the national average for veterans hiring at 9 percent.

Table 22.
Electric Power Generation Sector – Demographics, Q4 2018

	Electric Power Generation		National Workforce Averages ³⁵
Male	586,305	67%	53%
Female	289,279	33%	47%
Hispanic or Latino	163,610	19%	17%
Not Hispanic or Latino	711,974	81%	83%
American Indian or Alaska Native	10,685	1%	1%
Asian	88,046	10%	6%
Black or African American	75,240	9%	12%
Native Hawaiian or other Pacific Islander	10,660	1%	>1%
White	604,404	69%	78%
Two or more races³⁶	86,550	10%	2%
Veterans	77,168	9%	6%
55 and over	122,865	14%	23%
Union	55,620	6%	11%

³⁵ All demographic information except union membership from 2017 data in “Labor Force Statistics from the Current Population Survey,” Bureau of Labor Statistics, U.S. Department of Labor, <https://www.bls.gov/cps/demographics.htm>. Information on union membership is from “Table 3: Union affiliation of employed wage and salary workers by occupation and industry, 2016-17 annual averages,” in U.S. Department of Labor, Bureau of Labor Statistics, “Union Members Summary,” news release, January 19, 2018, <https://www.bls.gov/news.release/union2.nr0.htm>.

³⁶ While federal guidelines were followed in administering the demographic questions, respondents may have reported two or more races as including Hispanic or Latino ethnicity, inappropriately inflating the total and deflating other racial categories.

SOLAR ELECTRIC POWER GENERATION

The solar EPG industry is an example of the inability of BLS labor market data to completely capture employment in emerging industries (such as solar) and those that cut across multiple sectors (such as Energy Efficiency). For 2018, the BLS reported that utilities employed just under 3,300 workers for solar-specific generation. However, this figure does not include many jobs in the construction or other value-chain industries for solar projects even when they are financed, owned, or directed by utilities. The data suggest that utilities are directly responsible for at least 25 percent of the solar jobs in the United States, but no other NAICS codes yet exist for solar electric generation. Existing labor market data therefore dramatically underestimate the additional workers engaged in solar-related work.

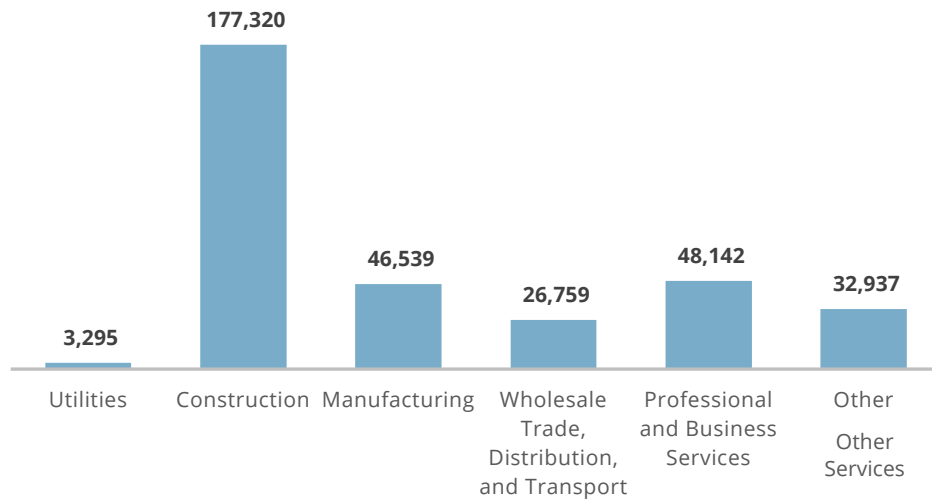
In 2018, there were 242,343 Americans who spent 50 percent or more of their time working to manufacture, install, distribute, or provide professional services to solar technologies across the nation. Another 92,649 employees spent less than half their time on solar work.³⁷ That represents a reduction of 3.2 percent or just under 8,000 jobs for workers who spent a majority of their time on solar. Another 7,000 jobs were lost by employees who spent a minority of their time on solar tasks.

The majority of solar employment in 2018 is found in construction and installation activities, totaling 177,320 jobs, followed by professional business services with over 48,000 workers and manufacturing with about 46,500.³⁸

³⁷ The Solar Foundation, National Solar Jobs Census 2018, 9.

³⁸ This division of solar jobs by industry, including the data in Figure 38, includes both those employees who spend more than 50% of their time and less than 50% of their time on solar activities.

Figure 38.
Solar Electric Power Generation – Employment by Industry



Currently, a majority of U.S. photovoltaic (PV) solar electric power generation is from utility-scale facilities, as shown in Figure 40—roughly 56,179 thousand MWh compared to 25,847 thousand MWh of distributed solar generation in 2018.³⁹ In 2018, more than 56 percent of U.S. solar workers were spending the majority of their time working on residential-scale projects, as shown in Figure 39.

Figure 40.
Estimated Percentage of Solar Generation Installed

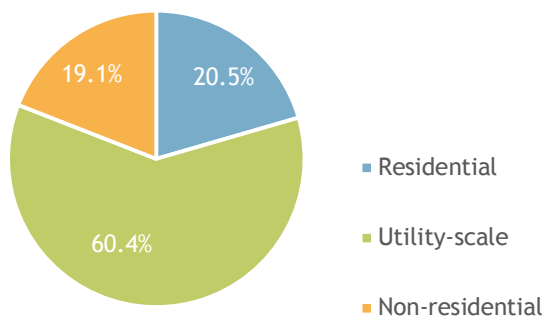
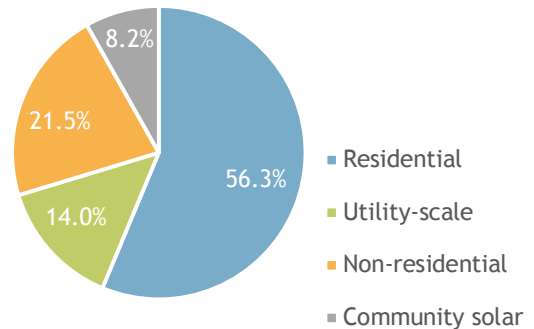


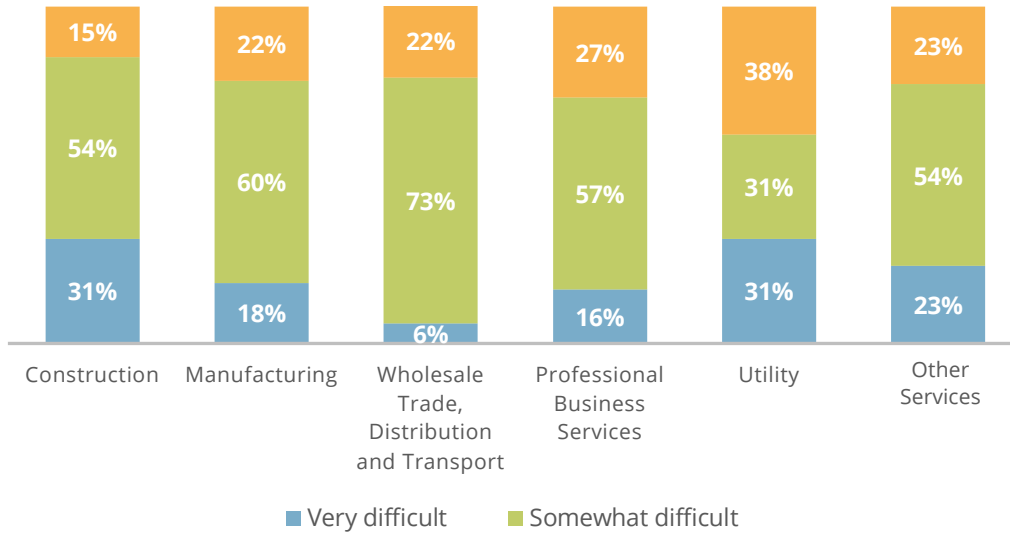
Figure 39.
Majority-Time Solar Employees by Type of Project – 2018



³⁹ EIA, *Electric Power Monthly*, Table 1.1.A. Data for 2017 for Generation at Utility Facilities: Solar Photovoltaic and Small Scale Generation: Estimated Solar Photovoltaic.

In 2018, 85 percent of construction employers engaged in the solar industry who employ the majority of the solar workforce, reported that hiring was either somewhat difficult or very difficult. 73 percent and 78 percent of professional services and manufacturing employers respectively also reported that hiring was somewhat difficult or very difficult in 2018.

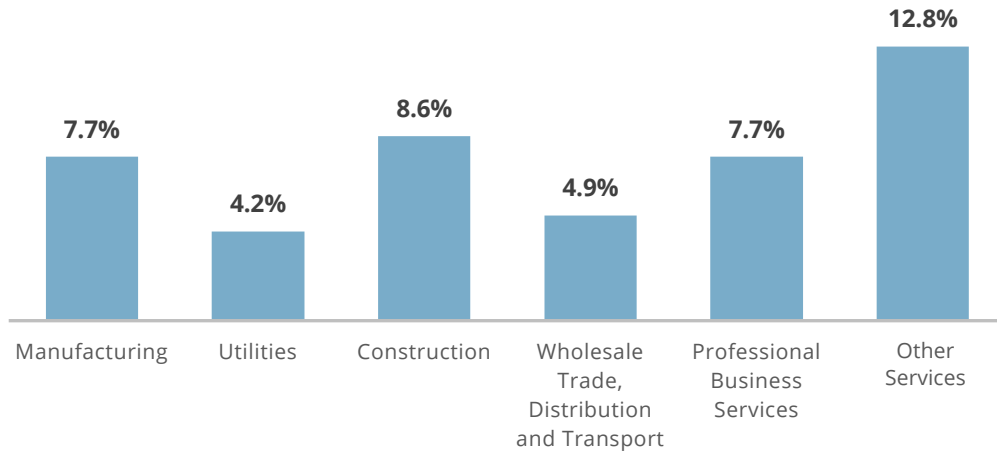
Figure 41.
Solar Electric Power Generation — Hiring Difficulty by Industry



In spite of two straight years of decline, solar employers reported that they expect to increase employment by 8.4 percent in 2019. Most solar employment supports PV technologies, with a small portion—7.6 percent—of workers supporting concentrating solar power (CSP) technologies.⁴⁰

⁴⁰ The terms “PV” and “CSP” refer to specific solar electricity production technologies. When references are made to either distributed generation or utility-scale generation, these include both solar PV and CSP technologies.

Figure 42.
Solar Electric Power Generation —
Expected Employment Growth by Industry



About one-third of the solar workforce in 2018 was female. Overall, the solar workforce is racially more diverse than the national workforce. Roughly two in ten workers are Hispanic or Latino, and one in ten are Asian. Black or African American employees are under-represented. Both PV and CSP technologies employed veterans at a higher rate than the national workforce.

Table 23.
Solar Electric Power Generation – Demographics, Q4 2018

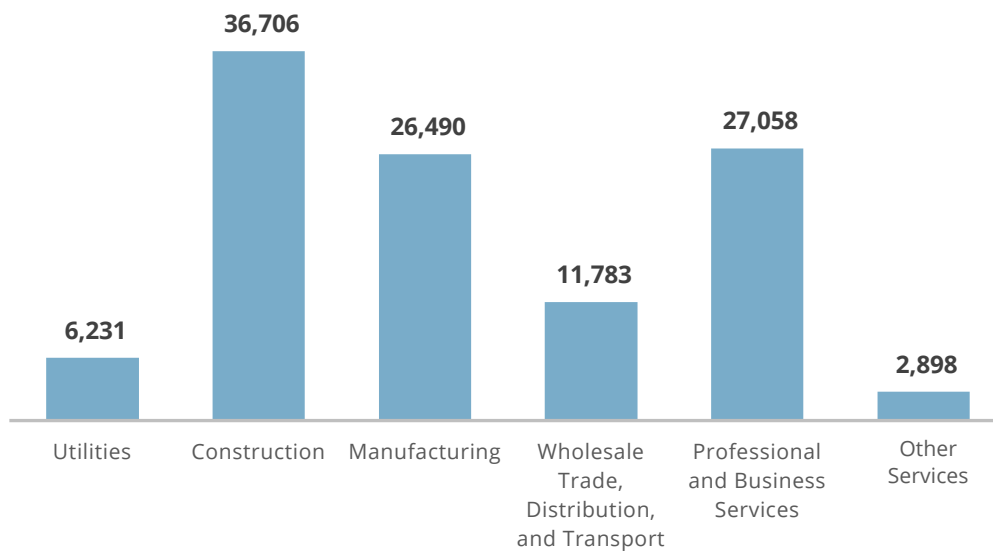
Demographics	Solar Photovoltaic	Concentrating Solar Power	National Workforce Averages
Male	69%	67%	53%
Female	31%	33%	47%
Hispanic or Latino	20%	22%	17%
Not Hispanic or Latino	80%	78%	83%
American Indian or Alaska Native	1%	1%	1%
Asian	10%	9%	6%
Black or African American	7%	7%	12%
Native Hawaiian or other Pacific Islander	1%	1%	>1%
White	71%	69%	78%
Two or more races	10%	12%	2%
Veterans	9%	8%	6%
55 and over	12%	9%	23%
Union	4%	4%	11%

WIND ELECTRIC POWER GENERATION

Wind EPG provides the third largest share of employment in the Electric Power Generation sector (behind solar and natural gas generation). In 2018, firms that support the U.S. wind EPG sector employed a total of 111,166 workers—a 4 percent increase from 2017. Similar to solar EPG, the largest share of employment was in construction; this industry sector accounted for 33 percent of all wind EPG workers in 2017, followed by professional services at 24 percent and manufacturing at 24 percent.

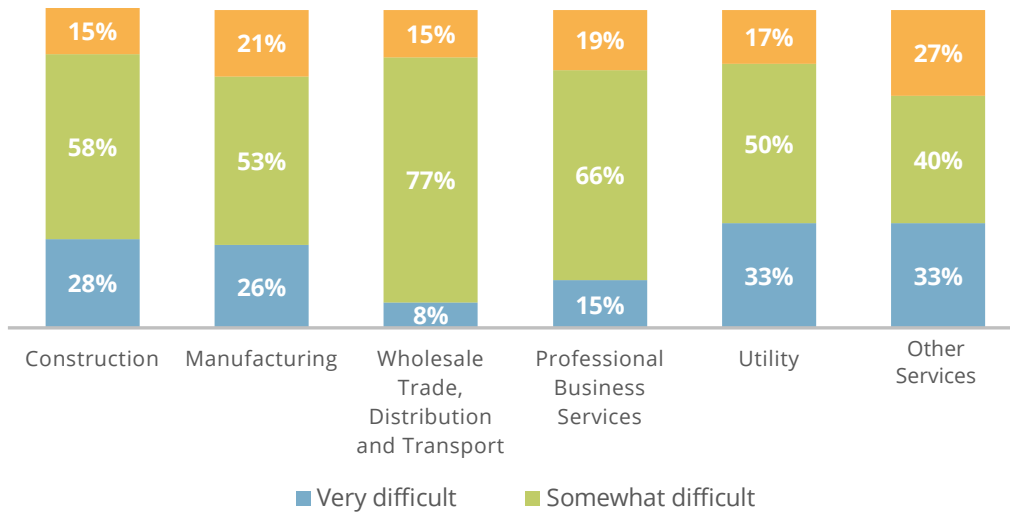
Figure 43.

Wind Electric Power Generation – Employment by Industry Sector



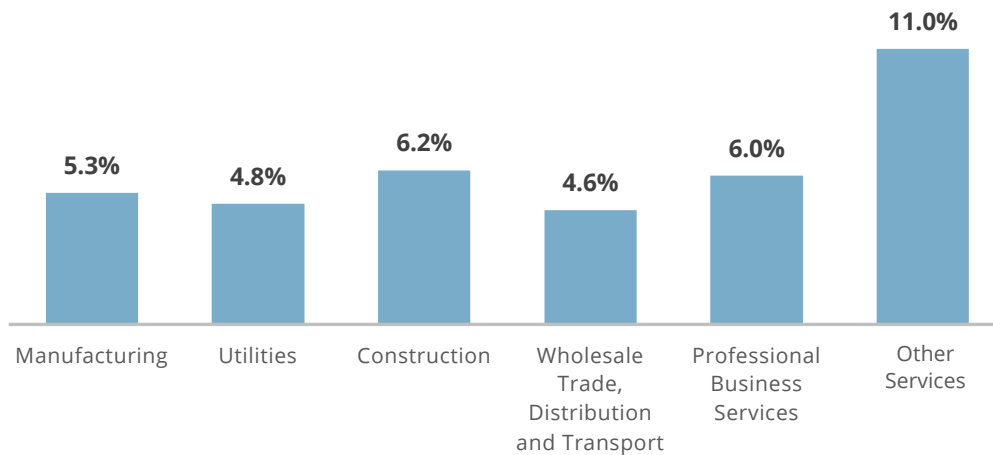
In 2018, 86 percent of construction employers in the wind sector reported that hiring new workers was somewhat difficult or very difficult (with 28 percent reporting that hiring was very difficult). The next two largest segments of the wind industry—professional services and manufacturing—reported overall hiring difficulty of 81 percent and 79 percent, respectively.

Figure 44.
Wind Electric Power Generation – Hiring Difficulty by Industry



Employers in the wind EPG industry expect almost 5 percent growth in 2019. This is led by the construction sector, which expects over 6 percent growth.

Figure 45.
Wind Electric Power Generation — Expected Employment Growth by Industry



Wind EPG has a demographic distribution that is nearly identical to solar EPG, with a slightly higher proportion of workers who are 55 years and older in age. Wind EPG is also more racially diverse than the national workforce, with higher levels of Hispanic or Latino and Asian workers. One out of 10 workers is a veteran.

Table 24.
Wind Electric Power Generation — Demographics, Q4 2018

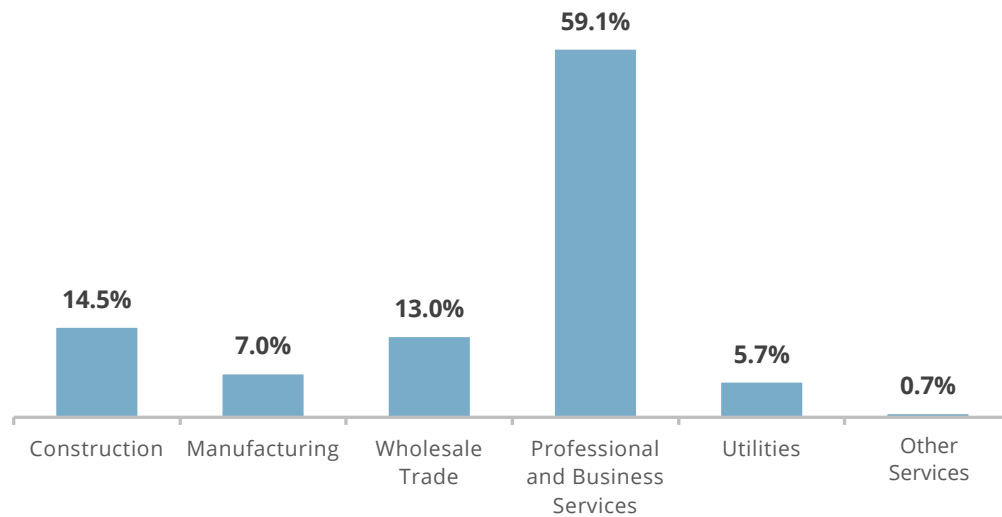
Demographics	Wind	National Workforce Averages	
Male	75,403	68%	53%
Female	35,763	32%	47%
Hispanic or Latino	23,015	21%	17%
Not Hispanic or Latino	88,151	79%	83%
American Indian or Alaska Native	1,359	1%	1%
Asian	11,206	10%	6%
Black or African American	8,466	8%	12%
Native Hawaiian or other Pacific Islander	1,532	1%	>1%
White	75,582	68%	78%
Two or more races	13,021	12%	2%
Veterans	10,956	10%	6%
55 and over	16,574	15%	23%
Union	5,320	5%	11%

COMBINED HEAT AND POWER GENERATION

Combined heat and power (CHP) generation technologies employed 29,245 workers, or about 2 percent of the employment in Electric Power Generation, in 2018. In 2018, this industry added 2,000 jobs, which is over 7 percent growth from 2017. With small generation capacities and significant overlap with other sectors (many companies with CHP report according to their underlying fuel source), employment in CHP is mostly comprised of professional service workers. This industry category accounted for 59 percent of CHP jobs in 2018, followed by the construction industry at 15 percent.

Figure 46.

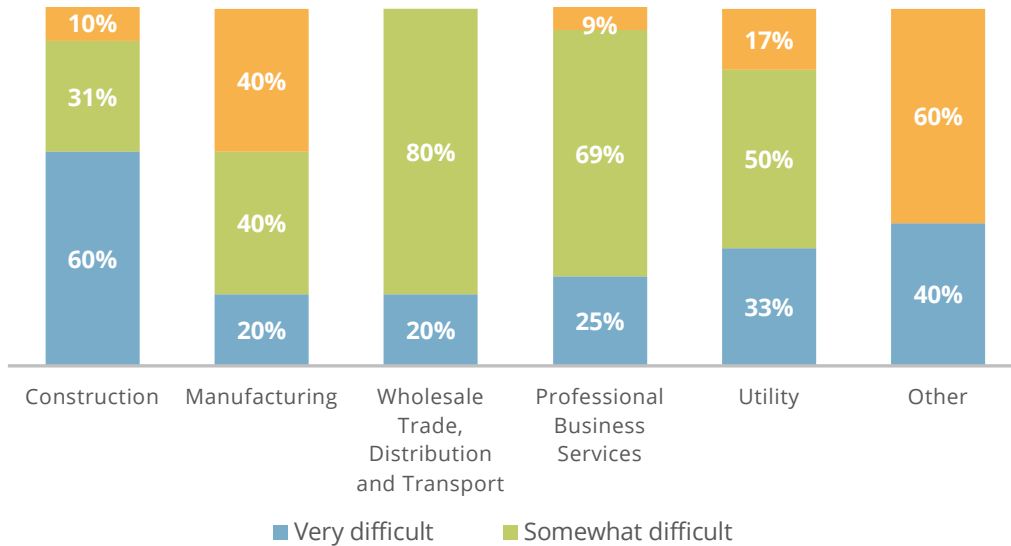
Combined Heat and Power Generation — Employment by Industry



In 2018, 91 percent of CHP professional and business services employers reported that hiring new workers was somewhat difficult or very difficult (with 25 percent reporting that hiring was very difficult). Similarly, 90 percent of CHP construction employers reported that hiring in 2018 was somewhat difficult or very difficult (with 60 percent reporting that hiring was very difficult).⁴¹

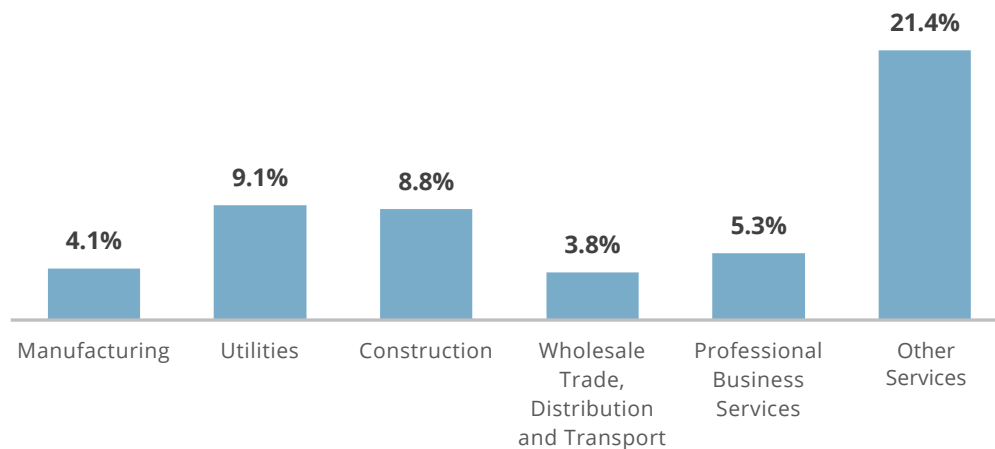
⁴¹ Some industries are omitted from this discussion due to their small sample size in the data contributing to Figure 47. Conclusions have been made only about industries with sufficient sample size.

Figure 47.
Combined Heat and Power Generation – Hiring Difficulty by Industry



Employers in the CHP generation industry expect almost 4 percent growth in 2019. This is led by the utilities sector, which expects over 9 percent growth, and the construction sector, which expects almost 9 percent growth. The professional and business services, the largest sector, anticipates 5.3 percent growth.

Figure 48.
Combined Heat and Power Generation — Expected Employment Growth by Industry



Almost a third of the CHP workforce in 2018 was comprised of women, it is also more racially diverse than the workforce as a whole, with 29 percent racial minorities, compared to 22 percent nationally.

Table 25.
Combined Heat and Power Generation — Demographics, Q4 2018

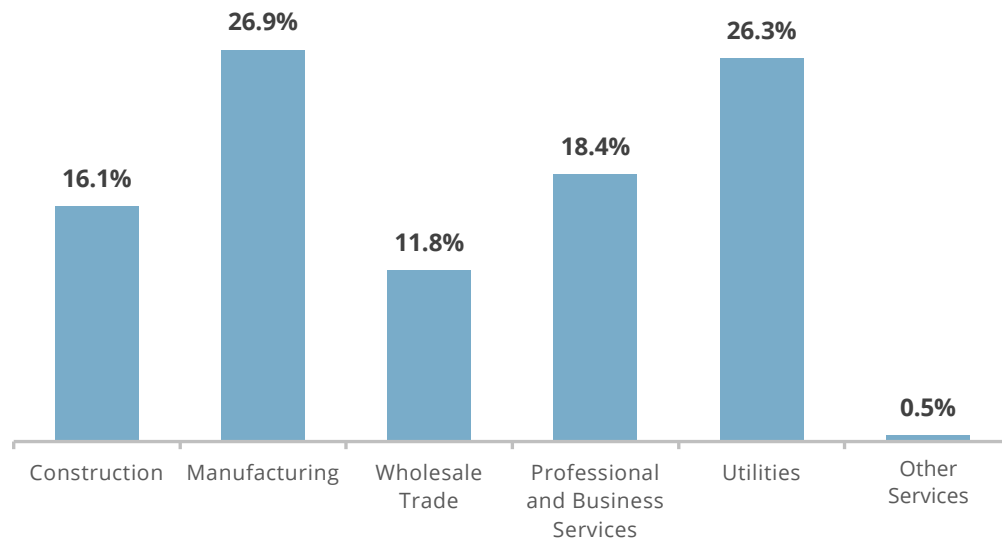
Demographics	CHP	National Workforce Averages
Male	19,775	68%
Female	9,470	32%
Hispanic or Latino	5,256	18%
Not Hispanic or Latino	23,989	82%
American Indian or Alaska Native	278	1%
Asian	2,614	9%
Black or African American	2,163	7%
Native Hawaiian or other Pacific Islander	268	1%
White	20,787	71%
Two or more races	3,135	11%
Veterans	3,460	12%
55 and over	6,238	21%
Union	2,475	8%

HYDROELECTRIC POWER GENERATION

Hydroelectric power generation employed a total of 66,448 workers⁴² across the nation in 2018. Most of this employment (54,870 workers, or 83 percent) was in traditional hydroelectric generation technologies, while the remainder was in low-impact hydroelectric technologies (11,578 workers). Manufacturing and utilities each made up over 26 percent of hydroelectric generation employment in 2018, while professional business services supported over 18 percent and construction supported over 16 percent of employment.

Figure 49.

Hydroelectric Power Generation — Employment by Industry

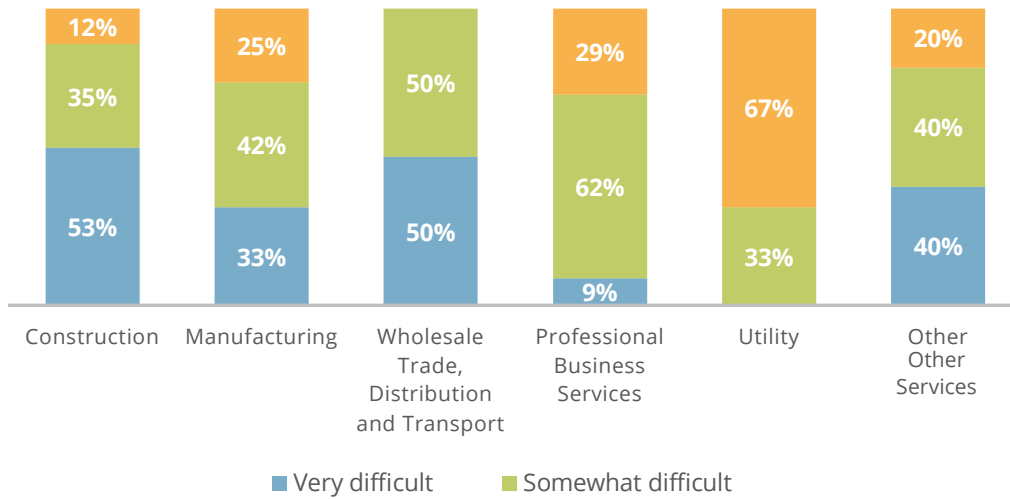


In 2018, 88 percent of construction employers reported that hiring new workers was somewhat difficult or very difficult (with 53 percent reporting that hiring was very difficult). A smaller percentage of professional business services employers (71 percent) reported that hiring was somewhat difficult or very difficult, and only 9 percent of them reported hiring to have been very difficult. Utilities, consistent with other technologies, reported an easier time hiring new employees, with only 33 percent reporting hiring as somewhat difficult and none as very difficult.⁴³

⁴² Methodology was revised in 2016 to capture subcontractor employment in Traditional Hydro, so employment totals are not reflective of growth year over year. Primary Traditional Hydro employers reported a minimal decline of -4.2 percent between 2015 and 2016.

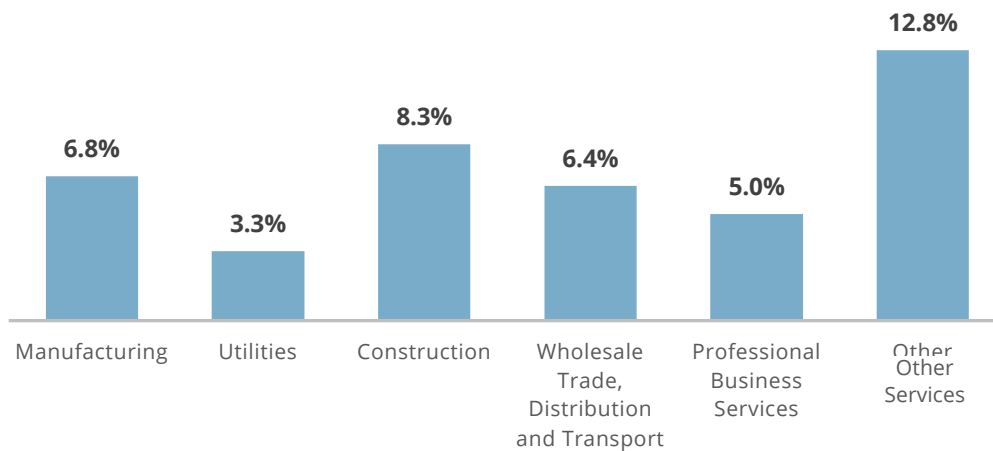
⁴³ Some industries are omitted from this discussion due to their small sample size in the data contributing to Figure 50. Conclusions have been made only about industries with sufficient sample size.

Figure 50.
Hydroelectric Power Generation — Hiring Difficulty by Industry



Overall, hydroelectric employers anticipate 5.8 percent growth in 2019. Utilities and manufacturing, the two largest segments, expect to grow by 6.8 percent and 3.3 percent, respectively.

Figure 51.
Hydroelectric Power Generation — Expected Employment Growth by Industry



Hydroelectric power generation had about a third female employees in 2018 in both low-impact hydroelectric generation and traditional hydroelectric generation technologies. These technologies are also more diverse than the national workforce average, with higher representation in 2018 across Hispanic or Latino workers as well as Asian workers. Veterans employment also exceeded the national average.

Table 26.
Hydroelectric Power Generation — Demographics, Q4 2018

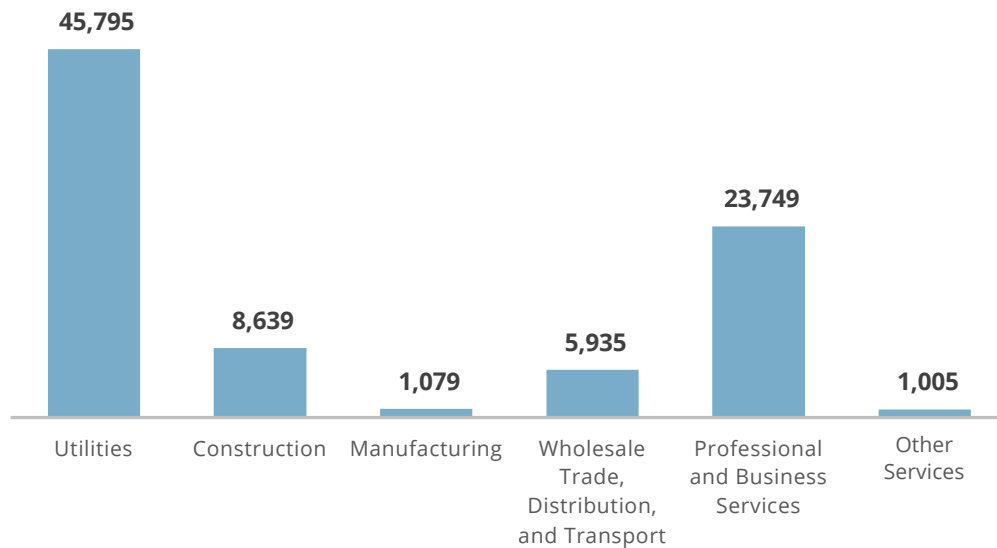
Demographics	Low-impact Hydroelectric Generation		Traditional Hydroelectric Generation		National Workforce Averages
Male	7,926	68%	36,478	66%	53%
Female	3,652	32%	18,392	34%	47%
Hispanic or Latino	2,331	20%	9,592	17%	17%
Not Hispanic or Latino	9,247	80%	45,278	83%	83%
American Indian or Alaska Native	189	2%	739	1%	1%
Asian	1,183	10%	5,921	11%	6%
Black or African American	902	8%	5,550	10%	12%
Native Hawaiian or other Pacific Islander	150	1%	675	1%	>1%
White	8,079	70%	37,130	68%	78%
Two or more races	1,075	9%	4,854	9%	2%
Veterans	1,264	11%	4,685	9%	6%
55 and over	1,898	16%	8,848	16%	23%
Union	464	4%	3,272	6%	11%

COAL ELECTRIC POWER GENERATION

Coal-fired EPG employed a total of 86,202 workers⁴⁴ across the nation in 2018. This is a 7 percent decrease in jobs from 2017. Utilities held over half of coal EPG jobs in 2018, with professional business services making up almost 28 percent of the industry.

Figure 52.

Coal Electric Power Generation — Employment by Industry

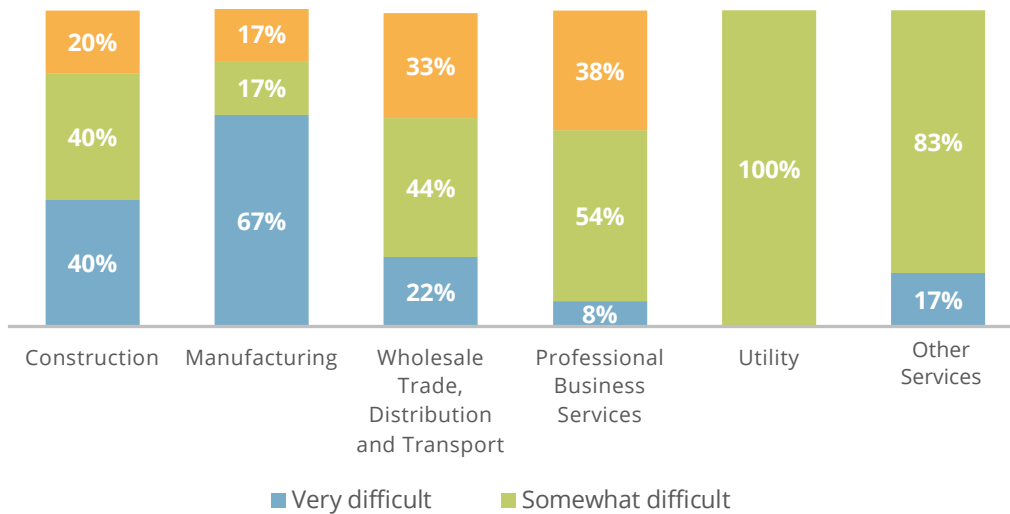


No utilities reported that it was very difficult to hire in 2018. Only 8 percent of professional business services employers reported that hiring new workers was very difficult. The segment with greatest difficulty in hiring in 2018 was construction, in which 40 percent of firms reported that hiring was very difficult.⁴⁵

⁴⁴ Methodology was revised in 2016 to capture subcontractor employment in Traditional Hydro, so employment totals are not reflective of growth year over year. Primary Traditional Hydro employers reported a minimal decline of -4.2 percent between 2015 and 2016.

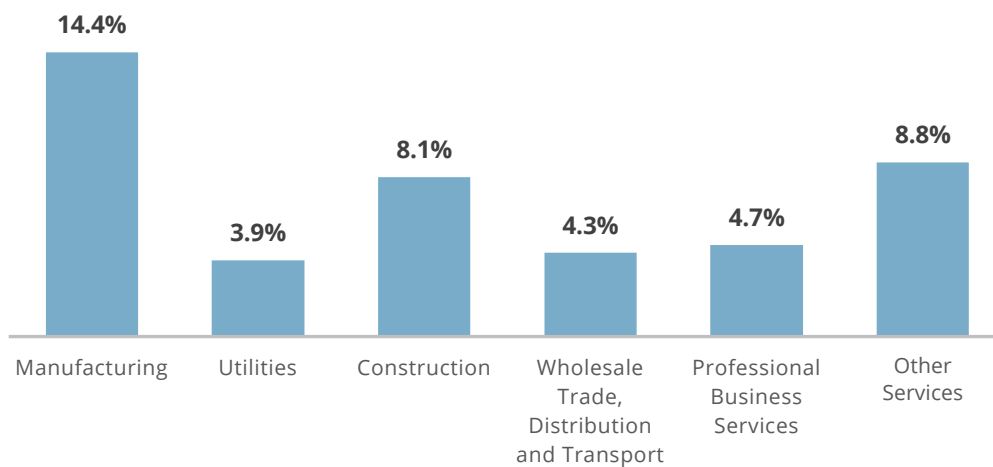
⁴⁵ Some industries are omitted from this discussion due to their small sample size in the data contributing to Figure 53. Conclusions have been made only about industries with sufficient sample size.

Figure 53.
Coal Electric Power Generation — Hiring Difficulty by Industry



In spite of job losses in 2018, employers in the coal EPG industry expect almost 5 percent growth in 2019. This is led by the manufacturing sector, which expects over 14 percent growth, and the construction sector, which expects over 8 percent growth. Utilities, the largest sector, expect 3.9 percent growth

Figure 54.
Coal Electric Power Generation – Expected Employment Growth by Industry



Coal EPG had over one-third female employees in 2018—(36 percent). Coal generation is also more racially diverse than the national workforce, employing 31 percent minorities. Almost one in 10 employees is unionized.

Table 27.
Coal Electric Power Generation – Demographics, Q4 2018

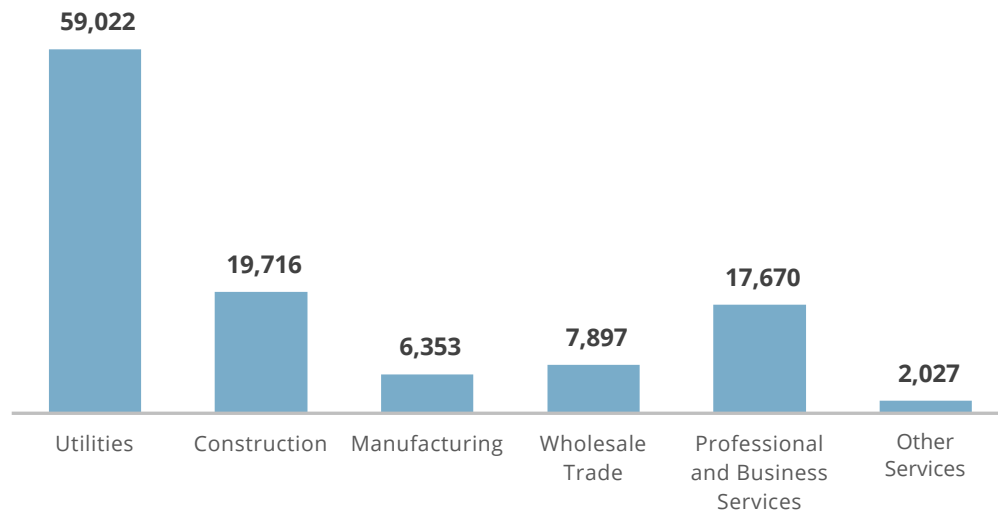
	Coal Generation		National Workforce Averages
Male	55,496	64%	53%
Female	30,706	36%	47%
Hispanic or Latino	12,703	15%	17%
Not Hispanic or Latino	73,499	85%	83%
American Indian or Alaska Native	1,025	1%	1%
Asian	9,091	11%	6%
Black or African American	9,399	11%	12%
Native Hawaiian or other Pacific Islander	788	1%	>1%
White	59,515	69%	78%
Two or more races	6,384	7%	2%
Veterans	5,971	7%	6%
55 and over	14,322	17%	23%
Union	8,092	9%	11%

NATURAL GAS ELECTRIC POWER GENERATION

Natural gas EPG employed a total of 112,685 workers across the nation in 2018; of these, 69,159 jobs, or 61 percent, are in the category of advanced/low emissions natural gas generation. Over the past year, over 5,000 jobs were added by natural gas EPG—an almost 5 percent increase. Utilities provided over half of natural gas power generation jobs in 2018, with construction and professional business services making up 17 percent and 16 percent of the industry, respectively.

Figure 55.

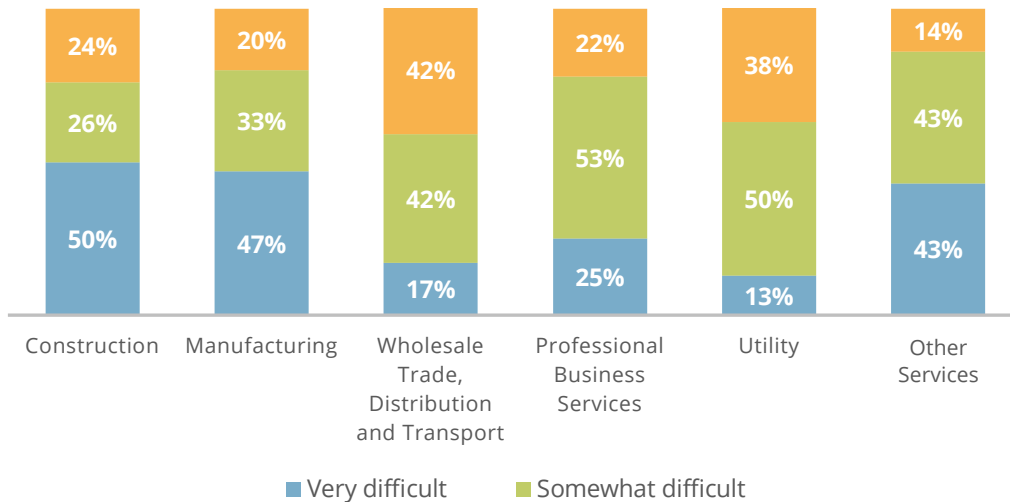
Natural Gas Electric Power Generation – Employment by Industry



Utilities, the largest sector of natural gas EPG, reported the easiest hiring with only 13 percent reporting that it was very difficult. By comparison, 76 percent of construction employers report that hiring during 2018 was somewhat difficult or very difficult (with 50 percent reporting it was very difficult). Similarly, 78 percent of professional and business services employers reported that hiring new workers in 2018 was somewhat difficult or very difficult.⁴⁶

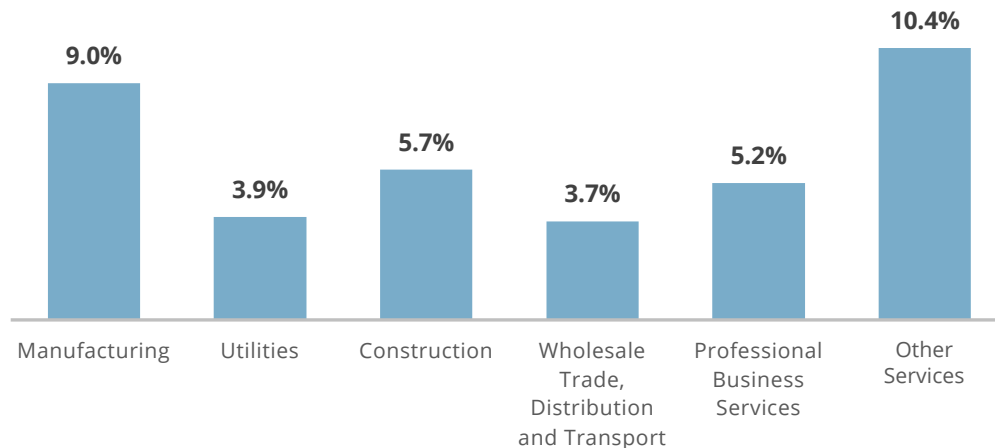
⁴⁶ Some industries are omitted from this discussion due to their small sample size in the data contributing to Figure 56. Conclusions have been made only about industries with sufficient sample size.

Figure 56.
Natural Gas Electric Power Generation – Hiring Difficulty by Industry



Employers in the natural gas EPG industry expect over 5 percent growth in 2019. This is led by the manufacturing sector, which expects over 9 percent growth, and the construction sector, which expects almost 6 percent growth.

Figure 57.
Natural Gas Electric Power Generation – Expected Employment Growth by Industry



Natural gas EPG, compared to the EPG sector as a whole, had a proportionally high number of female employees in 2018—over one-third (37 percent). Natural gas EPG is more racially diverse than the national workforce, employing 35 percent racial minorities, the second highest in the electric power generation sector. Eight percent of its employees are veterans, exceeding the national average by two percentage points. Eleven percent are unionized.

Table 28.
Natural Gas Electric Power Generation – Demographics, Q4 2018

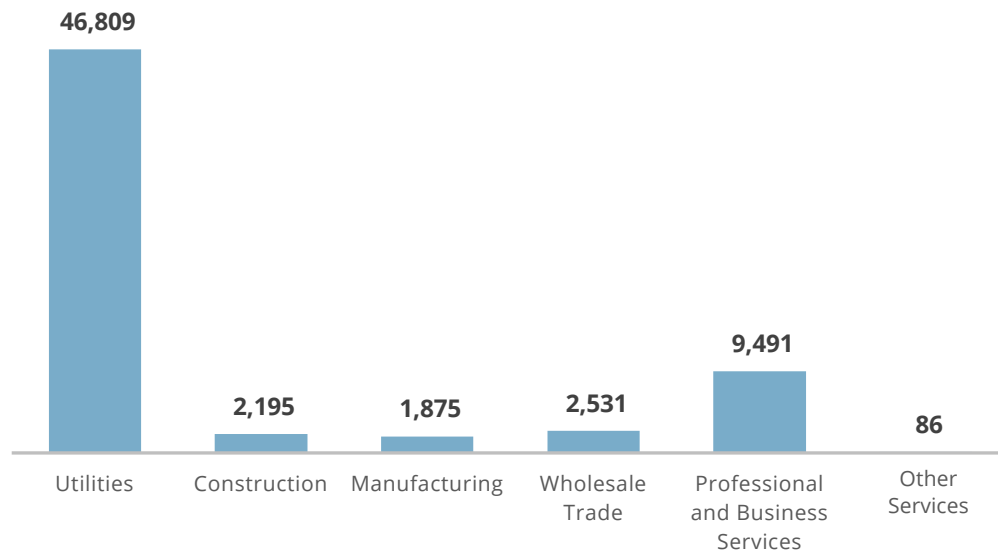
	Natural Gas Generation		National Workforce Averages
Male	71,290	63%	53%
Female	41,395	37%	47%
Hispanic or Latino	18,985	17%	17%
Not Hispanic or Latino	93,700	83%	83%
American Indian or Alaska Native	1,476	1%	1%
Asian	11,807	10%	6%
Black or African American	11,905	11%	12%
Native Hawaiian or other Pacific Islander	1,166	1%	>1%
White	73,595	65%	78%
Two or more races	12,737	11%	2%
Veterans	9,307	8%	6%
55 and over	16,657	15%	23%
Union	12,550	11%	11%

NUCLEAR ELECTRIC POWER GENERATION

Nuclear EPG employed a total of 62,987 workers across the nation in 2018. Over the past year, over 1,700 jobs were lost from nuclear generation—an almost 3 percent decrease in employment. Almost 75 percent of nuclear power generation jobs were in the utility industry in 2018.

Figure 58.

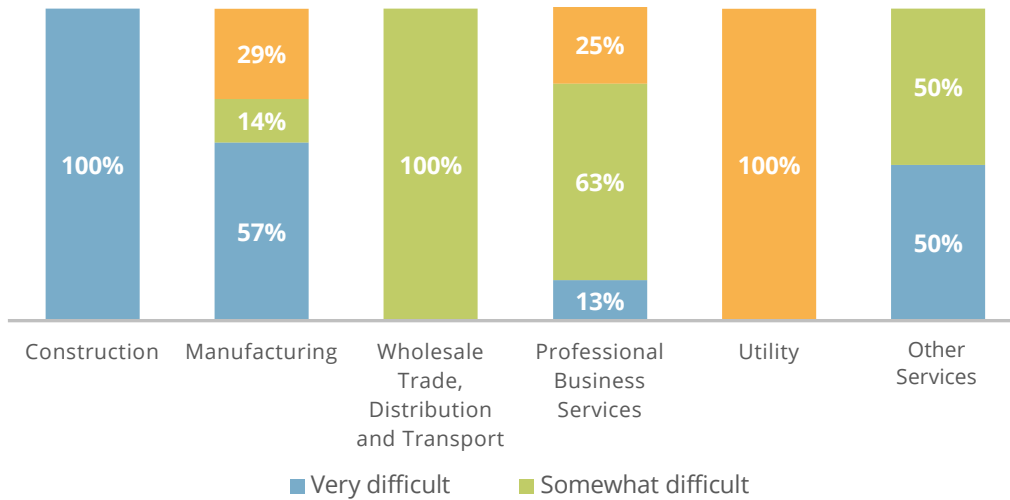
Nuclear Electric Power Generation – Employment by Industry



Utilities in the nuclear generation sector reported little difficulty in hiring in 2018. However, virtually all construction firms reported that it was very difficult. In 2018, 76 percent of professional and business services employers reported that hiring new workers was somewhat difficult or very difficult.⁴⁷

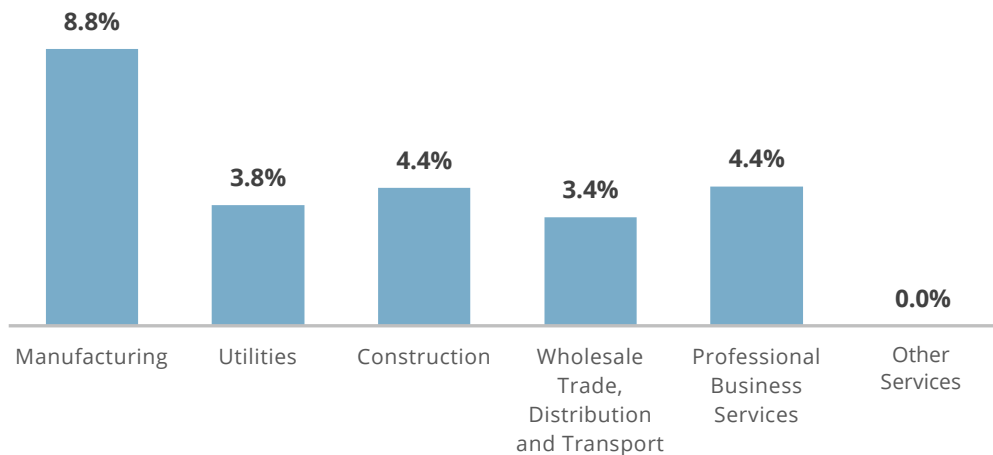
⁴⁷ Some industries are omitted from this discussion due to their small sample size in the data contributing to Figure 59. Conclusions have been made only about industries with sufficient sample size.

Figure 59.
Nuclear Electric Power Generation – Hiring Difficulty by Industry



Employers in the nuclear EPG industry expect over 4 percent growth in 2019. This is led by the manufacturing sector, which expects almost 9 percent growth.

Figure 60.
Nuclear Electric Power Generation – Expected Employment Growth by Industry



Nuclear EPG, compared to the EPG sector as a whole, had a proportionally high number of female employees in 2018—over one-third (38 percent), the highest of any generation technology. Nuclear EPG is the most racially diverse of all generation technologies, employing 36 percent racial minorities, compared to 22 percent in the national workforce. It also employs the highest level of black or African American workers at 12 percent, equal to the national workforce. One in ten nuclear generation workers is unionized.

Table 29.
Nuclear Electric Power Generation – Demographics, Q4 2018

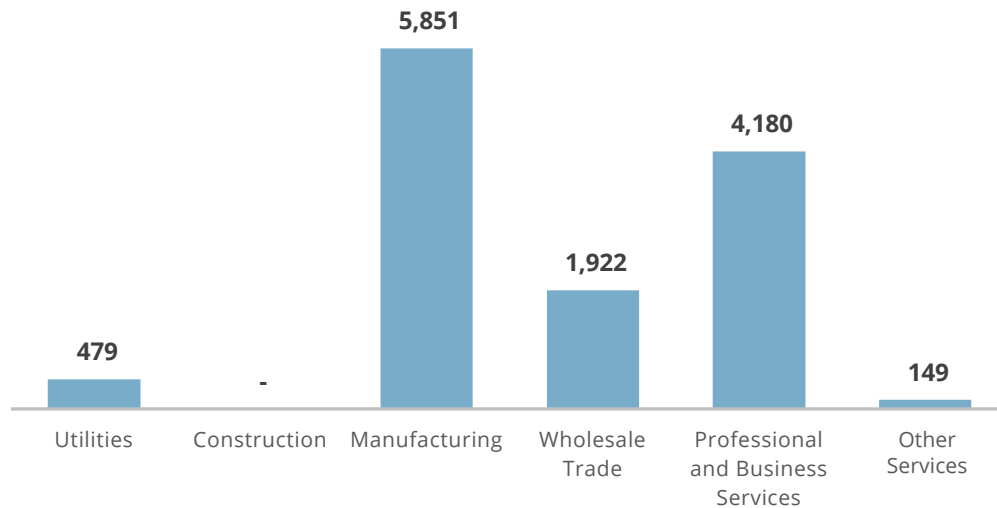
	Nuclear Generation		National Workforce Averages
Male	39,078	62%	53%
Female	23,909	38%	47%
Hispanic or Latino	9,681	15%	17%
Not Hispanic or Latino	53,306	85%	83%
American Indian or Alaska Native	820	1%	1%
Asian	6,791	11%	6%
Black or African American	7,327	12%	12%
Native Hawaiian or other Pacific Islander	585	1%	>1%
White	40,593	64%	78%
Two or more races	6,871	11%	2%
Veterans	3,650	6%	6%
55 and over	8,899	14%	23%
Union	6,185	10%	11%

OIL ELECTRIC POWER GENERATION

Oil EPG employed a total of 12,582 workers across the nation in 2018. Over the past year, 165 jobs were created for oil generation—a 1 percent increase in employment. Manufacturing accounted for almost 47 percent of oil power generation jobs in 2018, while professional business services supported over 33 percent.

Figure 61.

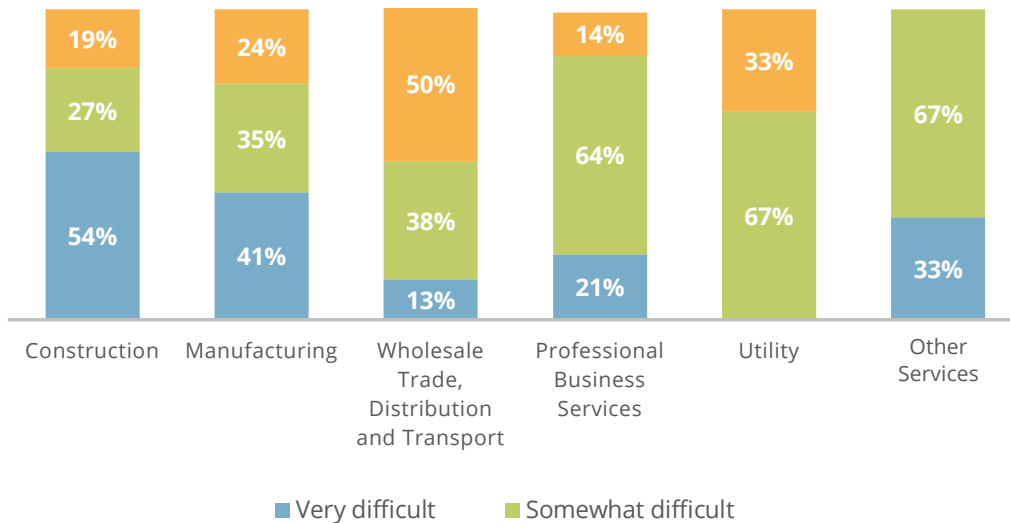
Oil Electric Power Generation – Employment by Industry



In 2018, 76 percent of manufacturing employers, the largest segment, reported that it was somewhat difficult or very difficult to hire employees. Similarly, 85 percent of professional business services employers reported that hiring new workers in 2018 was either somewhat difficult or very difficult.⁴⁸

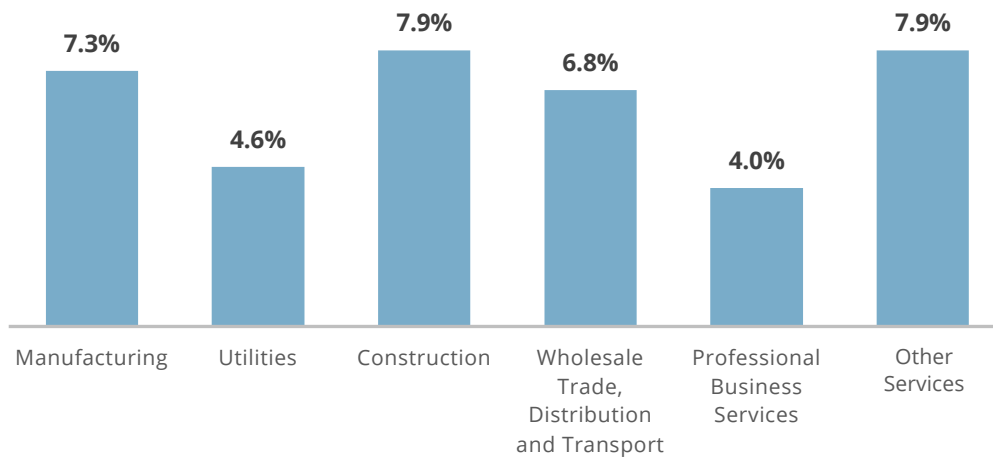
⁴⁸ Some industries are omitted from this discussion due to their small sample size in the data contributing to Figure 62. Conclusions have been made only about industries with sufficient sample size.

Figure 62.
Oil Electric Power Generation – Hiring Difficulty by Industry



Employers in the oil EPG industry expect over 6 percent growth in 2019. the manufacturing sector that predicts over 7 percent growth.

Figure 63.
Oil Electric Power Generation – Expected Employment Growth by Industry



Oil EPG has a workforce that is 31 percent women. Similar to many other generation technologies, it is more racially diverse than the national workforce, with 32 percent racial minorities.

Table 30.
Oil Electric Power Generation – Demographics, Q4 2018

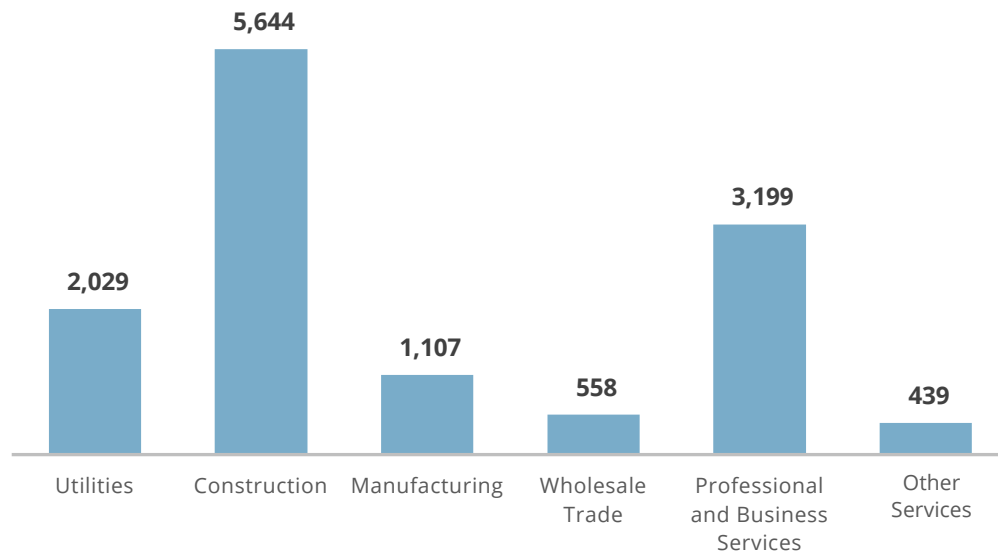
	Oil Generation		National Workforce Averages
Male	8,694	69%	53%
Female	3,888	31%	47%
Hispanic or Latino	2,475	20%	17%
Not Hispanic or Latino	10,107	80%	83%
American Indian or Alaska Native	166	1%	1%
Asian	1,404	11%	6%
Black or African American	1,019	8%	12%
Native Hawaiian or other Pacific Islander	160	1%	>1%
White	8,575	68%	78%
Two or more races	1,258	10%	2%
Veterans	1,085	9%	6%
55 and over	1,796	14%	23%
Union	367	3%	11%

BIOMASS ELECTRIC POWER GENERATION

Biomass EPG employed a total of 12,976 workers across the nation in 2018. Over the past year, 591 jobs were created for biomass generation—a 4.6 percent increase in employment. Construction captured over 43 percent of biomass power generation jobs in 2018, while professional business services supported almost 25 percent.

Figure 64.

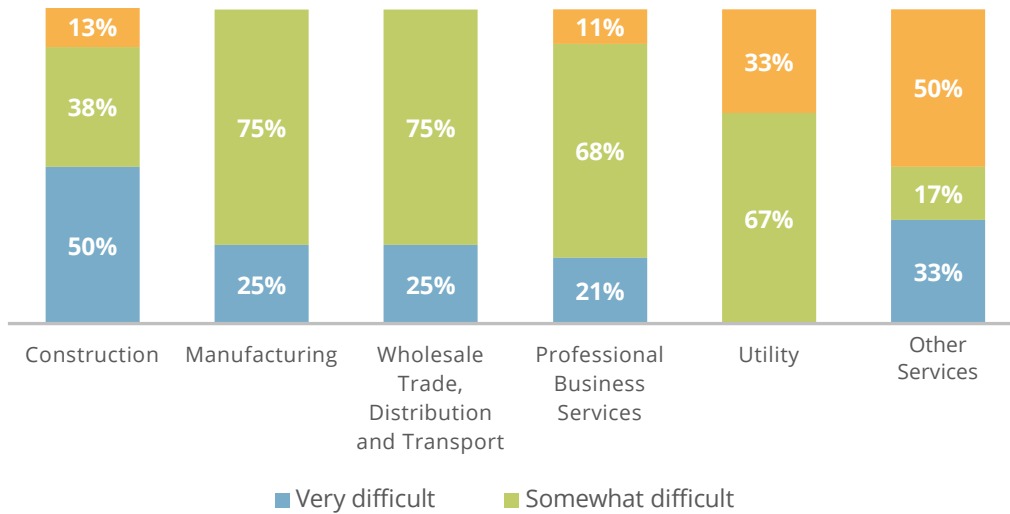
Biomass Electric Power Generation – Employment by Industry



In 2018, 88 percent of construction employers reported that hiring was somewhat difficult or very difficult (with 50 percent reporting that hiring was very difficult). Similarly, 89 percent of professional business services employers reported that hiring new workers in 2018 was either somewhat difficult or very difficult. In contrast, while 67 percent of utilities reported that hiring in 2018 was somewhat difficult, none reported that it had been very difficult.⁴⁹

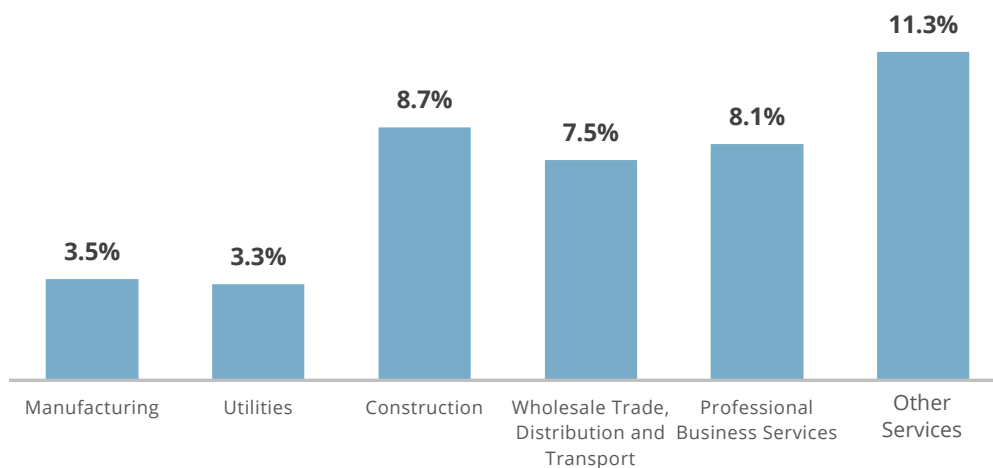
⁴⁹ Some industries are omitted from this discussion due to their small sample size in the data contributing to Figure 65. Conclusions have been made only about industries with sufficient sample size.

Figure 65.
Biomass Electric Power Generation – Hiring Difficulty by Industry



Employers in the biomass EPG industry expect over 5 percent growth in 2019. This is led by the construction sector and the professional business services sectors, which both predict over 7 percent growth.

Figure 66.
Biomass Electric Power Generation – Expected Employment Growth by Industry



Biomass EPG has a workforce that is 32 percent female workers. Similar to most of the electric power generation workforce, it is more racially diverse than the national workforce, employing 28 percent racial minorities.

Table 31.
Biomass Electric Power Generation – Demographics, Q4 2018

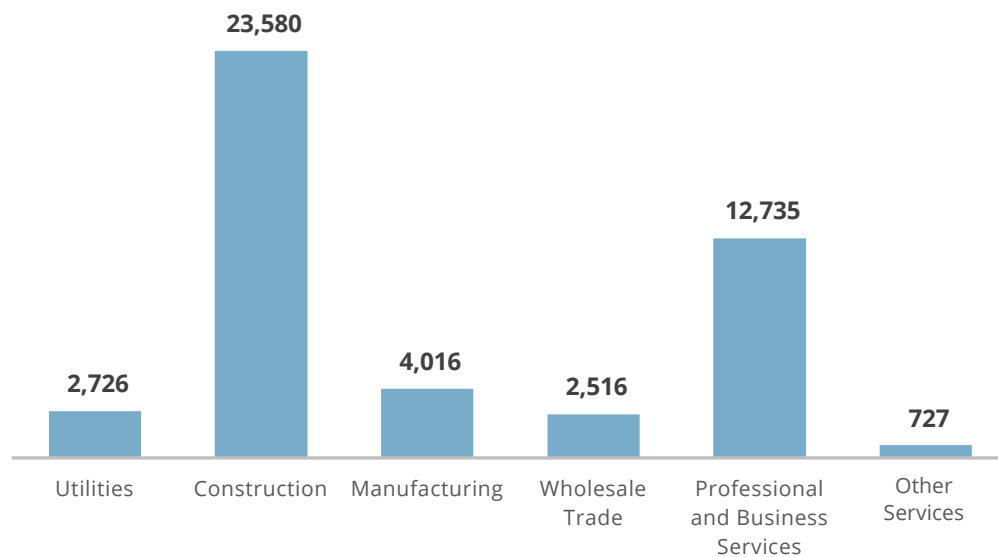
	Biomass Generation		National Workforce Averages
Male	8,809	68%	53%
Female	4,167	32%	47%
Hispanic or Latino	2,265	17%	17%
Not Hispanic or Latino	10,711	83%	83%
American Indian or Alaska Native	153	1%	1%
Asian	1,309	10%	6%
Black or African American	1,002	8%	12%
Native Hawaiian or other Pacific Islander	159	1%	>1%
White	9,367	72%	78%
Two or more races	987	8%	2%
Veterans	1,671	13%	6%
55 and over	3,052	24%	23%
Union	1,143	9%	11%

OTHER ELECTRIC POWER GENERATION

Other EPG⁵⁰ technologies employed a total of 37,775 workers across the nation in 2018. Over the past year, almost 3,000 jobs were created for other generation technologies— a greater than 8 percent increase in employment. Construction accounted over half of other EPG jobs in 2018, while professional business services supported almost 28 percent.

Figure 67.

Other Electric Power Generation – Employment by Industry

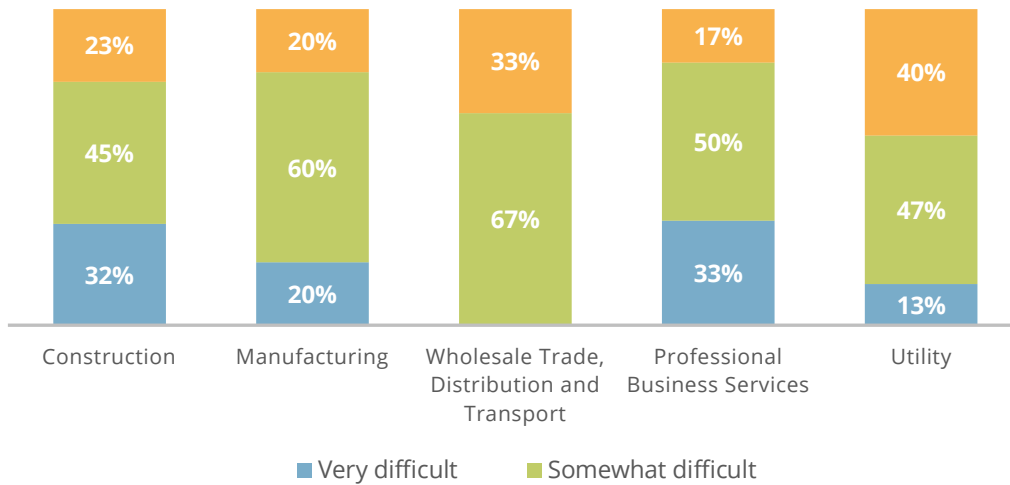


In 2018, 77 percent of construction employers reported that hiring was somewhat difficult or very difficult (with 32 percent claiming that it was very difficult). Similarly, 83 percent of professional and business services employer reported that hiring in 2018 was somewhat difficult or very difficult. However, only 60 percent of utilities employers reported that hiring new workers in 2018 was somewhat difficult or very difficult.⁵¹

⁵⁰ Includes generation from incineration of other fuels (waste, etc.), tidal generation, and employment that can not be classified into a single category.

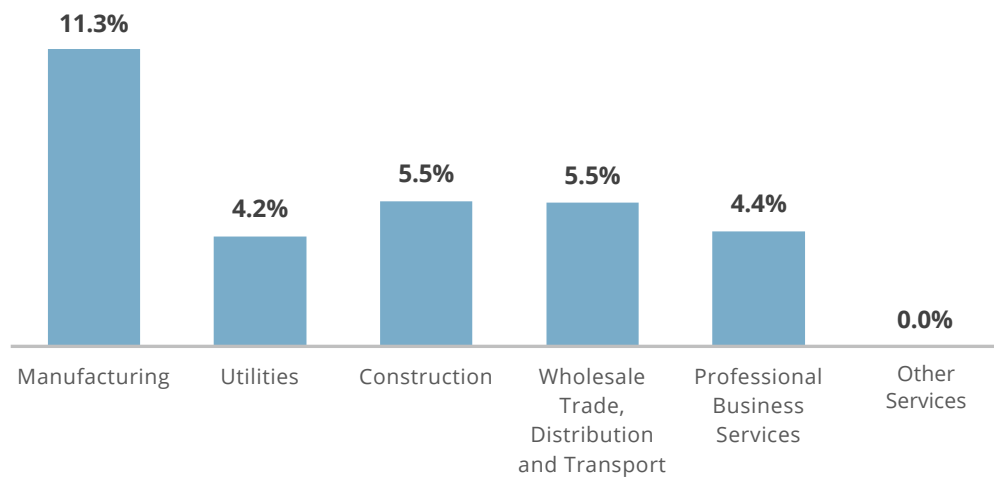
⁵¹ Some industries are omitted from this discussion due to their small sample size in the data contributing to Figure 63. Conclusions have been made only about industries with sufficient sample size.

Figure 68.
Other Electric Power Generation – Hiring Difficulty by Industry



Employers in the other EPG industry expect over 6 percent growth in 2019. This will be led by the manufacturing sector, which predicts over 11 percent growth.

Figure 69.
Other Electric Power Generation – Expected Employment Growth by Industry



The workforce profile of other EPG is similar to electric power generation profiles generally. Other EPG has a workforce that is 32 percent female employees, while it is more racially diverse than the national workforce—with 28 percent racial minorities, compared to a national average of 22 percent.

Table 32.
Other Electric Power Generation – Demographics, Q4 2018

	Other Generation		National Workforce Averages
Male	31,578	68%	53%
Female	14,723	32%	47%
Hispanic or Latino	8,901	19%	17%
Not Hispanic or Latino	37,400	81%	83%
American Indian or Alaska Native	529	1%	1%
Asian	4,730	10%	6%
Black or African American	3,268	7%	12%
Native Hawaiian or other Pacific Islander	595	1%	>1%
White	33,521	72%	78%
Two or more races	3,659	8%	2%
Veterans	4,236	9%	6%
55 and over	5,907	13%	23%
Union	2,217	5%	11%

ELECTRIC POWER GENERATION AND FUELS EMPLOYMENT CROSSCUT

In Table 33, data on Electric Power Generation and Fuels technologies are combined to better understand the employment characteristics and trends of each. Some generation technologies, such as natural gas or nuclear power, require the use of fuels while others, such as wind or hydropower, do not. In addition, some fuels, such as coal and nuclear fuel, are used primarily for electric power generation while others such as oil and natural gas have multiple purposes.

For example, advanced natural-gas-powered electricity generation and nuclear-powered electricity generation are technology applications that employ roughly the same number of workers, while the underlying technologies used in natural gas and nuclear energy systems are significantly different, as are the associated employment numbers for all energy uses of these resources.

Table 33.
Electric Power Generation and Fuels Employment by Major Energy Technology Application and Detailed Technology Application

	Electric Power Generation	Fuels	Total
Oil/Petroleum	12,282	602,810	615,092
Natural Gas	112,685	-	383,311
Traditional Gas	43,526	270,626	314,152
Advanced Gas	69,159	-	69,159
Majority-Time Solar Employment*	242,343	-	242,343
Coal	86,202	74,831	161,033
Bioenergy	12,976	106,709	119,685
Corn Ethanol	-	35,055	35,055
Other Ethanol/ Non-Woody Biomass, including Biodiesel	-	20,074	20,074
Woody Biomass Fuel for Energy and Cellulosic Biofuels	-	33,166	33,166
Other Biofuels	-	18,414	18,414
Wind	111,166	-	111,166
Other Generation/ Other Fuels	37,775	63,417	101,192
Nuclear	62,987	9,159	72,146
Hydroelectric Generation	66,448	-	66,448
Low Impact Hydroelectric Generation	11,578	-	11,578
Traditional Hydropower	54,870	-	54,870
CHP	29,245	-	29,245
Geothermal	8,526	-	8,526

* **Note:** An additional 92,649 employees spent less than 50 percent of their time on solar.