U.S. DEPARTMENT OF ENERGY

United States Energy & Employment Report 2024

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DEPARTMENT OF ENERGY
Secretary Jennifer M. Granholm

DEPARTMENT OF ENERGY
OFFICE OF ENERGY JOBS

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Executive Summary

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EXECUTIVE SUMMARY

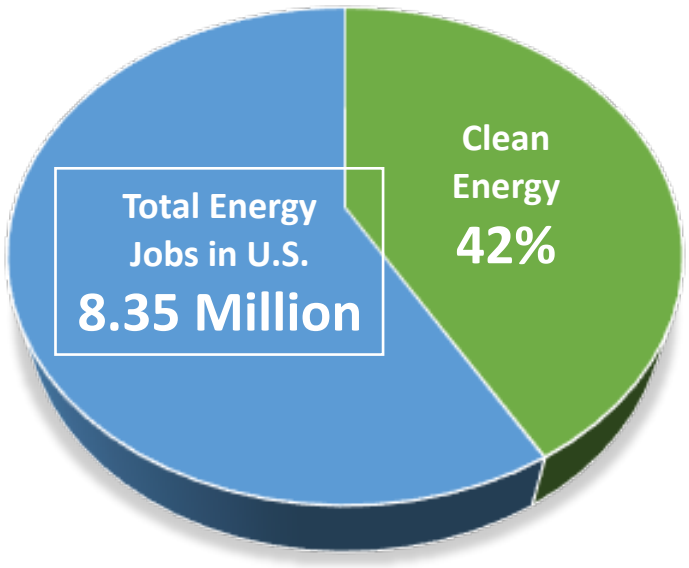
In 2023, clean energy investments powered strong overall growth of jobs in the energy sector.[1] Unionization rates in clean energy grew to their highest level yet, driven by large increases in union-dense construction and utility employment. Energy employers reported less difficulty in hiring qualified workers than in the previous year.

U.S. energy sector jobs grew 3% in 2023, outpacing solid overall U.S. employment growth by 50%.[2] Energy sector employment increased by over 250,000 from 8.10 million total energy jobs in 2022 to 8.35 million in 2023.[3]

Clean energy employment increased by 142,000 jobs, accounting for more than half (56%) of new energy sector jobs and growing at a rate (4.2%) twice as large as that for the rest of the energy sector and the U.S. economy overall (2.0%).[4] Just under 5% of all new jobs created in the U.S. economy in 2023 were in clean energy, and clean energy now accounts for 42% of all energy jobs (Figure 1).

The U.S. Energy and Employment Report (USEER) allocates energy employment to five technology areas: electric power generation; energy efficiency; fuels; motor vehicles; and transmission, distribution, and storage. Employment increased across all five of these technology areas in 2023.

Figure 1: Jobs in Clean Energy as a Percentage of Total Energy Jobs (millions of jobs), 2023



What has not historically been counted in the above technology areas (or reported) are the construction jobs associated with building and expanding clean energy manufacturing facilities. A supplemental survey in 2023 found an additional 28,000 jobs in the construction of new clean energy supply chain facilities, such as new or expanded battery and solar panel factories, ports to service offshore wind, and warehouses used for clean energy materials—all of which are needed to support the onshoring of clean energy supply chains. These jobs data, which are included in USEER for the first time in 2024, are separate from — and in addition — to the reported totals.[5]

KEY STATISTICS

- **Clean energy is driving job growth in the energy sector.** Since 2020, jobs in clean energy have grown by 400,000, showing a growth rate of 12.8%. This is faster than the rest of the energy sector, which added more than 427,000 net jobs for a growth rate of 9.7% over the same period.

- **Motor vehicle jobs are growing, and the most rapid growth is in clean zero-emission vehicles.** Nationwide, jobs in motor vehicles grew, with clean vehicle employment increasing 11.4%, adding 24,826 jobs.[6] This does not include employment growth in battery manufacturing (2,800 new jobs), or EV charging (550 new jobs), both of which are covered in the transmission, distribution and storage category. Employment in gas and diesel vehicles, including (non-plug-in hybrids and natural gas vehicles) also rose, but more slowly, at 2% adding 39,305 jobs.[7]

- **Jobs in battery electric vehicles are growing more rapidly than hybrid and plug-in hybrid vehicles.** Within clean vehicles, battery electric vehicle employment increased by 17,064 jobs (12.9%), outpacing hybrid and plug-in hybrid growth of 10.5% and 8.4%, respectively.[8] Hydrogen fuel cell vehicles increased by 2,019 (11.5%).

JOBS ADDED IN 2023

+250,000

IN THE ENERGY SECTOR, WHICH NOW EMPLOYS

8.35 MILLION

4.2%

INCREASE IN **CLEAN ENERGY JOBS**, OUTPACING GROWTH IN ENERGY JOBS OVERALL

- **Wind and solar employment grew at rates well above average, and solar became more diverse and more heavily unionized.** Wind employment grew 4.6%, adding 5,715 jobs. Solar employment grew 5.3%, adding over 18,000 jobs with employment gains substantially increasing the number and share of Hispanic/Latino workers by 9,400 in the sector. The number of workers in solar represented by unions grew 13.7% by 5,000 jobs.

- **Latino and Hispanic workers and Veterans saw significant gains in the energy sector.** Approximately 32% of total new energy jobs, and 33% of new clean energy jobs in 2023 were filled by Hispanic or Latino workers, raising their total representation in the energy workforce by 79,000 to just under 1.5 million, which represents 18% of total energy jobs. Veterans made up 9%

of the U.S. energy workforce, higher than their representation in the overall U.S. economy (5%). More than 34,000 Veterans were added to the energy workforce in 2023.

- **Unionization rates in clean energy surpassed traditional energy employment for the first time.** Driven largely by rapid growth in the comparatively highly unionized construction (particularly of transmission and distribution systems) and utility sectors, unionization rates in clean energy grew to 12.4%.[9] The share of workers represented by unions also increased from 12% to 13% in Electric Power Generation (8,600 workers). Union density in the energy sector (11%) was 50% greater than the private sector average (7%).

- **Employers had an easier time hiring qualified workers compared to the previous year, and union employers reported lower difficulty finding workers than non-union employers.**[10] Only 24% of unionized firms reported that it was "very difficult" to find workers compared to 40% of non-union firms. . Both union and non-union firms reported less difficulty hiring relative to 2022.

- **Unionized firms show greater commitment to diversity, equity, and inclusion.** Union employers were 50% more likely to offer or require a diversity and/or inclusion training program aimed at advocating workplace diversity and inclusion than non-union employers (36% and 24%, respectively), as well as more likely to report specific strategies, policies, or programs to increase the number of women, ethnic and racial minorities, and LGBTQ+ hires.[11]

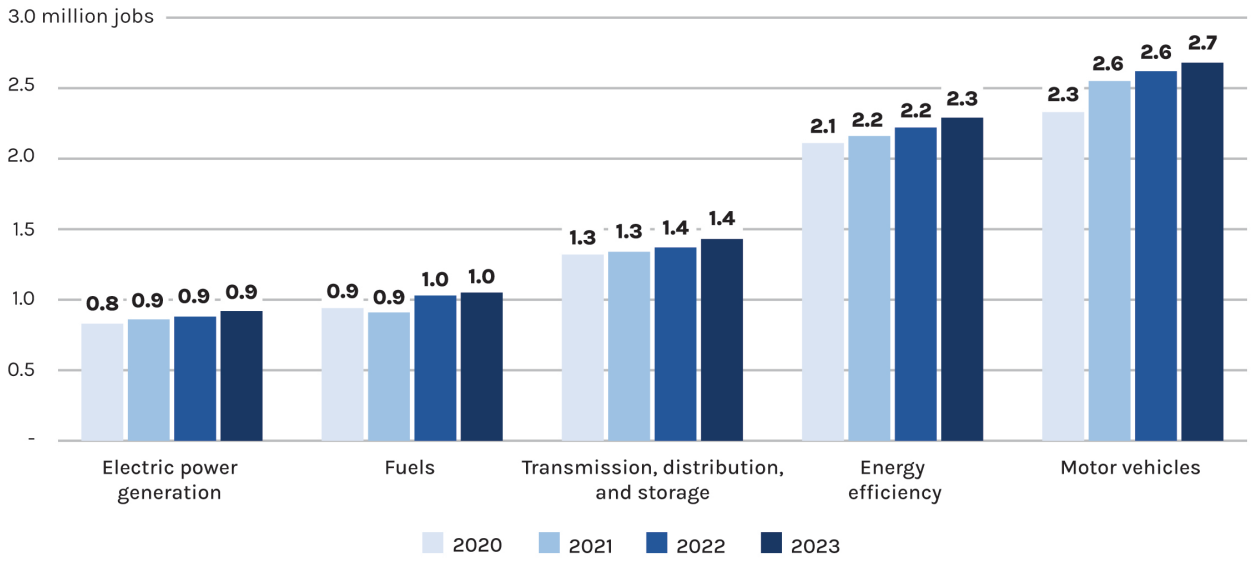
- **Traditional transmission, distribution, and storage technologies saw rapid and significant net growth despite a loss of jobs in transportation of fuels.** Traditional transmission, distribution, and storage including electric bulk power transmission and control, electric power distribution, and natural gas distribution, grew 5.4%, adding 52,515 net new jobs. While still comparatively small, the fastest growing segment in transmission, distribution, and storage was electric vehicle charging deployment at 25.1% growth to support more than 550 new jobs. Battery storage, which includes battery storage for electric vehicles as well as for the electric grid, grew 3.8% (+2,779 jobs). Transportation of fuels saw a loss of 16,382 jobs (-11.6%) in this sector.[12]

- **The industry sectors experiencing the highest job growth from 2022 to 2023 were utilities and construction.** When aggregating jobs across technology categories into traditional industrial sectors, the utilities sector saw the fastest employment growth of 5.0% in 2023, adding nearly 30,000 jobs. The construction sector added nearly 90,000 energy jobs, growing 4.5%, almost double the economy-wide construction employment growth of 2.3%. Driving both increases were robust activities in Electric Power Generation and Transmission, Distribution, and Storage, driven by the expansion and build out of generation facilities and upgrades to the grid.
- **Women and Black or African American workers remain under-represented in the U.S. energy workforce.** Across every major technology and industry category, Black or African American workers are underrepresented, holding just 9% of energy jobs while representing 13% of the U.S. workforce. Women held 26% of energy jobs but make up 47% of American workers. Women filled half of new energy jobs in 2022 but only 17% of new energy jobs in 2023 (42,000 of the 250,000).

EMPLOYMENT BY TECHNOLOGY

Figure 2 shows energy employment job growth since 2020, organized by technology category. Each category experienced growth in 2023. Motor vehicle jobs increased 14.6% since 2020, transmission, distribution, and storage jobs by 7.8%, electric power generation by 10.2%, fuels by 12.1%, and energy efficiency jobs by 8.7%. Each section of the report examines the growth in each technology sector more closely.

Figure 2. Energy Employment by Technology, 2020-2023 (Millions of Jobs)



The Investing in America agenda is driving new investments and jobs across energy production, infrastructure and supply chains

Since taking office in 2021, the Biden-Harris Administration has spearheaded a series of legislative initiatives and driven policy implementation aimed at rebuilding the U.S. economy from the bottom up and the middle out, reversing decades of offshoring and outsourcing, and repositioning the country as a global leader in innovation, technology, and manufacturing.

Three major pieces of legislation passed by Congress and signed into law by President Biden, and collectively known as the Investing in America agenda, include the Bipartisan Infrastructure Law of 2021 (BIL), the Inflation Reduction Act of 2022 (IRA), and the CHIPS and Science Act of 2022. These policies contribute to the Biden-Harris Administration's goal of making the United States a world leader in clean energy innovation, production, and manufacturing, while creating good jobs and reinvesting in American communities.

BIL represents a landmark investment in infrastructure, with a total federal allocation of $1.2 trillion, spanning advanced transportation, broadband, and energy infrastructure investment.[13] The CHIPS and Science Act of 2022 represents another strategic investment in science, research, innovation, domestic manufacturing, and workforce development.

The IRA, signed into law on August 16, 2022, makes historic investments to modernize domestic energy infrastructure and make the U.S. a leader in clean and advanced energy production, technology, and supply chains. To work towards reaching President Biden's objective of net-zero emissions economy-wide by 2050, the IRA invests $370 billion in clean energy projects. At the same time the law combats the drivers of inflation and includes tax provisions that help cut energy costs for American families. It speeds the adoption of clean energy technologies through grants, loans, rebates, and incentives and spurs investment, with bonus credits to projects that meet key wage and training standards or are located in low-income or energy communities.[14]

The Biden-Harris Administration has moved rapidly to implement this legislation, and the additional private investments they enable are now underway. As of July 2024, starting with implementation of BIL, the Biden-Harris Administration has announced or awarded $563 billion in public investments in energy and transportation infrastructure in communities in every state and territory, including $79.5 billion to accelerate the deployment of clean energy.

These federal investments have spurred significant private sector investment. Companies have announced $898 billion related to the Investing in America agenda, including $177 billion for EVs and batteries, $160 billion for clean power, $81 billion for clean energy manufacturing and infrastructure[15] and $44 billion for heavy industry.

The enactment of the IRA created a surge of investments in manufacturing activity within the U.S., with new investments in clean energy, clean vehicles, building electrification, and carbon management technology.

In the EV sector, companies have announced more than 250 new or expanded factories nationwide to produce batteries for electric vehicles and grid storage, and public incentives have attracted investments from the largest international conglomerates to build and expand factories for vehicles and batteries in the U.S.

Looking across the economy, since President Biden took office, a record 17 million business applications have been filed, including over 290,000 in the manufacturing sector.[16] Real private investment in manufacturing structures is at a record high and has more than doubled since January 2021.[17] Since the passage of BIL and IRA, national expenditures on manufacturing construction[18] have rapidly increased, growing from $70 billion in May 2021 to $223 billion in March 2024.[19] As a result, private manufacturing construction hit its largest annual growth on record in the fourth quarter of 2023.

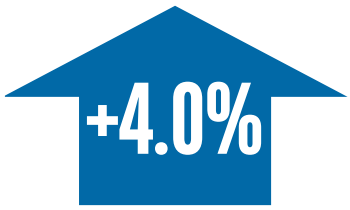
ELECTRIC POWER GENERATION

The Electric Power Generation (EPG) sector employed

900,000

a gain of

35,600 JOBS



CLEAN ENERGY EPG WORKFORCE GREW BY 4.6% – SOLAR ADDED 18,400 WORKERS (+5.3%)

Electric power generation (EPG) jobs grew the fastest of any major energy technology in 2023 at 4.0%, nearly double the overall U.S. job growth rate. EPG gained 36,458 jobs and lost 870 jobs, with a net gain of 35,588 jobs. In total, there were over 900,000 EPG jobs in the U.S. in 2023.

Clean energy technologies accounted for 79% of net new EPG employment, adding 28,086 jobs. The clean energy EPG workforce grew by 4.6%, which was more than double the growth rate for the economy overall.

Both solar and wind, the two largest employment sectors of EPG technologies, increased from 2022 to 2023, following increases from 2020 through 2022. Solar had the largest number of jobs gained and the fastest growth rate, adding 18,401 workers (5.3%). Land-based wind had the second largest, adding 5,715 workers, for a growth rate of 4.6%.

Employment in other renewable energy EPG technologies also grew in 2023, including traditional and low-impact hydropower employers, which added 2,100 jobs (3.2%) and geothermal employers, which added 235 jobs (2.7%). Though the absolute number of jobs gained for some renewable energy technologies, such as offshore wind and bioenergy, is small, they exhibit above average rates of growth.

Nuclear EPG employment increased by 1,596 jobs in 2023, up 2.8% from 2022. Employment increased and decreased across different categories of fossil energy for EPG. Coal EPG job losses slowed from 2022 to 2023, decreasing by 870 positions (-1.4%) (compared to -9.6% from 2021 to 2022), while natural gas EPG[20] jobs increased by 4,713, a growth rate of 4.0%. Oil EPG employment increased by 2.6%, adding 318 jobs in 2023.

TRANSMISSION, DISTRIBUTION AND STORAGE

Transmission, Distribution, and Storage (TDS) employed

1.42 MILLION

a gain of

52,000 JOBS

+3.8%

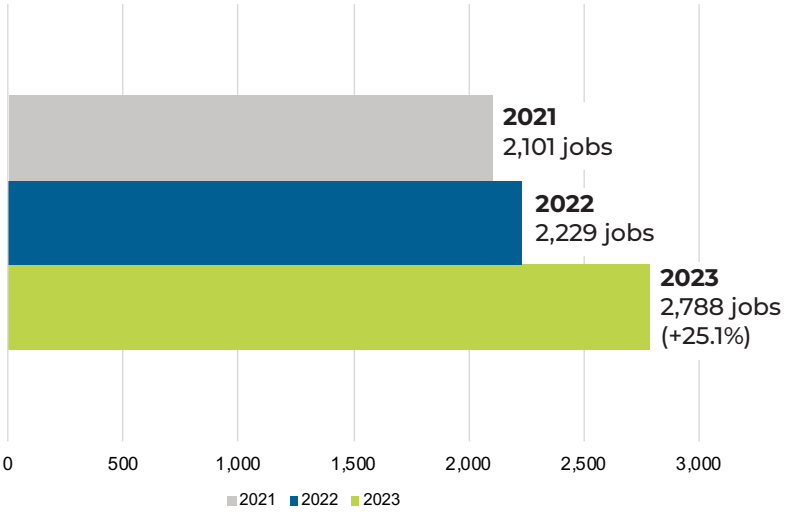
TRADITIONAL TDS ADDED THE MOST JOBS (52,500) AND GREW 5.4% IN 2023

Transmission, distribution, and storage (TDS) employed over 1.4 million workers in 2023. The employment growth rate in TDS from 2022 to 2023 continued to accelerate, growing 3.8% in 2023, up from 2.2% in 2022.

The TDS sector saw a net gain of 52,017 jobs, with the majority of job losses stemming from commodity flows (16,382 jobs). While still an emerging sector, "EV Charging" outpaced all other TDS technologies in growth rate, increasing 25.1% (559 jobs). Traditional TDS added the most jobs (52,515) and grew 5.4%[21], significantly greater than the 1.9% growth rate from the previous year.

SPOTLIGHT

EV Charging Employment



Storage, which includes batteries for a number of applications: spanning consumer devices, vehicles or other transportation (including electric vehicles), behind-the-meter (buildings or industrial facilities), and front-of-meter (electric grid), added 2,779 jobs (3.8%). In 2023, battery manufacturing represented 15% of all storage jobs (14,028 jobs).

Industries involved in the transportation of coal, petroleum, and other fuels by truck, rail, air, and water (also known as commodity flows) lost a combined total of 16,382 jobs (-11.6%) from 2022 to 2023, the only segment of TDS to have a net decrease in employment.

FUELS

The Fuels sector employed nearly **1.1 MILLION**

a gain of **19,100 JOBS**

+1.8%

RENEWABLE DIESEL FUELS EMPLOYMENT GREW AT THE FASTEST RATE (+7.3%)

Fuels employed nearly 1.1 million workers in 2023. From 2022 to 2023, fuels employers added 19,075 net jobs for 1.8% growth. Onshore oil and gas activities added the most jobs in the sector (9,023 in 2023), while renewable diesel fuels and offshore natural gas grew at the fastest rate (7.3% and 4.9% respectively).

Mining and extraction employment within fuels remained relatively flat from 2022 to 2023, adding only 1,765 jobs for a growth rate of 0.4%, maintaining the employment level reached by the rapid increase of 107,029 jobs added and 33.1% employment growth in the segment from 2021 to 2022. Mining and extraction jobs are spread across coal fuels and onshore and offshore petroleum and natural gas.

ENERGY EFFICIENCY

The Energy Efficiency sector employed nearly **2.3 MILLION**

a gain of **74,700 JOBS**

+3.4%

ENERGY EFFICIENCY FIRMS ADDED THE MOST JOBS OF ANY TECHNOLOGY IN 2023

Energy efficiency supported almost 2.3 million jobs in 2023. From 2022 to 2023, energy efficiency firms added 74,748 jobs, the most of any technology (3.4%). All energy efficiency technology sub-categories experienced positive job growth, most notably in traditional heating, ventilation, and cooling (HVAC), which added 18,165 jobs and grew by 3.2%.[22] ENERGY STAR® certified installation added 5,509 new jobs over the period (5.2%) followed by efficient lighting (+8,853, 4.2%).

MOTOR VEHICLES AND COMPONENT PARTS

Motor Vehicles (MV)[23] and Component Parts employed nearly

2.7 MILLION

+2.8%

a gain of nearly

73,000 JOBS

MOTOR VEHICLES AND COMPONENT PARTS IS THE LARGEST ENERGY TECHNOLOGY AREA

CLEAN ENERGY VEHICLES

Jobs in clean energy vehicles (BEV, plug-in hybrid, and hydrogen/fuel cell), increased by nearly 25,000.

+11%

BATTERY ELECTRIC VEHICLES

Jobs in battery electric vehicles (BEV) grew by 17,065 in 2023.

+12.9%

FUEL CELL ELECTRIC VEHICLES

Jobs in fuel cell electric vehicles grew by 2,019 in 2023.

+11.5%

Jobs in clean vehicles (BEV, plug-in hybrid, and hydrogen/fuel cell) increased by 11%, adding almost 25,000 jobs. This does not include employment growth in battery manufacturing (2,779 new jobs), or EV charging (559 new jobs), both of which are included in the transmission, distribution and storage category.

Employment in battery electric vehicles grew the fastest increasing by 12.9%, adding 17,065 jobs, followed by jobs in fuel cell electric vehicles (11.5%, 2,019 jobs). Employment in gas and diesel-powered vehicles rose, but more slowly, at 2.0%, adding 39,305 jobs.

Supplemental Jobs in Construction and Expansion of Clean Energy Manufacturing and Supply Chain Infrastructures

The BIL, IRA, and CHIPS and Science Act, collectively known as Invest in America, are currently spurring public and private investment in expansion and improvement of energy infrastructure and the onshoring of clean energy manufacturing. Grants, loans, rebates, and tax incentives have stimulated the construction of new factories and energy supply chain infrastructure across the country.

Since 2016, USEER has collected data on employment across the energy sector, including energy efficiency and vehicle production and maintenance, and thus captures any changes in energy sector employment as a result of changing policy and market conditions. Jobs resulting from the construction and upgrades of domestic energy manufacturing facilities or supply chain infrastructure, however, have not previously been tracked or reported in USEER.

This new supplemental section assesses employment in the build out of the domestic energy supply chain, such as construction or upgrades of manufacturing or materials processing facilities, ports, and distribution facilities related to U.S. energy supply chain investments. For more information on the methodology for the domestic energy supply chain estimates, please see Appendix B.

In 2023, more than 28,000 workers were actively building out energy manufacturing and distribution facilities and developing ports for offshore wind and other energy projects. Approximately 1,000 firms across industrial building construction; commercial and institutional building construction; power and communication line and related construction; land subdivision, highway, street, and bridge construction; and other heavy and civil engineering

construction were actively building out energy supply chain infrastructure projects. There is room for employment to grow as an estimated 5,600 additional construction firms in the U.S. have capacity for domestic energy supply chain infrastructure work.

Below we display the total number of firms with capacity to build out domestic energy supply infrastructure, as well as the total number of firms and employment that actively worked on projects in 2023. This data is being included for the first time this year, so we are only able to show current employment levels, not job growth or decline. Accordingly, this information is separated from the rest of USEER and not included in summary energy employment statistics.

Manufacturing Facilities for Clean Energy Supply Chain

- 3,524 total construction firms with capacity
- 368 total construction firms actively building out projects
- 13,278 total workers actively building out projects in 2023

Warehouse and Distribution Facilities for Clean Energy Supply Chain

- 2,374 total construction firms with capacity
- 504 total construction firms actively building out projects
- 9,448 total workers actively building out projects in 2023

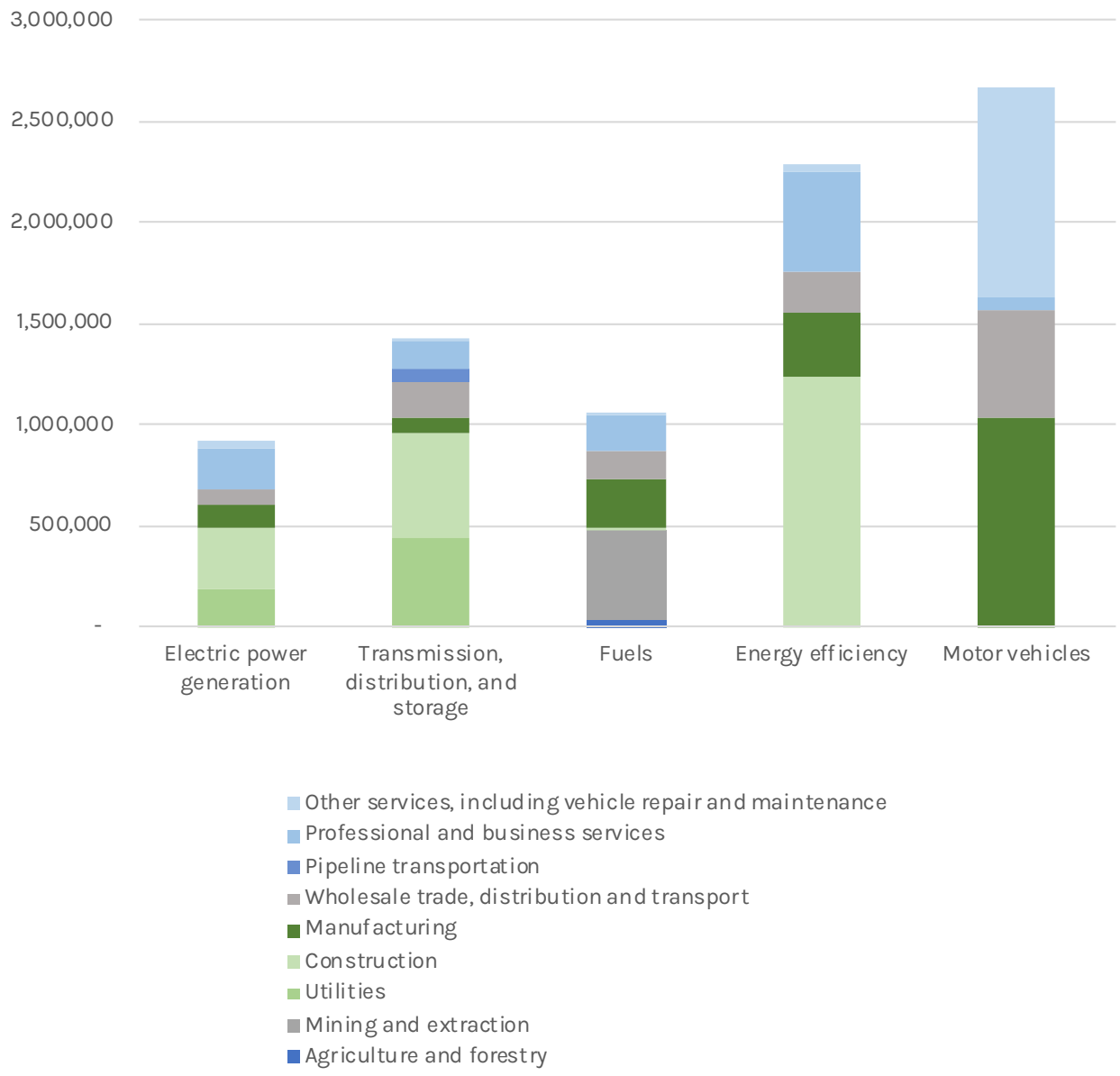
Ports for Clean Energy Projects

- 756 total construction firms with capacity
- 193 total construction firms actively building out projects
- 5,630 total workers actively building out projects in 2023

INDUSTRY DATA

This report also reports employment across different industries (Figures 3 and 4) and the change within each technology sector (Tables 1 and 2). Construction industry jobs grew the most among industry categories, with the majority of new workers employed within energy efficiency. All of the technology sectors added jobs in the manufacturing, professional and business services, and "other services" industries. Manufacturing employment in energy increased by 3% in 2023, adding over 50,000 jobs.

Figure 3. Energy Employment by Technology Category and Industry, 2023



Construction Industry Highlight

With the passage of the Bipartisan Infrastructure Law, Inflation Reduction Act, and CHIPS and Science Act, the construction industry has seen massive new public and private sector investments, driving significant job growth across the U.S. In 2023, growth of jobs in the construction industry outpaced job growth in the overall economy (2.3% compared to 2.1%).

Energy-related construction employment grew by 90,000 jobs, grew at almost twice the rate (4.5%) of otherwise robust construction industry growth (2.3%). When accounting for the additional 28,000 in previously uncounted clean energy manufacturing and supply chain facility construction, 2023 saw an increase of 5.9% growth of energy-related construction industry employment.

Figure 4. Energy Employment by Industry Category and Technology, 2023

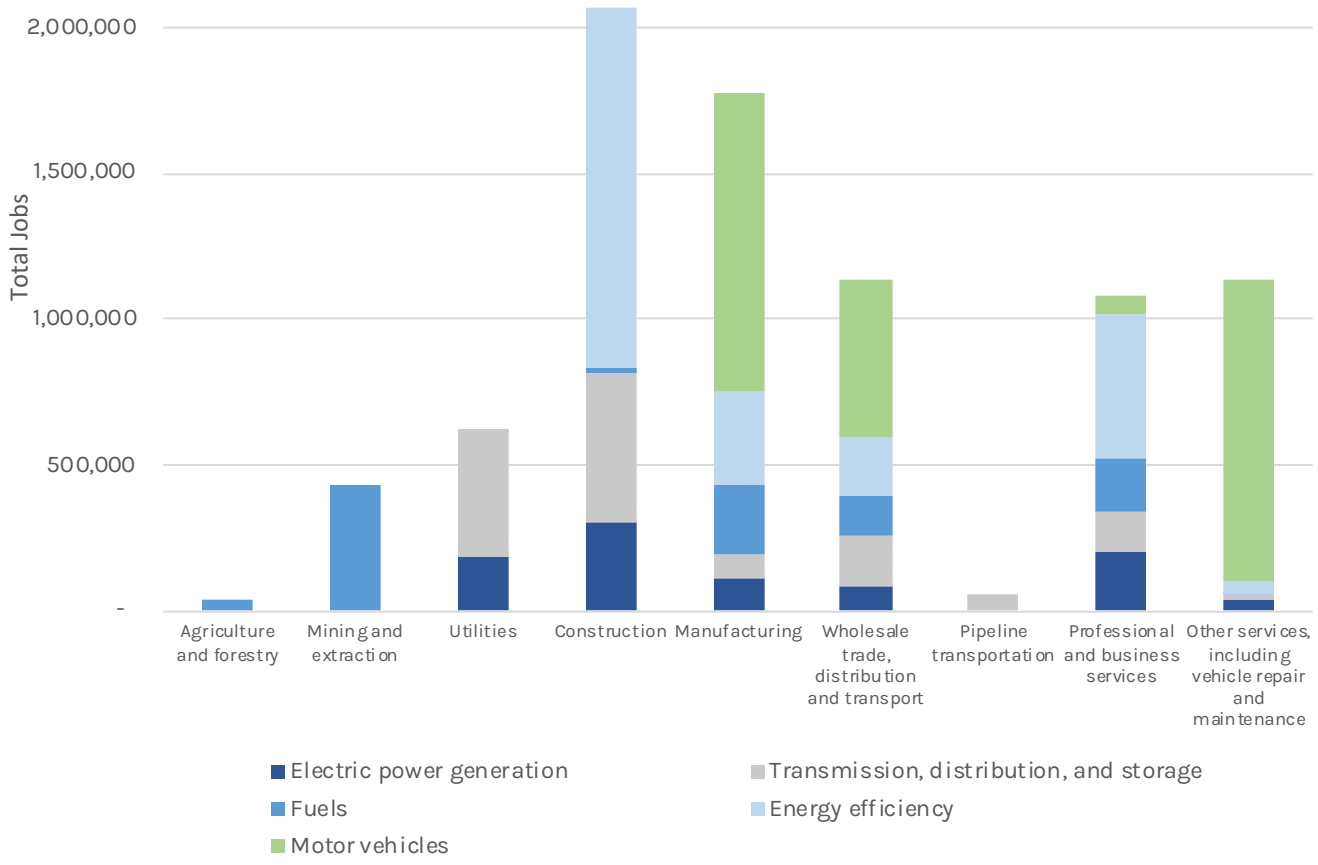


Table 1. Net Change in Energy Jobs by Industry and Technology, 2022-2023

	Electric Power Generation	Transmission, Distribution, and Storage	Fuels	Energy Efficiency	Motor Vehicles	Industry Total
Agriculture and Forestry	0	0	448	0	0	448
Mining and Extraction	0	0	1,765	0	0	1,765
Utilities	11,921	17,965	0	0	0	29,886
Construction	7,046	34,805	1,894	45,334	0	89,078
Manufacturing	1,779	3,716	8,453	15,893	23,594	53,436
Wholesale Trade, Distribution, and Transport	3,849	(14,296)[24]	1,910	733	6,702[25]	(1,100)
Pipeline Transportation [26]	0	3,026	0	0	0	3,026
Professional and Business Services [27]	8,917	6,447	4,583	11,256	2,795	33,999
Other Services [28]	2,075	353	21	1,532	39,892	43,872
Total change from 2022	**35,588**	**52,017**	**19,075**	**74,748**	**72,984**	**254,411**

Table 2. Percent Change in Energy Jobs by Industry and Technology, 2022-2023

	Electric Power Generation	Transmission, Distribution, and Storage	Fuels	Energy Efficiency	Motor Vehicles	Industry Total
Agriculture and Forestry	--	--	1.2%	--	--	1.2%
Mining and Extraction	--	--	0.4%	--	--	0.4%
Utilities	6.7%	4.3%	--	--	--	5.0%
Construction	2.4%	7.3%	9.7%	3.8%	--	4.5%
Manufacturing	1.7%	4.6%	3.7%	5.3%	2.4%	3.1%
Wholesale Trade, Distribution, and Transport	5.0%	-7.5%	1.4%	0.4%	1.3%	-0.1%
Pipeline Transportation	--	5.9%	--	--	--	5.9%
Professional and Business Services	4.7%	4.7%	2.6%	2.3%	4.5%	3.2%
Other Services	5.2%	2.4%	1.1%	3.8%	4.0%	4.0%
Total change from 2022	**4.0%**	**3.8%**	**1.8%**	**3.4%**	**2.8%**	**3.1%**

2023 DEMOGRAPHIC INFORMATION + DIVERSITY

As with other data in this report and in previous USEER reports, demographic information and diversity data is collected from surveys with employers and augmented by data from the Bureau of Labor Statistics (BLS), the Quarterly Census of Employment and Wages (QCEW), and the U.S. Energy Information Administration (EIA).[29] A summary of the demographics of the U.S. energy workforce is in Table 3.[30] The energy sector is younger than the workforce average, and veterans, Native Americans, and Asian workers are well-represented. Job growth among Hispanic or Latino workers was strong in 2023, holding about one-third of new energy jobs. Women and Black or African American workers remain under-represented in the energy sector.

82%

OF THE ENERGY WORKFORCE IS YOUNGER THAN 55

(COMPARED TO 77% OF OVERALL WORKFORCE)

31%

OF THE NEW ENERGY JOBS IN 2023 WERE HELD BY HISPANIC OR LATINO WORKERS

- The energy workforce was younger than the U.S. workforce as a whole. Eighty-two percent of the energy workforce was younger than 55 compared to the national workforce average of 77% (Table 3). Motor vehicles and component parts had the largest share of workers aged 55 and over at 22%.
- Veterans accounted for 9% of the U.S. energy workforce, greater than their representation in the overall U.S. workforce (5%). Veterans made up 10% of the motor vehicles and fuels sectors.
- American Indian or Alaska Native workers accounted for 2% of the energy workforce, which was slightly higher than the U.S. workforce average of 1%.
- Hispanic or Latino workers represented 31% of all new energy jobs in 2023, and 33% of all new clean energy jobs in 2023. The proportion of Hispanic or Latino workers in energy (18%) was just below the national average of 19%.
- The percentage of Asian workers in energy was the same as the national workforce average at 7%.
- Black or African American workers continue to be under-represented in the energy sector. Across all energy technologies, the representation of Black or African American workers was less than their proportion in the overall U.S. workforce. Transmission, distribution, and storage had the highest share of Black or African American workers, at 10% compared to the national average of 13%. Black or African American workers are better represented in traditional fossil energy as well as hydropower and nuclear.

Table 3. United States Energy Workforce Demographics and Characteristics [31]

	Number of Workers	Energy Workforce Average	National Workforce Average
Male	5,943,655	73%	53%
Female	2,107,472	26%	47%
Gender Nonbinary	62,148	<1%	n/a
Hispanic or Latino	1,489,313	18%	19%
Not Hispanic or Latino	6,623,961	82%	81%
American Indian or Alaska Native	179,482	2%	1%
Asian	532,880	7%	7%
Black or African American	718,291	9%	13%
Native Hawaiian or Other Pacific Islander	94,326	1%	<1%
White	6,028,835	74%	76%
Two or More Races	389,933	5%	3%
Unknown Race	170,940	2%	n/a
Veterans	744,128	9%	5%
18 to 29	2,390,642	29%	22%
30 to 54	4,256,560	52%	53%
55 and Over	1,466,073	18%	23%
Disability	180,429	2%	5%
Formerly Incarcerated	114,142	1%	2%
Represented by Unions, Collective Bargaining Agreements, and/or Project Labor Agreements	921,494	11%	7%

National sources: BLS (2023a, 2023b, 2023c, 2023d), Jobs EQ (2022), Prison Policy (2022)

- The energy workforce was largely male at 73%, compared to the U.S. workforce average, which was 53% male. Women make up 26% of the energy workforce but held only 19% of the new energy jobs in 2023.
- Individuals requesting accommodations for disabilities were underrepresented in the energy workforce (2% compared to 5% in the overall U.S. workforce). Individuals requesting accommodations for disabilities worked in EE at a higher rate (3%) than the energy workforce average.
- While 2% of the U.S. workforce was formerly incarcerated, these individuals made up only 1% of the energy workforce.

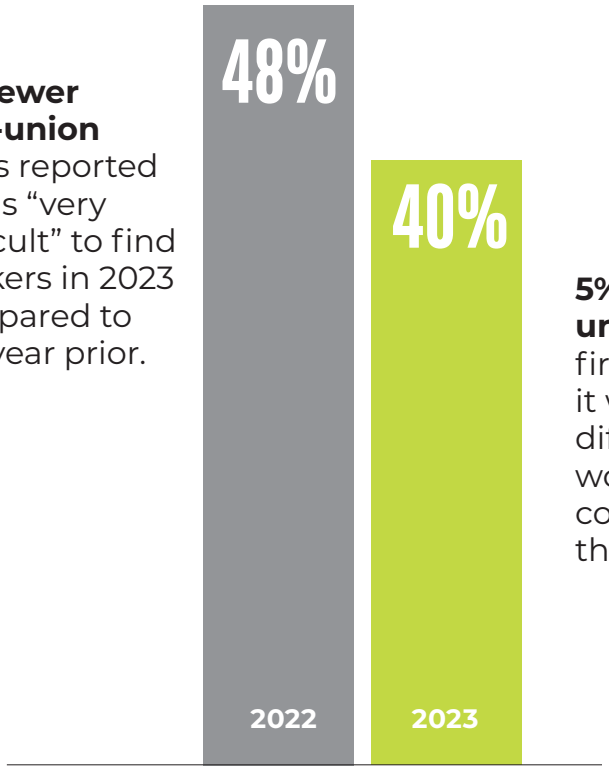
UNION MEMBERSHIP

The percentage of workers represented by a union or covered under a project labor or collective bargaining agreement in the energy workforce (11%) was over 50% higher than the private sector average (7%), although there was considerable geographic variability. The percentage of workers represented by a union or covered under a project labor or collective bargaining agreement in transmission, distribution, and storage (21%) was considerably higher than the overall energy workforce average (11%).

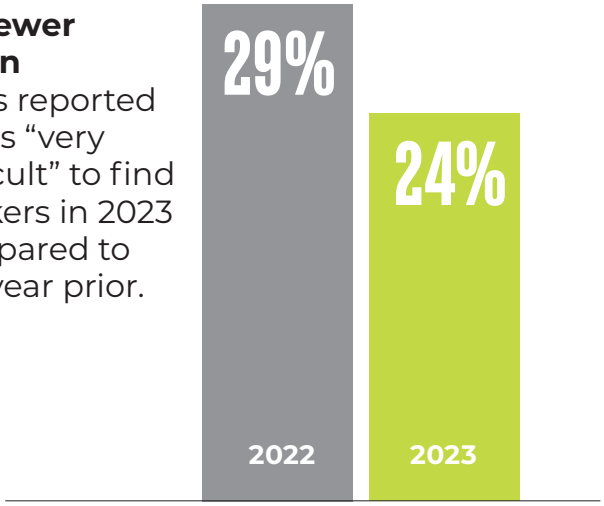
UNIONIZATION & ENERGY JOBS

Union employers[32] reported lower difficulty finding workers than non-union employers in 2023, with 24% of union and 40% of non-union firms reporting that it was "very difficult" to find workers. One explanation for union employers' relative ease of hiring, especially in the construction trades, is that project labor agreements provide multiple avenues for finding qualified talent, including internal permanent employees, members in union hiring halls, and lateral recruitment from skilled trades workers in the area – as well as developed mechanisms in place that can attract "travelers," which are union trade workers who belong to local unions from other geographic regions.[33]

8% fewer non-union firms reported it was "very difficult" to find workers in 2023 compared to the year prior.



5% fewer union firms reported it was "very difficult" to find workers in 2023 compared to the year prior.

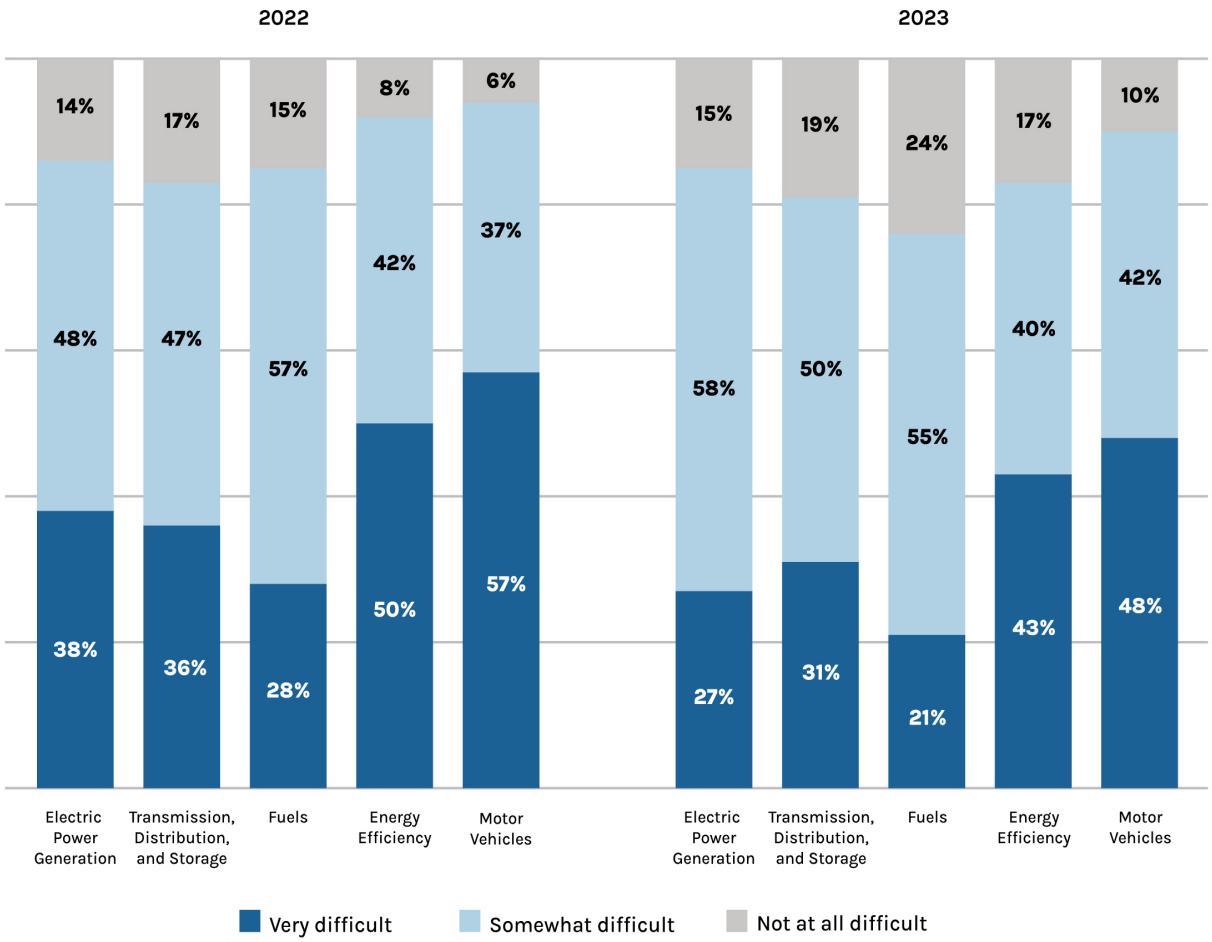


EMPLOYER PERSPECTIVE ON WORKFORCE ISSUES

When asked about their experience "finding qualified workers," 76% of employers across energy technologies reported at least "some difficulty," down from 85% in 2022. Motor vehicles (90%) and electric power generation (85%) employers reported the highest overall difficulty among all technologies. Just under half (48%) of all motor vehicles employers indicated that finding qualified workers was "very difficult" in 2023, down from 57% in 2022. Energy efficiency employers had the second largest share of employers responding that it was "very difficult" to find qualified workers at 43%, down from 50% in 2022. (See Figure 5)

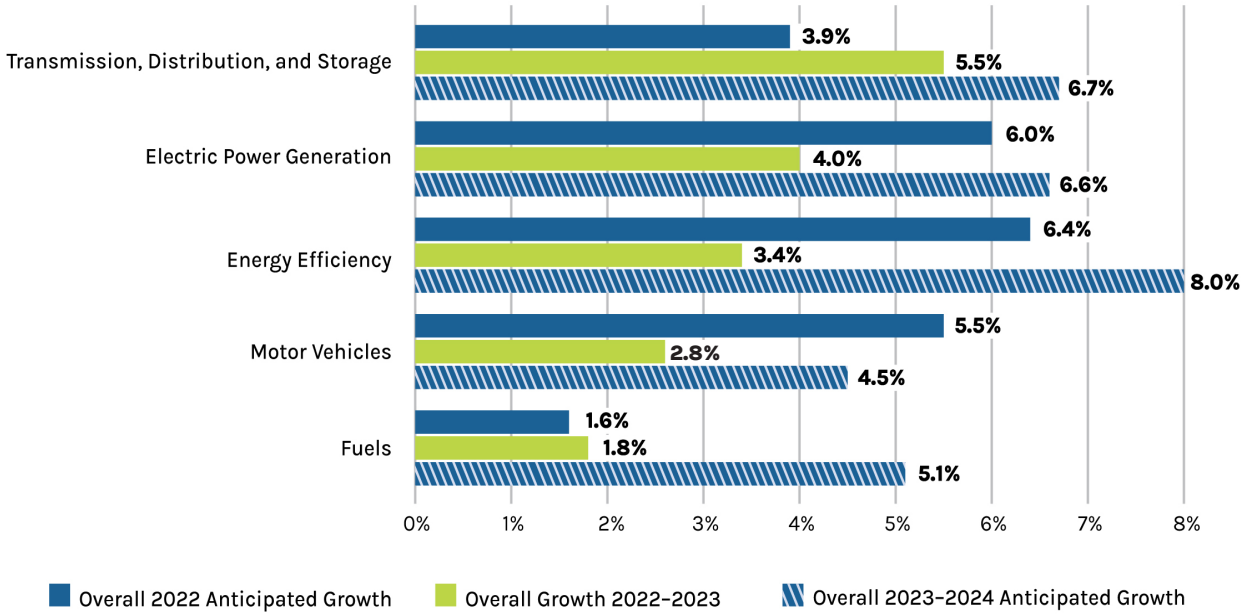
As discussed in a previous section, union employers experienced much lower difficulty finding workers in 2023 than non-union employers (24% of union employers versus 40% of non-union employers reported that hiring was "very difficult"). This difference was also present in the construction industry, where 32% of union construction employers reported that it was "very difficult" to find workers, compared to 47% of non-union employers.

Figure 5. Hiring Difficulty by Technology



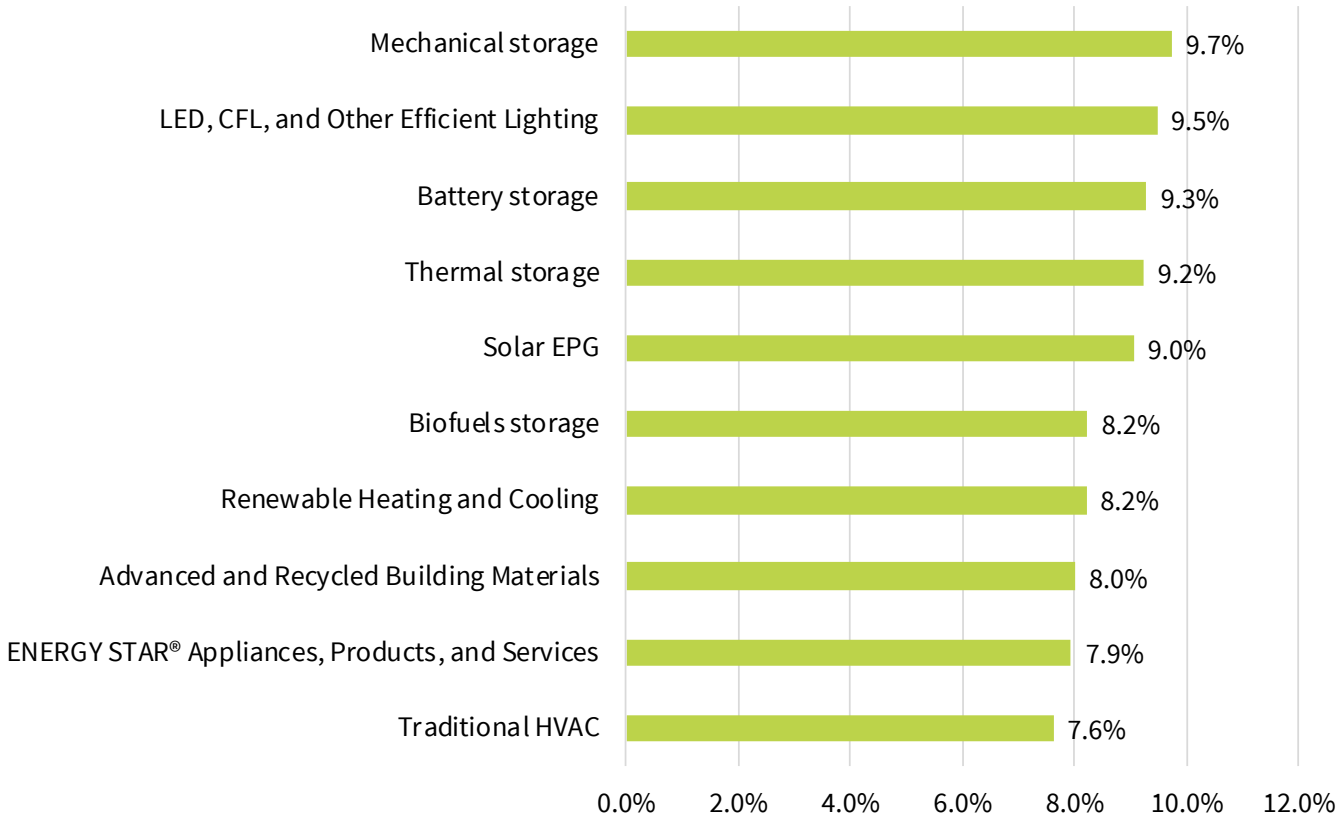
Despite this optimism, past surveys show that employers' expectations are unreliable indicators of the magnitude and direction of such changes. Figure 6 illustrates the actual employment change by technology from 2022 to 2023 compared to employer expectations from the 2022 USEER. Employment in transmission, distribution, and storage and fuels grew more than employer expectations from 2022, with an increase of 5.5% compared to an anticipated growth of 3.9% in transmission, distribution, and storage and 1.8% growth compared to expectations of 1.6% in fuels. Employment in electric power generation, energy efficiency, and motor vehicles grew more slowly than employers had expected from 2022-2023.

Figure 6. Anticipated Employment Change in 2022 and 2023 vs. Actual Employment Change 2022-2023



Surveyed companies in all energy technologies reported that they expect job growth from 2023 to 2024. Companies were asked to report anticipated hiring over the next 12 months, so growth rates are aggregated estimates by each technology area. Anticipated growth was led by energy efficiency (8.0% growth expected by employers), followed by transmission, distribution, and storage (6.7%), electric power generation (6.6%), fuels (5.1%), and motor vehicles (4.5%). Employers in all energy technologies expressed more optimism for future growth this year as compared to last. Figure 7 shows the technologies with the highest projected growth.

Figure 7. Highest Anticipated Growth by Detailed Technology, 2024[34]



CONCLUSION

In 2023, clean energy investments drove rapid job growth in the energy sector. Just under 5% of all new jobs in the U.S. were in clean energy. Employment in clean energy grew at twice the rate of the otherwise strong growth in the traditional energy sector as well as the overall economy. As jobs expanded, they also got better. The number of workers represented by unions increased, driven by increase utility and construction employment. Employment for military veterans and Latino or Hispanic workers also increased considerably. Latino or Hispanic workers held 1/3 of all new clean energy jobs. The expansion of energy sector employment wasn't only good for workers; it was also good for employers, who reported significantly less difficulty hiring qualified workers than the year prior.

Publication Number: DOE/OP-0020

[1] The USEER definition of clean energy is more narrow than most private sector definitions. For the purposes of this report, "clean energy" refers to net-zero emissions aligned technologies. This includes renewable energy, nuclear, non-fossil energy efficiency, zero emission vehicles, and carbon capture, utilization, and storage.

[2] Bureau of Labor Statistics (BLS) Current Employment Statistics (CES) December 2022 to December 2023 total employment grew 2.1%

[3] In USEER, a job is counted in the segment that accounts for the majority (more than 50%) of their qualifying energy-related work time for an energy sector employer, to avoid double counting of energy jobs. So if a worker is spending 60% of their time working in solar and 40% of their time working on EV charging infrastructure, that job would be considered in the solar technology area. If a worker spends 60% of their time on a non-energy technology, such as building data centers, and 40% of their time on energy efficiency, that job would be counted as an energy efficient job in USEER. If a worker performs energy-related work for an employer who is not classified as an energy employer, their job would not be counted — so for example, neither a city building code inspector nor a renewable energy procurement specialist working for a software technology would be counted in USEER.

[4] Bureau of Labor Statistics (BLS) Current Employment Statistics (CES) December 2022 to December 2023 total employment, not seasonally adjusted.

[5] Considering all 28,000 supply chain construction jobs as jobs in clean energy, 2023 saw a total of 8.63 million energy jobs, 44% of which are in clean energy. Counting the additional 28,000 construction jobs would mean that clean energy jobs increased by 170,000 in 2023.

[6] This figure is inclusive of light, medium, and heavy duty vehicles.

[7] "Other" vehicles, defined as any motor vehicle technology that is not captured in the categories listed previously or a category that is used when unable to split employment into a single motor vehicle category where employees spend "more of their time," was the only technology category to decrease in employment, losing 4,413 jobs.

[8] These data do not include battery manufacturing or EV charging, which are included in the Transmission, Distribution, and Storage section. Battery materials processing and manufacturing is not yet included in the USEER survey.

[9] Union coverage rates among energy workers from the USEER survey mirrored BLS reported statistics in relevant industries. See https://www.bls.gov/news.release/union2.t03.htm.

[10] For this analysis, a union employer is defined as one with at least 20% of its workforce as a member of a labor union or covered by either a project labor agreement or a collective bargaining agreement.

[11] Question was asked for each demographic group. Union employers were between 43%-150% more likely to have such programs or policies as non-union employers. These findings are consistent with research from other federal agencies in other sectors. See generally, U.S. Department of Treasury, "Labor Unions and the U.S. Economy," available at: https://home.treasury.gov/news/featured-stories/labor-unions-and-the-us-economy.

[12] Commodity flows (air, water, truck, and rail transport of fuels) dropped more than 16,000 jobs between 2022 and 2023, mostly in truck transportation of fuels. According to BLS QCEW, truck transportation (NAICS 484) lost more than 31,000 jobs between Q4 2022 and Q4 2023 economy-wide.

[13] A Guidebook to the Bipartisan Infrastructure Law | The White House

[14] Building a Clean Energy Economy: A Guidebook to the Inflation Reduction Act's Investments in Clean Energy and Climate Action | The White House, cleanenergy.gov

[15] Investing In America | The White House

[16] https://www.census.gov/econ/bfs/index.html

[17] https://apps.bea.gov/iTable/?reqid=19&step=3&isuri=1&1921=underlying&1903=2031

[18] Tracked by the U.S. Census Bureau and construction spending on manufacturing defined as all buildings and structures at manufacturing sites. Office buildings and warehouses owned by manufacturing companies but not constructed at a manufacturing site are classified as "office" and "commercial" respectively | U.S. Census Bureau

[19] Total Construction Spending: Manufacturing in the United States (TLMFGCONS) | FRED | St. Louis Fed (stlouisfed.org)

[20] Includes traditional natural gas generation and advanced natural gas generation (combined cycle, etc.)

[21] Total electric vehicle charging locations increased from 55,015 in December 2022 to 61,667 in December 2023, a growth rate of 12.1%. Source: U.S. Energy Information Administration (EIA), Monthly Energy Review, April 2024, Appendix F Table F1. Electric Vehicle Charging Infrastructure.

[22] Heat pumps are considered ENERGY STAR Appliances, Products, and Services rather than traditional HVAC.

[23] Motor vehicles include light, medium, and heavy duty vehicles, excluding the operations of those vehicles.

[24] This includes the addition of 2,086 jobs in wholesale trade and the loss of 16,382 jobs in commodity flows.

[25] This includes the addition of 9,811 jobs in wholesale trade and the loss of 5,489 jobs in commodity flows.

[26] This does not include pipeline construction. Pipeline construction falls under the NAICS 23712 code, which is construction.

[27] Includes companies and organizations in NAICS 51-56 supersectors. Sample for USEER includes R&D at universities, think tanks, and national labs (NREL, NETL, Oak Ridge, etc.).

[28] Other services includes repair and maintenance, business and industry associations, and other jobs associated with energy from the BLS NAICS 81 supersector.

[29] Depending on an employer's source of data, the demographic data (particularly for the race and ethnicity of workers) reported by employers could vary from the race and ethnicity individuals would report for themselves.

[30] For more information on diversity in the U.S. energy workforce, please see: https://www.naseo.org/data/sites/1/documents/publications/Workforce%20Diversity%20Data%20Findings%20MASTER%20Final42.pdf

[31] For more information about the definition of different demographics categories and how the questions are framed see Appendix B.

[32] For this analysis, a union employer is defined as one with at least 20% of its workforce as a member of a labor union or covered by either a project labor agreement or a collective bargaining agreement.

[33] See generally, U.S. Department of Labor, "Project Labor Agreement Resource Guide," available at: https://www.dol.gov/general/good-jobs/project-labor-agreement-resource-guide.

[34] Includes the 10 detailed technologies with the highest anticipated growth within the energy sector.

OVERVIEW

The U.S. energy system is rapidly transforming, driven by state and federal policies and investments that are reducing emissions while fostering innovative new technologies, supporting domestic manufacturing and production, and creating high-wage jobs all across America.

A robust suite of industrial policies, including the Bipartisan Infrastructure Law (BIL), the CHIPS and Science Act, and the Inflation Reduction Act (IRA), provides historic funding to expand opportunity for U.S. companies, supports American workers, and delivers benefits to communities that have often been overlooked and left behind.

The pace of change in the energy sector makes tracking energy employment more important than ever, but it also increases the complexity of the task. The diversity of energy industries across the United States creates significant challenges for economic modeling and traditional labor market data collection. While many of its segments, such as utility-scale power generation, fossil fuel extraction, and electric and gas transmission and distribution, are inarguably part of the energy sector, other activities (such as storage technologies and energy efficiency products and services) can be difficult to define and isolate from other sectors of the economy.

Given the complex relationship between energy and the overall economy, the 2024 U.S. Energy Employment Report (USEER) investigates, with a special supplemental survey, Traditional Energy sectors—Electric Power Generation; Fuels; and Transmission, Distribution, and Storage —followed by individual analyses of employment in two important energy end-use sectors—Energy Efficiency and Motor Vehicles. Additionally, for the first time, the 2024 USEER tracks employment related to the buildout of domestic energy supply chain manufacturing facilities, domestic energy supply chain warehouse and distribution facilities, and the construction of ports for energy projects (such as offshore wind). This employment is collected from construction firms in the U.S. that do not explicitly identify as energy firms (part of USEER energy definition) but that do conduct work for projects that will be utilized within the nation's energy supply chain.

Employment data collected by the U.S. Bureau of Labor Statistics (BLS) provide information on many, but not all, energy-related job categories. Most notably, BLS does not collect data on employment levels by energy technology across business segments. For instance, residential solar installation establishments are typically labeled as electrical contractors (together with all other traditional electrical businesses) without being identified specifically as solar companies.

Petroleum-engineering firms are included in engineering services, with civil, mechanical, and other engineers, while electric vehicle manufacturers are combined with gasoline and diesel-fueled vehicle manufacturing. As a result, BLS employment data does not capture the full scope of energy employment trends.[36]

The breadth of business activities within each of the analyzed sectors presents additional taxonomic challenges, as early-stage research and development, repair and maintenance, or professional and technical services vary across energy, energy efficiency, and manufacturing sectors. Natural gas business activities, for instance, differ from business activities relating to advanced building materials and solar photovoltaic (PV) materials.

In addition to these challenges, new investments in infrastructure and supply chain facilities present new opportunities and needs. While not historically included in this report, **new public and private investments in domestic energy supply chain infrastructure** are creating thousands of jobs connected to building out new manufacturing plants, warehousing facilities, ports, and other facilitating infrastructure to support **the American processing, making, and moving of energy related products and materials, such as batteries or the raw minerals that go into them**. Tracking this activity is critical in order to continue to make data-informed decisions on policy and investments in the enabling infrastructure.

. . . . .

The 2024 USEER relies on a comprehensive survey of approximately 42,100 business representatives across the United States, conducted by BW Research Partnership on behalf of the U.S. Department of Energy. The survey data are used to filter and analyze the concentration, intensity, and distribution of various energy technologies and activities throughout traditional industry sectors, using third-quarter 2023 employment data from the BLS Quarterly Census of Employment and Wages (QCEW) and the BLS Unemployment Situation Table B-1 monthly reports through December 2023. Due to the United Auto Workers (UAW) strike in September of 2023 and corresponding anomalies in BLS data, revised 2022 and 2023 Q3 BLS QCEW data is used for motor vehicle and motor vehicle component parts employment estimates.

USEER data also provides an additional layer of information to track sector-specific growth potential, obstacles, and opportunities. The data presented in the USEER are not intended to remove, replace, or replicate existing data from the BLS QCEW, but rather to reorganize categories and provide insight for policymakers and the public regarding trends in energy employment, energy production, and energy consumption across the United States.

For the USEER survey, a Qualifying Firm is—

> An organization with employees in the United States that is directly involved with researching, developing, producing, manufacturing, distributing, selling, implementing, installing, or repairing components, goods or services related to Electric Power Generation; Electric Power Transmission, Distribution, and Storage; Energy Efficiency, including Heating, Cooling and Building Envelope; Fuels, including Extraction, Processing, Production, and Distribution; and Transportation, including Motor Vehicles. This also includes supporting services such as consulting, finance, tax, and legal services related to energy, fuels, energy efficiency, or motor vehicles. To qualify for the base USEER survey, firms must explicitly state their involvement in energy as defined above. Firms in construction, that do not identify as energy firms, but work in building out projects that have energy end uses, or are part of the energy supply chain, qualify for the infrastructure survey, as explained below.

Qualifying Workers are —

> Employees of a qualifying firm that spend some portion of their time supporting the qualifying energy, energy-efficiency, or motor vehicle portion of the business.[37]

The 2024 USEER also includes employment data on construction firms that have been active over the previous 12 months building out domestic energy supply chain infrastructure projects that include manufacturing facilities for energy supply chain, warehouse and distribution facilities for energy supply chain, and ports for energy projects. This data has not been previously included in the USEER and required a supplemental survey effort.

For the USEER energy infrastructure construction survey, a Qualifying Firm is —

> A construction firm that does not meet the conditions to be classified as an "Energy" firm using the standard USEER qualification, but is involved in the building, construction, or retrofitting of energy supply chain manufacturing, assembling, or processing facilities; the building, construction, or retrofitting of warehouses and related logistical facilities for energy supply chain; and/or the building, construction, or retrofitting of ports and port related facilities with and end use related to energy.

Qualifying Workers for energy infrastructure are —

> Employees of a qualifying firm that spend some portion of their time supporting the qualifying building, construction, and/or retrofitting of energy infrastructure projects.

This report provides detail on levels of employment activity that include both "a portion of their time" and "a majority of their time" when referencing qualifying workers. This is especially true within the Energy Efficiency sector, where the employing construction or repair firms are frequently engaged in both traditional energy-related construction or installation as well as in high-efficiency activities that qualify for ENERGY STAR® designation.

Clean energy is defined as –

> Technologies that enable a transition to net zero emissions. This includes renewables, nuclear, non-fossil storage, non-fossil transmission and distribution, non-fossil energy efficiency, biofuels, and vehicles that do not require fossil fuel. This definition includes carbon capture, storage, and utilization (CCUS) technologies, but excludes efficiency related to the reduction, but not elimination of, fossil fuels such as high-efficiency gas furnaces or boilers. It also excludes more efficient vehicles, such as hybrid vehicles that are not plug-in hybrids that can operate without fossil fuels. Transmission and distribution of carbon free electricity is included in national clean energy employment data. State-level USEER data is not granular enough to separate transmission and distribution of clean energy, so Appendix A includes clean energy jobs with and without total transmission and distribution.

USEER METHODOLOGY

The 2024 USEER relies on a survey of 42,100 business representatives to analyze existing data from the BLS based on technology and value-chain definitions that reflect the activities of the DOE. The survey is conducted using a stratified sampling method (which relies on survey quotas based on specific characteristics of companies, to ensure representation). BW Research uses three characteristics in this sampling plan: (1) NAICS industry[38], (2) state location, and (3) company size.

Using the NAICS framework and building the sample frame using establishment totals from the QCEW allows for more accurate and efficient data collection and analysis. Further, it accommodates changes in business models. If a utility, for example, outsources a portion of its activities to a construction firm, USEER's methodology allows for those jobs to continue to be counted and tracked.

At the same time, employment is allocated based on NAICS industries only. In the utility-outsourcing example used above, the USEER would still count the jobs as energy employment but would allocate those jobs to construction rather than utilities. Because the supplemental survey captures employment across a wide range of activities and industries, the report includes more than a million jobs that would not otherwise be identified as part of the Traditional Energy sectors.

The USEER relies primarily on data from public sources as well as a comprehensive employer survey. As a result, there are some data limitations. The overall margin of error for identifying Qualifying Firms is +/- 0.47% at a 95% confidence interval[39]. The margin of error for the number of Qualifying Workers sector-wide is +/- 0.97% at a 95% confidence interval. Data included in this report represent an estimate with a range based on the specific margin of error. For more detail, please see Appendix B, Methodology.

[36] DOE, Quadrennial Energy Review: Energy Transmission, Storage, and Distribution Infrastructure, 8-7.

[37] Data presented in this report exclude retail employees. Qualifying Workers in energy will be referenced as energy-related jobs, where "portion of their time" includes employees whose activities are less than 50 percent of their time, specific reference will be made of that fact.

[38] The North American Industry Classification System (NAICS) is the standard used by Federal statistical agencies in classifying business establishments for the purposes of collecting, analyzing, and publishing statistical data related to the U.S. economy.

[39] For a number of detailed NAICS codes, data on establishments and employment are directly included in the total. Therefore, these margins represent an overstatement of potential error. It is also important to note that the margin of error increases for each subgroup of participants that participated in the survey. For example, the margin of error for questions answered by all firms that identified as "solar photovoltaic" is +/- 2.67% at a 95% confidence interval.

HOW TO USE THIS REPORT

The 2024 USEER is organized into seven chapters. The first three chapters—Electric Power Generation (EPG); Transmission, Distribution, and Storage (TDS); and Fuels—describe Traditional Energy jobs, from fuel extraction to processing, generation, transmission, and distribution. These chapters include fossil, nuclear, and renewable energy sources and their value chains. The next two chapters describe two sectors selected for their importance to energy demand: Energy Efficiency and Motor Vehicles. Finally, the report includes a chapter that addresses technologies that cut across multiple chapters, such as natural gas, which has employment in EPG, TDS, and Fuels, together with a chapter that profiles the jobs associated with the buildout of new and retrofitted infrastructure and facilities to support the growth of domestic energy supply chains.

Within each chapter of this report, data are reported across three distinct lenses: by technology, industry, and occupation. The first lens, technology, can be used to understand changes in specific products and services over time. Viewing employment through this lens can therefore illustrate relative changes in employment among different generation technologies, such as solar, wind, coal, natural gas, etc. These changes in employment can then be analyzed in the context of changes in the energy mix over the same period.

Viewing data through the second lens, industry, allows for deeper understanding of changes within the energy value chain and can be useful for developing industrial and economic policy for the sector. Viewing data through this lens depicts changes in economic sectors, such as construction, manufacturing, professional services, etc. These changes can be further analyzed and understood in the context of broad macroeconomic trends over the same period.

Finally, viewing the data through the third lens, occupation, allows for a deeper exploration of workforce availability and needs. Organizing data by occupation provides key detail on the types of opportunities that are growing and declining and can provide a framework for empirically driven workforce development. By filtering the same data through each lens, this report provides critical detail to a wide range of stakeholders.

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Electric Power Generation

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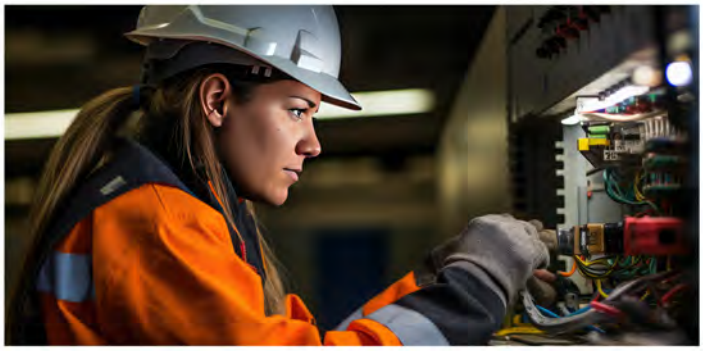


Electric Power Generation

The electricity sector accounts for 25% of U.S. greenhouse gas emissions.[1] According to the Energy Information Administration (EIA), "Economic growth paired with increasing electrification in end-use sectors results in stable growth in U.S. electric power demand through 2050… Declining capital costs for solar panels, wind turbines, and battery storage, as well as government subsidies such as those included in the Inflation Reduction Act (IRA), result in renewables becoming increasingly cost-effective compared with the alternatives when building new power capacity."[2] The IRA includes a comprehensive set of investments and tax incentives to advance zero carbon technology deployment, including increased tax credits for individuals and developers, new project financing mechanisms, support for American manufacturers, and direct purchases for federal properties and tribal lands.

Electric power generation (EPG) includes a wide variety of industries, activities, and technologies related to generating electricity, including the construction, maintenance, operation, and decommissioning of power plants (including renewable energy projects). EPG has changed dramatically over the past several decades, with marked declines in coal-fired generation and significant new capacity additions of combined cycle natural gas and renewable energy systems. The decarbonization of electricity generation is projected to continue through 2050,[3] suggesting that the employment trends evident in EPG (e.g., decreases in coal generation employment and increases in renewable energy employment) are likely to continue for the foreseeable future.

In addition to the construction, operation, and maintenance of utility and non-utility generation facilities and projects, EPG includes key manufacturers and other suppliers, as well as vendors providing professional and technical services. For example, the data in this chapter include information on employment not only at utilities and energy project developers, but also at U.S.-based original equipment manufacturers, component suppliers (largely Tier 1-4), and consultants and technical advisors.

TRENDS AND KEY TAKEAWAYS

- Employment in EPG grew by 35,588 jobs or 4.0% in 2023 — double the employment growth rate of the overall economy at 2.0% and higher than the 3.0% growth in EPG reported in 2022.

[1] Environmental Protection Agency, Inventory of U.S. Greenhouse Gas Emissions and Sinks, available at https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks
[2] U.S. Energy Information Administration, Annual Energy Outlook 2023, available at https://www.eia.gov/outlooks/aeo/narrative/index.php#TheElectricityMixinth
[3] Id at Figure 2.

- Clean energy technologies[4] accounted for nearly 79% of net new EPG jobs, adding 28,086 jobs and growing by 4.6%, more than double the rate of economy-wide employment growth in the U.S. from 2022 to 2023.
- Solar EPG added the most jobs of all EPG technologies (18,401 jobs, 5.3% growth), with nearly 57% of growth concentrated in construction (5,318 jobs) and utilities (5,142 jobs).
- Coal EPG was the only EPG technology in which employment declined, shedding 871 jobs or -1.4%.
- The largest sectoral employment gains in EPG were in the utilities industry, with 11,921 new jobs. Industries with more moderate job gains included professional and business services (8,917 jobs), construction (7,046 jobs), wholesale trade (3,849 jobs), other services (2,075 jobs), and manufacturing (1,779 jobs).
- The percentage of non-white workers in the EPG workforce (28%) was higher than the national average (24%). This is attributable to the higher proportion of Asian workers in the EPG workforce (9%) compared to the overall U.S. workforce (7%) and the higher proportion of workers of two or more races in the EPG workforce (5%) compared to the overall U.S. workforce (3%). The demographic data for these categories of workers were largely unchanged from 2022.[5]
- Employment of veterans in the EPG workforce grew by more than 4,400 jobs in 2023 (8% job growth) and continued to outpace veteran employment growth in the overall economy (5% job growth).
- The percentage of workers represented by a union or covered under a project labor or collective bargaining agreement in the EPG workforce (13%) grew by one percentage point (8,632 workers) over 2022 and remained higher than the energy sector average (11%) and significantly higher than the national private sector average (7%).[6]
- The percentage of formerly incarcerated workers in the EPG workforce (1%) was slightly lower than the national workforce average (2%).

[4] Clean energy technologies include those aligned with net zero emissions. For electric power generation, this includes all carbon free sources of electricity (e.g. wind, solar, geothermal, hydropower, nuclear, etc. as well as carbon capture and storage on traditional power plants. Net-zero emissions refers to achieving an overall balance between greenhouse gas emissions produced and greenhouse gas emissions prevented or taken out of the atmosphere.

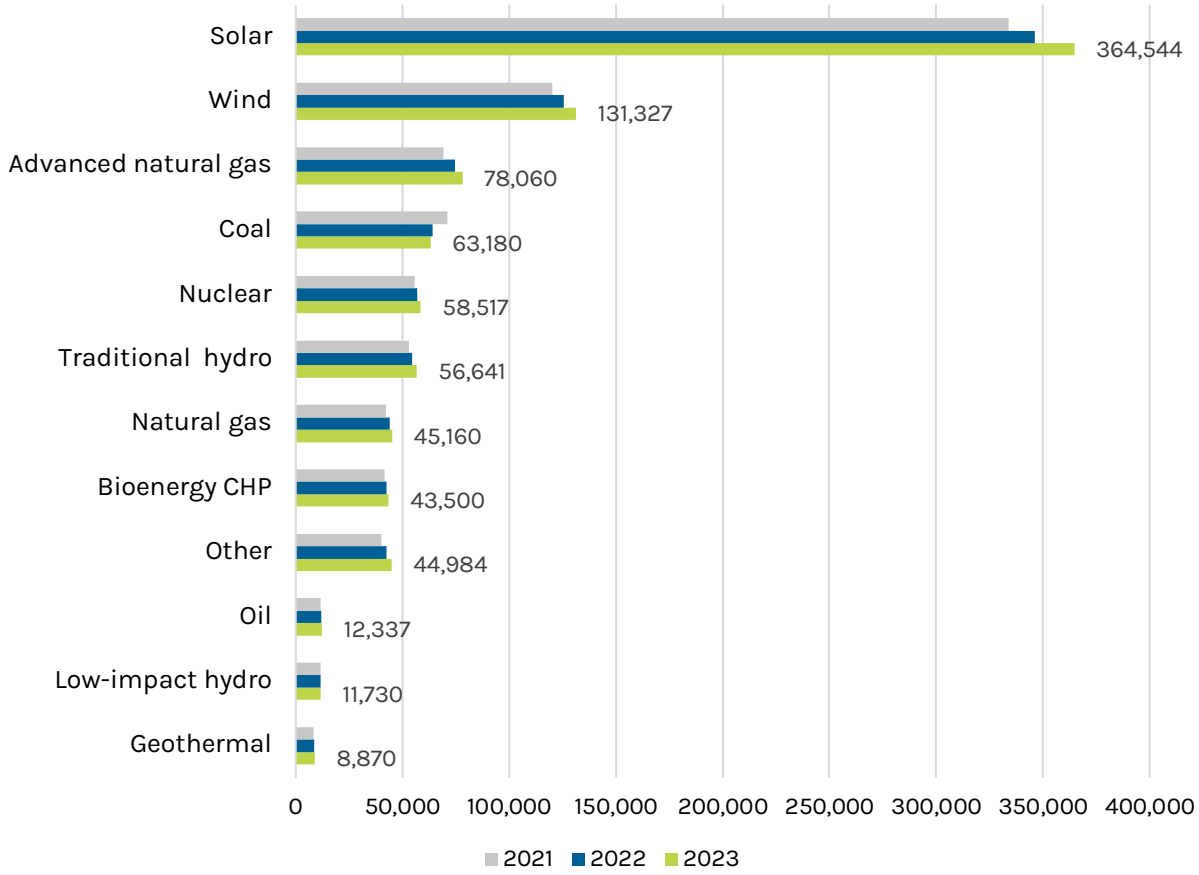
[5] It is important to note that employer-reported demographic data, particularly related to race and ethnicity, are likely to contain some level of respondent error. BW Research estimates employment demographics based on survey responses at the energy technology, detailed technology, and industry levels. These estimates are anchored by publicly available Bureau of Labor Statistics demographic data at the industry level (NAICS) and data from the U.S. Census Bureau.

[6] https://www.bls.gov/news.release/pdf/union2.pdf

EMPLOYMENT BY TECHNOLOGY AND INDUSTRY

In 2023, 918,850 workers were employed in EPG, representing a change of 4.0% from 2022 (Figure 1). As with the previous year, solar primarily drove these changes, increasing by 18,401 workers. Coal was the only technology with a decrease in employment, declining by 871 workers or -1.4%. In percentage terms, other generation[7] experienced the fastest growth at 5.7% (2,417 new jobs), followed by solar at 5.3% (18,401 new jobs), and advanced natural gas at 4.9% (3,647 new jobs).

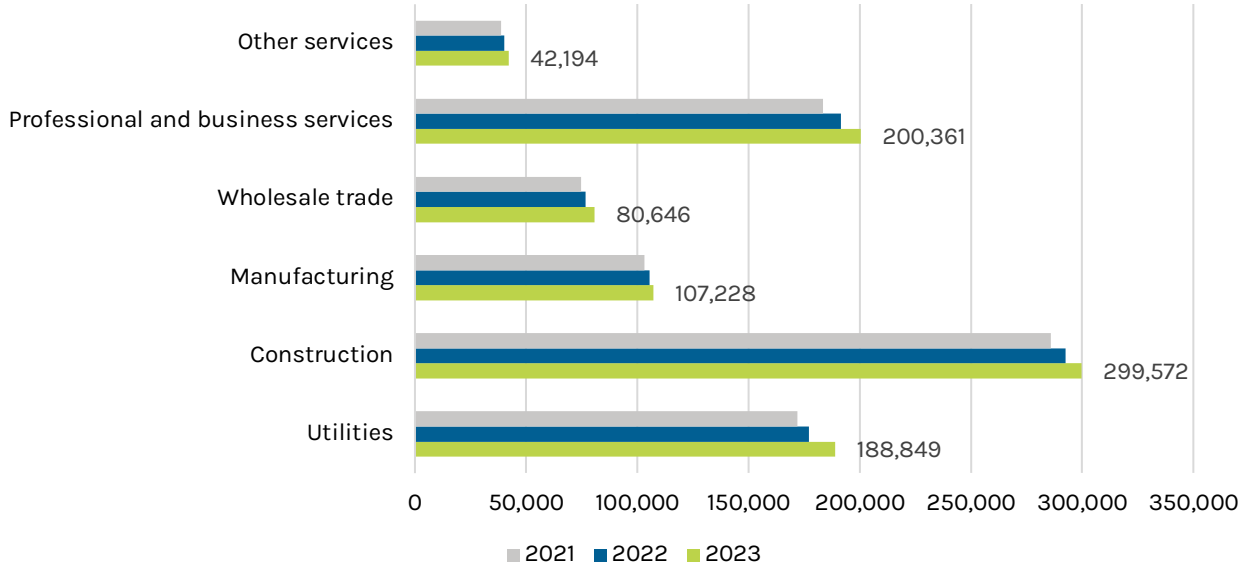
Figure 1. Electric Power Generation Employment by Technology



[7] Any generation that is not captured in other categories or a category that is used when unable to split employment into a single category where employees spend "more of their time". For definitions of EPG technologies, please see Appendix K.

The construction industry[8] employed the largest number of EPG workers, at 299,572.[9] EPG construction jobs grew 2.4% from 2022 to 2023 (Figure 2). The utilities industry experienced both the largest job growth in absolute terms (11,921 jobs) and in percentage terms (6.7%) within EPG.

Figure 2. Electric Power Generation Employment by Industry



[8] The construction industry is different from construction occupations. For example, solar installation may fall into the construction industry, even if the majority of workers are in non-construction occupations (administrative, management, etc.).
[9] As with data in the Quarterly Census of Employment and Wages from the Bureau of Labor Statistics, industry employment does not include unincorporated sole proprietors or workers whose wages are not reported to state and federal agencies (e.g., "under-the-table" or informal economy work).

Similar to previous years, technologies that have fewer operations and maintenance activities[10] had a higher concentration of workers in construction, while those with more operations and maintenance had a higher concentration of workers in utilities. Of all EPG technologies, geothermal had the highest concentration of jobs in construction, with 56% of all workers, followed by solar with 50% (Table 1), where the physical installation of solar arrays is considered construction activity and is conducted by electrical contractors, roofing contractors, other installation-oriented businesses. Nuclear EPG and advanced natural gas had the highest concentration of jobs in utilities, at 70% and 62%, respectively.

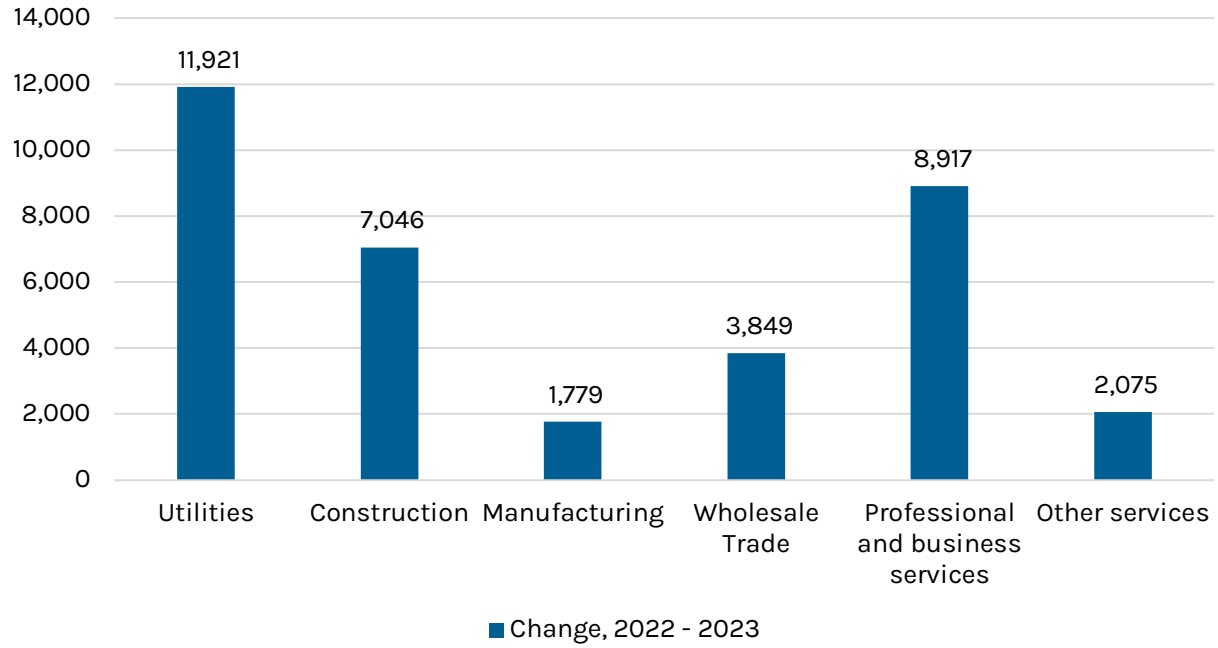
Table 1. Concentration of Electric Power Generation Employment by Technology and Industry

	Utilities	Construction	Manufacturing	Wholesale Trade	Professional and Business Services	Other Services
Solar	4%	50%	13%	8%	16%	10%
Land-based Wind	8%	35%	18%	11%	27%	2%
Offshore Wind	0%	33%	15%	1%	48%	3%
Geothermal	14%	56%	3%	5%	21%	0%
Bioenergy	18%	43%	8%	5%	22%	3%
Low-impact Hydro	0%	15%	27%	22%	36%	1%
Traditional Hydro	35%	15%	23%	11%	16%	0%
Advanced Natural Gas	62%	12%	3%	7%	15%	1%
Nuclear	70%	4%	3%	4%	18%	0%
Coal	41%	10%	2%	9%	37%	1%
Oil	4%	0%	43%	17%	35%	1%
Natural Gas	41%	23%	8%	8%	18%	2%
Combined Heat and Power (CHP)	5%	14%	6%	13%	61%	1%

[10] Operations and maintenance activities are spread across industries, but are most often located in utility generation, as part of developer activity in professional and business services, and in repair and maintenance embedded in other services.

Utilities businesses added the largest amount of EPG jobs from 2022 to 2023, creating 11,921 positions (Figure 3). This surpassed professional and business services[11] businesses, which added 8,917 jobs over the same time period. There were no job declines in any industry across EPG.

Figure 3. Electric Power Generation Employment Changes by Industry, 2022-2023



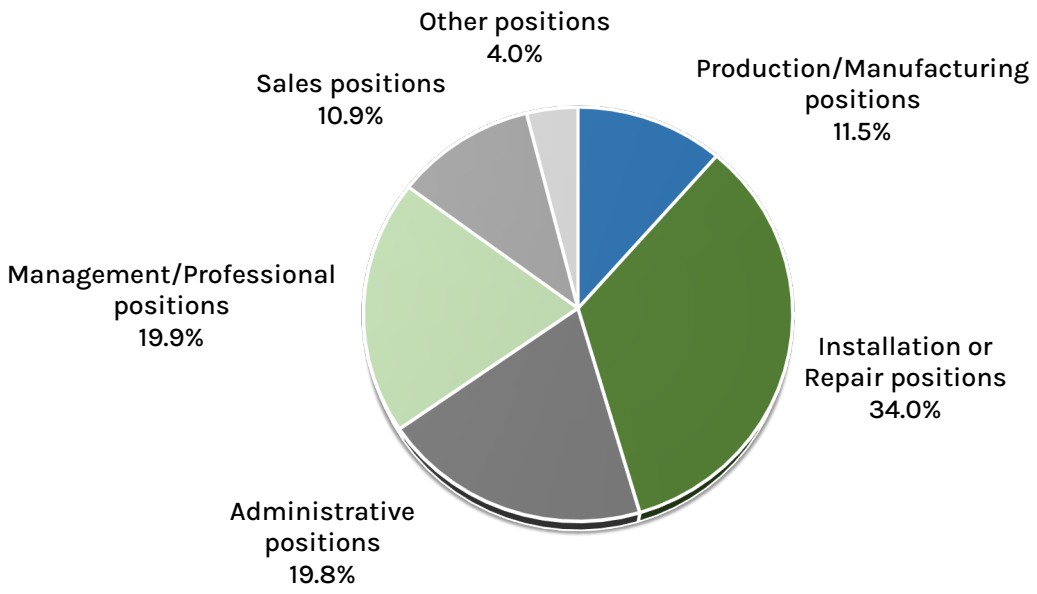
[11] Examples of job titles include computer software engineers, researchers, accountants, and lawyers.

EMPLOYMENT BY TECHNOLOGY AND OCCUPATION

Workers with the same occupation can work in different industries. For example, the construction industry includes many installation or repair occupations, but utilities and other industries also employ people in these occupations. For this reason, different trends appear if parsing the data by industry or occupation, and it can be useful to show energy employment data and trends by both.

In terms of distribution of jobs by occupation across all industries, the largest occupational category of workers within EPG was installation or repair positions, comprising 34% of EPG workers (Figure 4). This is a slight increase from 2022, when installation or repair positions accounted for 32% of the total. This was followed by management and professional positions (20%) and administrative positions (20%), each of which constituted approximately a fifth of all occupations within EPG.

Figure 4. Worker Occupations in Electric Power Generation



EMPLOYER PERSPECTIVE ON WORKFORCE ISSUES

Current Hiring Difficulty

Within EPG industries, the utilities industry had the greatest difficulty hiring workers, with the construction industry as a close second. (Figure 5). About 90% of EPG utilities employers reported finding qualified workers was "very difficult" or "somewhat difficult," with 23% claiming it was "very difficult." EPG construction businesses also reported high hiring difficulty (87%) and a high rate of "very difficult" hiring (34%), although those reporting the highest level of difficulty (i.e., "very difficult") dropped considerably from 2022 to 2023 (51% vs 34%, respectively). Union[12] construction businesses were significantly less likely to indicate hiring was "very difficult" (9%) when compared to non-union identified construction businesses (35%).

Figure 5. Electric Power Generation Employers' Perceived Hiring Difficulty by Industry

[12] A union firm is defined as a firm with 20% or more workers represented by a union or covered under a project labor or collective bargaining agreement.

Employers cited lack of experience, training, or technical skills as the most common reason for reported hiring difficulties in the construction, wholesale trade, and other services industries within EPG (Table 2). Within clean energy technologies, lack of experience, training, or technical skills is the most common reason for hiring difficulty in utilities, construction, and other services.

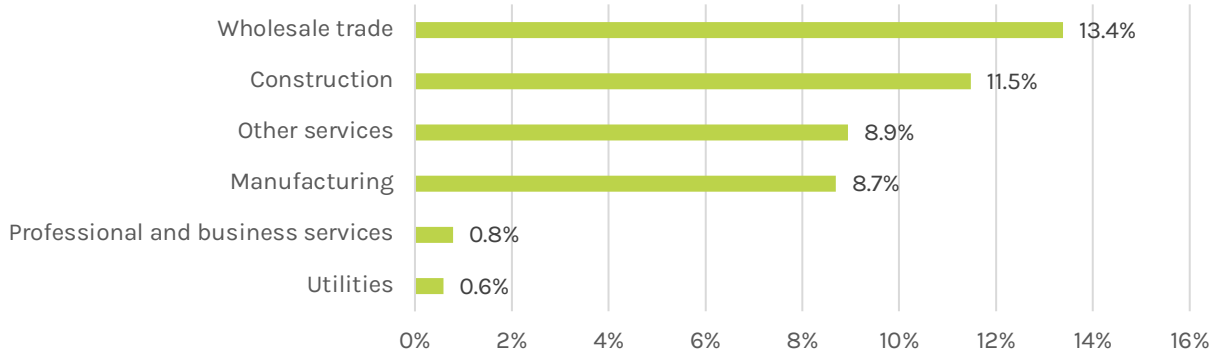
Table 2. Electric Power Generation Employer Reasons for Hiring Difficulty

Industry	Most Common Reason	Second Most Common Reason	Third Most Common Reason
Utilities	Insufficient non-technical skills (work ethic, dependability, critical thinking) (38%)	Lack of experience, training, or technical skills (25%)	Location (25%)
Construction	Lack of experience, training, or technical skills (36%)	Insufficient qualifications (certifications or education) (26%)	Difficulty finding industry-specific knowledge, skills, and interest (25%)
Manufacturing	Difficulty finding industry-specific knowledge, skills, and interest (27%)	Lack of experience, training, or technical skills (24%)	Insufficient qualifications (certifications or education) (24%)
Wholesale Trade	Lack of experience, training, or technical skills (38%)	Insufficient qualifications (certifications or education) (35%)	Difficulty finding industry-specific knowledge, skills, and interest (27%)
Professional and Business Services	Insufficient qualifications (certifications or education) (25%)	Difficulty finding industry-specific knowledge, skills, and interest (25%)	Competition/ small applicant pool (25%)
Other Services	Lack of experience, training, or technical skills (44%)	Cannot provide competitive wages (32%)	Competition/ small applicant pool (31%)

Employment Change by Industry

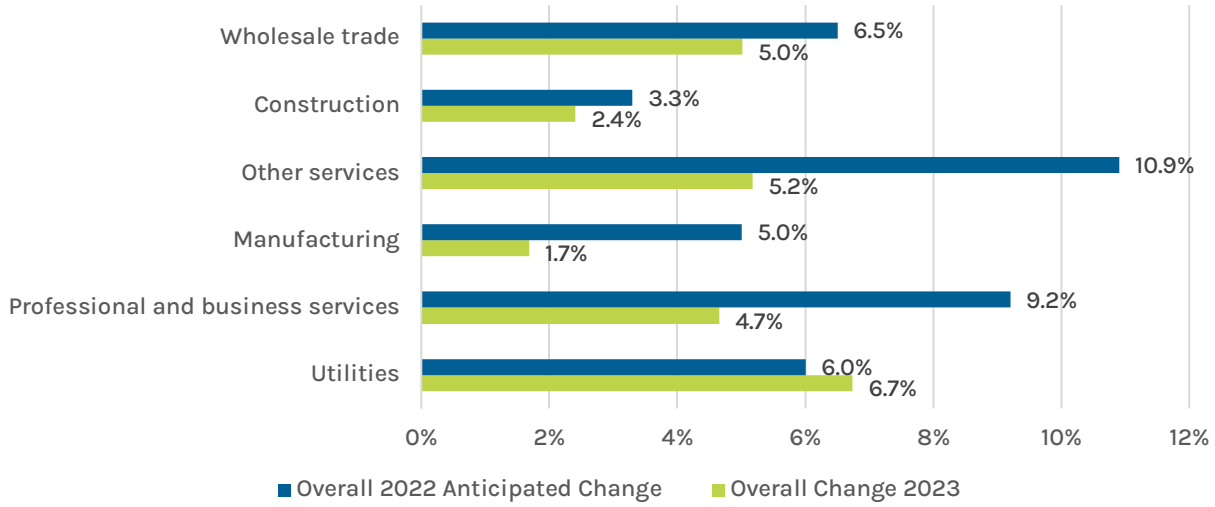
The previous section highlighted employers' current hiring difficulty across industry, whereas this section focuses on employers' anticipated employment change by industry. This section also compares employment change in 2022 to the actual employment change over the last year. Employers in all six industries within EPG anticipate growth in 2023, ranging from 0.6% in utilities to 13.4% in wholesale trade (Figure 6).

Figure 6. Electric Power Generation Employers' Anticipated Employment Changes, 2024



According to the 2023 USEER, employers across all industry classifications in EPG expected growth from 2022 to 2023, ranging from 3.3% anticipated growth reported by construction businesses, to 10.9% anticipated growth for businesses in "other services."[13] Overall, all industries within EPG registered growth, ranging from 1.7% in manufacturing to 6.7% in utilities (Figure 7). Figure 7 includes anticipated growth from the 2023 USEER (blue bars) as well as the actual employment change as published in the 2024 USEER (green bars). The chart illustrates that across nearly all categories (except utilities), employers' expectations for growth were much higher than actual growth.

Figure 7. Electric Power Generation Actual Employment Change 2022-2023 vs. Anticipated Employment Change 2022



[13] Includes relevant NAICS categories within NAICS 81.

Electric Power Generation Workforce Demographics

Demographics for the EPG workforce are displayed in Table 3. Female workers made up a higher proportion of the workforce in EPG (31%) than in the overall energy workforce (26%) but fell short of the overall U.S. workforce average (47%). Male workers made up a lower proportion of the EPG workforce (69%) compared to the energy workforce average (73%) but accounted for a larger share of the workforce as compared to the national workforce average (53%). EPG employers reported fewer than 1% of their employees as gender nonbinary.[14]

The proportion of non-white workers in the EPG workforce (28%) was higher than the overall energy workforce average (26%) and the national workforce average (24%).

The proportion of formerly incarcerated EPG workers in the EPG workforce (1%) was on par with the overall energy workforce (1%) but lower than the national workforce average (2%). The proportion of EPG workers requesting accommodations for disabilities in the EPG workforce (2%) was similar to the overall energy workforce average (2%), but lower than the national average (5%).

The proportion of EPG workers aged 55 or older (16%) was lower than the national average (23%). Workers aged 18 to 29 were more concentrated in EPG (29%) than in the national workforce (22%). Similarly, workers aged 30 to 54 were more concentrated in EPG (55%) than in the national workforce (53%). The percentage of veterans in the EPG workforce (8%) was slightly lower than the overall energy workforce average (9%), but higher than the national average (5%).

The concentration of EPG workers represented by a union or covered under a project labor or collective bargaining agreement (13%) increased by one percentage point (16,648 workers) when compared to 2022 and was slightly higher than the overall energy workforce average (11%) and double the national private sector average (7%).

[14] As with all demographic data in this report, there is a potential for reporting errors and biases. For gender specifically, it is important to note that the U.S. Census only collects data on biological "sex" and not "gender;" thus, reporting on gender nonbinary employment should be interpreted with caution.

Table 3. Electric Power Generation Demographics and Characteristics

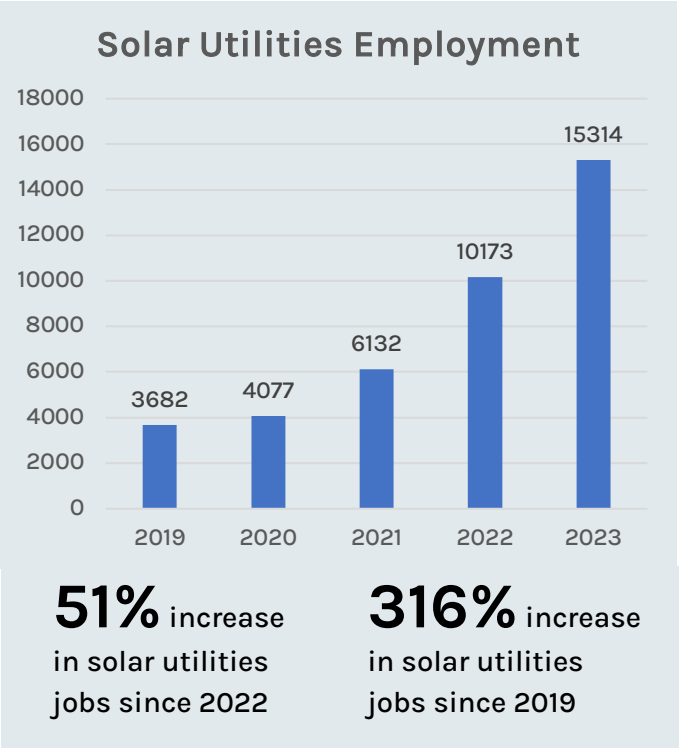
	Number of Workers	Electric Power Generation Average	Energy Workforce Average	National Workforce Average
Male	629,737	69%	73%	53%
Female	284,014	31%	26%	47%
Gender Nonbinary	5,099	<1%	<1%	n/a
Hispanic or Latino	186,835	20%	18%	19%
Not Hispanic or Latino	732,016	80%	82%	81%
American Indian or Alaska Native	14,390	2%	2%	1%
Asian	84,378	9%	7%	7%
Black or African American	82,543	9%	9%	13%
Native Hawaiian or Other Pacific Islander	12,121	1%	1%	<1%
White	658,792	72%	74%	76%
Two or More Races	47,213	5%	5%	3%
Unknown Race	19,597	2%	2%	n/a
Veterans	77,014	8%	9%	5%
18 to 29	263,068	29%	29%	22%
30 to 54	509,027	55%	52%	53%
55 and Over	146,755	16%	18%	23%
Disability	18,532	2%	2%	5%
Formerly Incarcerated	13,027	1%	1%	2%
Represented by Unions, Collective Bargaining Agreements, and/or Project Labor Agreements	126,412	13%[15]	11%	7%

National sources: BLS (2023a, 2023b, 2023c, 2023d), Jobs EQ (2023), Prison Policy (2018)

[15] Unionization rates vary by state.

Solar Electric Power Generation

Solar energy businesses, which include the value chain of activities from research and development through installation, operations, and maintenance for both photovoltaics and concentrating solar power, employed 364,544 workers part-time or full-time in 2023, up 18,401 (5.3%) from 2022.[16]



Trends and Key Takeaways

- Solar EPG's largest job gains were in the construction industry, with 5,318 new jobs (3%), and the utilities industry, which added 5,142 new jobs (50.5%).[17] Professional and business services (2,873 jobs, or 5.3%), wholesale trade (2,066 jobs, or 7.3%), other services (1,895 jobs, or 5.7%), and manufacturing (1,107 jobs, or 2.5%) all added jobs as well.
- Solar EPG employers in all six industries expect employment growth in 2024.
- The percentage of workers represented by a union or covered under a project labor or collective bargaining agreement in the solar EPG workforce (14%) was higher than the overall energy workforce average (11%) and the national private sector average (7%).[18]
- The number of workers represented by a union or covered under a project labor or collective bargaining agreement in the solar EPG workforce increased by more than 5,000 from 2022 to 2023.
- Female workers in the solar EPG workforce (30%) were more highly represented than in the overall energy workforce (26%) but were much less represented than in the national workforce (47%).
- Hispanic or Latino workers in the solar EPG workforce (23%) were more highly represented than in the overall energy workforce (19%) and the national workforce (18%).

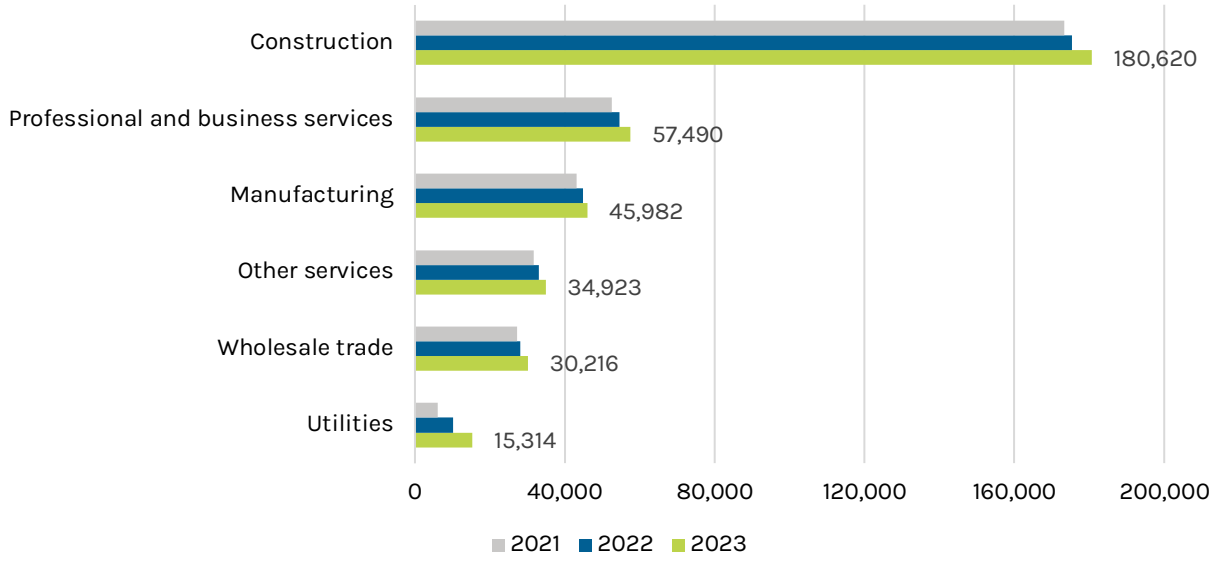
[16] In 2023, 276,136 solar workers spent 50% or more of their time on solar, a growth rate of 5.5% since 2022.
[17] In the EIA Annual Energy Outlook, which projects the effects of the IRA, s IRA provisions increase wind and solar generation from baseline growth of 15% to 39% to IRA-induced growth of 41% and 59% by 2050. Source: Annual Energy Outlook 2023, U.S. Energy Information Administration (EIA).
[18] Unionization rates vary by state.

- Non-white workers in the solar EPG workforce (27%) were more highly represented than in the overall energy workforce (26%) and the national workforce (24%).
- Black or African American workers in the solar EPG workforce (8%) were less represented than in the overall energy workforce (9%) and the national workforce (13%).
- Veterans in solar EPG jobs (8%) were less represented than in the overall energy workforce (9%) but were more represented than in the national workforce (5%).
- Workers requesting accommodations for disabilities in solar EPG jobs (2%) were less represented than in the national workforce (4%).
- Formerly incarcerated workers in the solar EPG workforce (1%) were less represented than in the national workforce (2%).

Employment by Industry

The largest number of solar EPG workers were employed in the construction industry, with 180,620 workers (Figure 8). Construction employers also reported the largest number of new jobs, adding 5,318 jobs (3% growth). In percentage terms, utilities grew the fastest, adding 5,142 jobs, representing 50.5% growth in 2023. Manufacturing employment grew by approximately 1,107 workers from 2022 to 2023 (2.5%) and is poised for more growth, as 45 solar manufacturing facilities are currently under construction in the United States (including one polysilicon facility, one ingot/wafer/cell facility, four cell facilities, and 15 module facilities) and an additional 61 have been announced (including one polysilicon facility, four ingot facilities, six wafer facilities, 14 cell facilities, and 23 module facilities).[19]

Figure 8. Solar EPG Employment by Industry



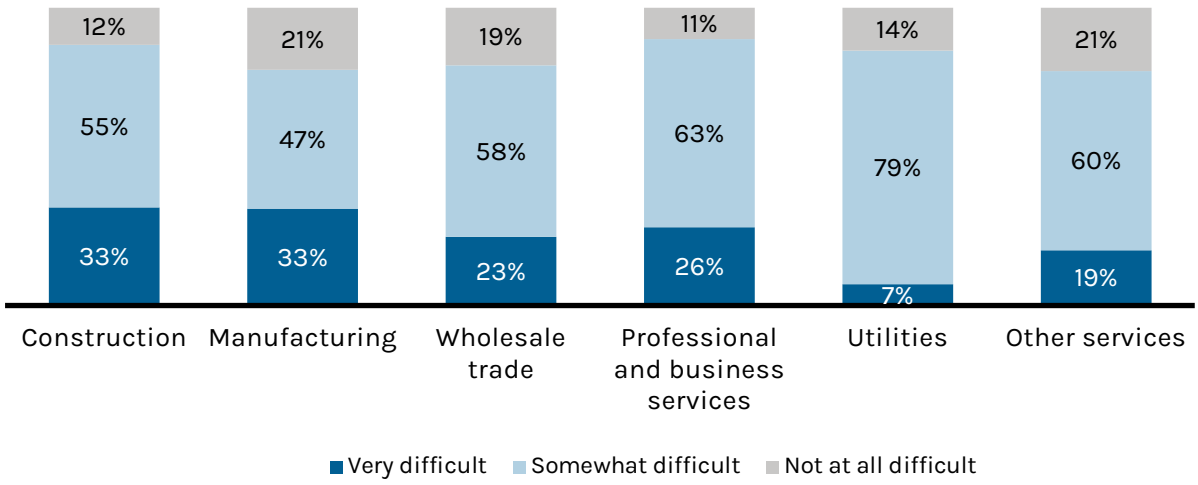
[19] Solar Energy Industries Association (SEIA), 2024

Employer Perspective on Workforce Issues

Current Hiring Difficulty

Among respondents employing solar energy workers[20], professional and business services and construction companies reported the greatest difficulty hiring workers (Figure 9). Although, both professional and business services (26% vs. 34%) and construction (33% vs. 51%) businesses reported lower instances of hiring being "very difficult" when compared to 2022. Eighty-nine percent of professional and business services employers reported difficulty finding qualified solar workers (with 26% reporting hiring as "very difficult"), while 88% of construction businesses indicated hiring difficulty (33% reporting that hiring was "very difficult"). Manufacturing and other services businesses reported the least difficulty hiring, with 21% of employers in each industry stating that it was "not at all difficult."

Figure 9. Solar EPG Employers' Perceived Hiring Difficulty by Industry



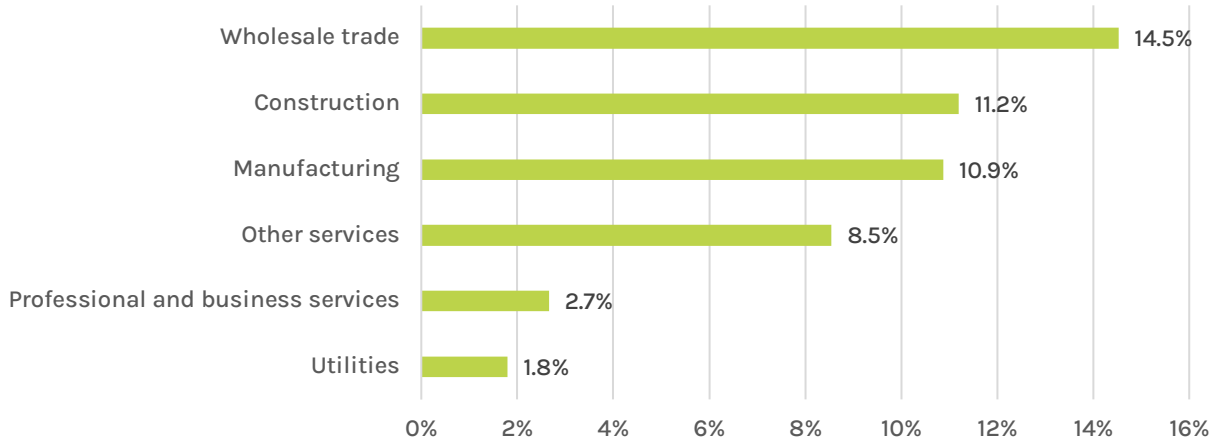
Employment Change by Industry

The previous section highlighted employers' current hiring difficulty across industry, whereas this section focuses on anticipated employment change by industry within solar EPG. This section also compares anticipated employment change in 2022 to the actual employment change over the last year.

As shown in Figure 10, all industries expect growth in solar EPG employment in 2024: wholesale trade employers predict the highest levels of job growth (14.5%), followed by construction (11.2%), manufacturing (10.9%), other services (8.5%), professional and business services (2.7%), and utilities (1.8%).

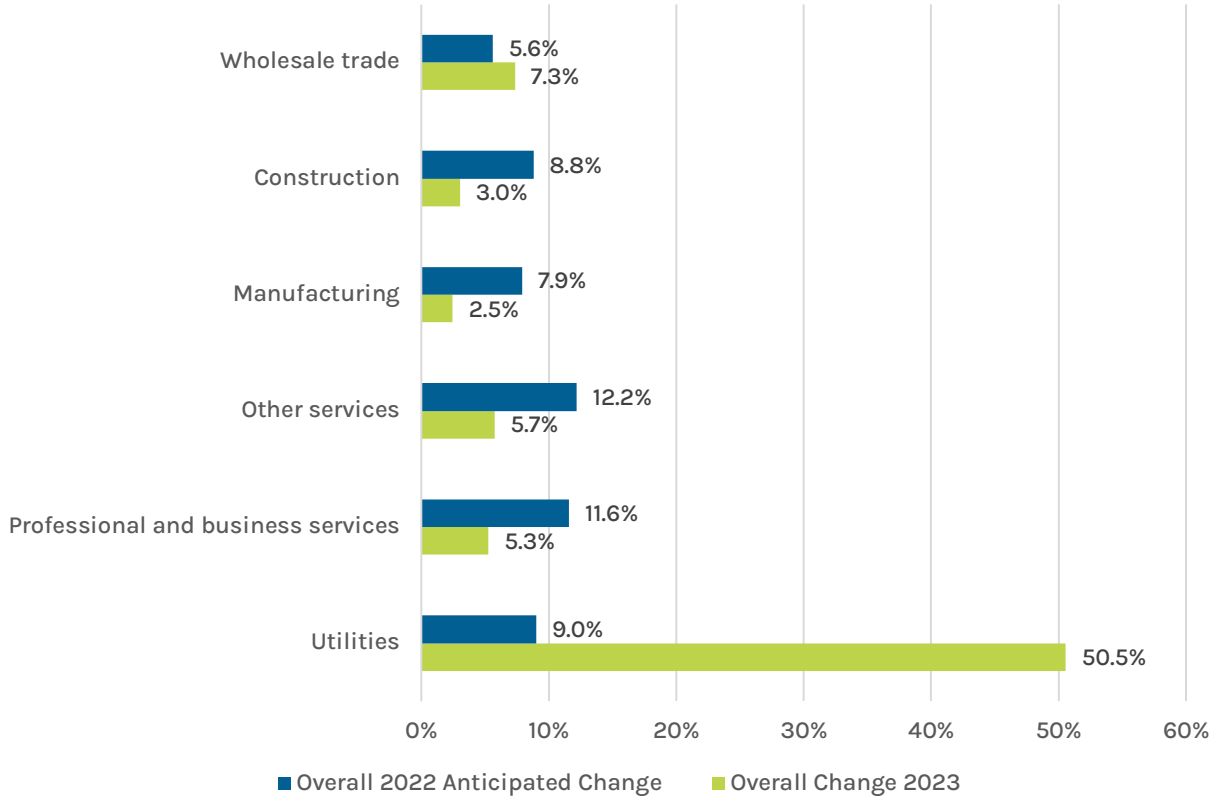
[20] Respondents had to have hired workers from 2022 to 2023 and completed enough of the survey to be asked the hiring difficulty question.

Figure 10. Anticipated 2024 Changes in Solar EPG Employment



All industries within solar EPG grew between 2022 and 2023. Utilities grew more than five times faster than the rate anticipated by employers in 2022 (Figure 11).

Figure 11. Solar EPG Actual Employment Change 2022-2023 vs. Anticipated Employment Change 2022



Solar EPG Workforce Demographics

Demographics for the solar EPG workforce are displayed in Table 4. Males made up 70% of the solar EPG workforce, lower than the energy workforce average (73%) but higher than the national workforce average (53%).

The proportion of Hispanic or Latino workers working in solar EPG (23%) was higher than the energy workforce average (18%) and the national workforce average (19%). The proportion of non-white workers in solar EPG jobs (27%) was also higher than the energy workforce average (26%) and the national workforce average (24%), which can partially be attributed to a higher representation of Asian workers in the solar EPG workforce (9%) than in the overall energy workforce (7%) and the national workforce (7%).

The concentration of veterans in the solar EPG workforce (8%) was lower than the energy workforce average (9%) but higher than the overall U.S. workforce average (5%). Workers aged 55 or older in the solar EPG workforce (14%) were less represented than in the overall energy workforce (18%) and the national workforce (24%). Workers under age 30 were more represented in the solar EPG workforce (31%) than in the overall energy workforce (29%) and the national workforce (22%). Similarly, workers between the ages of 30 and 54 were more represented in the solar EPG workforce (55%) as compared to the overall energy workforce (52%) and the national workforce (53%).

The proportion of formerly incarcerated workers in the solar EPG workforce (1%) was the same as the energy workforce average (1%) but lower than the national workforce average (2%). The proportion of workers represented by a union or covered under a project labor or collective bargaining agreement in the solar EPG workforce (11%) was similar to the overall energy workforce (11%) and higher than the national private sector average (7%).

Table 4. Solar EPG Workforce Demographics and Characteristics

	Number of Workers	Solar EPG Average	Energy Workforce Average	National Workforce Average
Male	254,635	70%	73%	53%
Female	108,189	30%	26%	47%
Gender Nonbinary	1,720	<1%	<1%	n/a
Hispanic or Latino	82,462	23%	18%	19%
Not Hispanic or Latino	282,083	77%	82%	82%
American Indian or Alaska Native	4,938	1%	2%	1%
Asian	31,620	9%	7%	7%
Black or African American	29,401	8%	9%	13%
Native Hawaiian or Other Pacific Islander	5,072	1%	1%	<1%
White	267,436	73%	74%	77%
Two or More Races	18,499	5%	5%	3%
Unknown Race	7,652	2%	2%	n/a
Veterans	30,124	8%	9%	5%
18 to 29	112,265	31%	29%	22%
30 to 54	200,533	55%	52%	54%
55 and Over	51,746	14%	18%	24%
Disability	6,085	2%	2%	4%
Formerly Incarcerated	1,617	1%	1%	2%
Represented by Unions, Collective Bargaining Agreements, and/or Project Labor Agreements	41,563	11%[21]	11%	7%

National sources: BLS (2023a, 2023b, 2023c, 2023d), Jobs EQ (2023), Prison Policy (2018)

[21] Unionization rates vary by state.

Wind Electric Power Generation

Wind EPG businesses employed 131,327 workers in 2023, an increase of 5,715 positions (4.6%). Most wind workers in the U.S. — 130,239 — were employed in land-based wind, and the remaining 1,088 were employed in offshore wind.

Trends and Key Takeaways

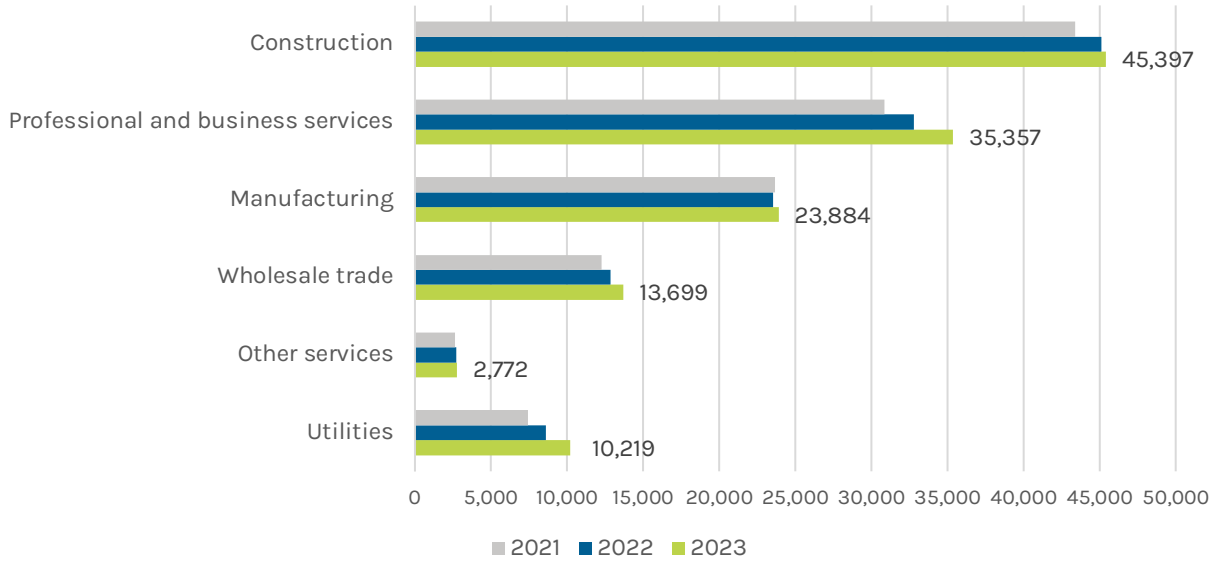
- Wind EPG employment continued to grow, with 5,715 new jobs in 2023.
- The largest job gains in wind EPG from 2022 to 2023 were in the professional and business services industry, with 2,578 new jobs (7.9%), followed by utilities (1,609 jobs), wholesale trade (839 jobs), manufacturing (341 jobs), construction (309 jobs), and other services (71 jobs).
- Wind EPG employers in three out of six industries (wholesale trade, construction, and other services) anticipate employment growth greater than 7% in 2024.
- Wind EPG's male workforce (69%) was lower than the energy workforce average (73%) but higher than the national workforce average (53%).
- Non-white workers constituted 29% of the wind EPG workforce as compared to 26% of the overall energy workforce and 24% of the national workforce. This is attributable to higher proportions of Asian workers (which constituted 9% of the wind EPG workforce as compared to 7% of the national and energy workforces), and workers of two or more races (which constituted 6% of the wind EPG workforce as compared to 5% of the energy workforce and 3% of the national workforce).
- The percentage of American Indian and Alaska Native workers in the wind EPG workforce (1%) was lower than the energy workforce average (2%) but similar to the national workforce average (1%).
- The proportion of Black or African American workers in the wind EPG workforce (8%) was lower than the energy workforce average (9%) and the economy-wide average (13%).
- The percentage of veterans in the wind EPG workforce (9%) was equivalent to the energy workforce average (9%) and higher than the U.S. workforce average (5%).
- The percentage of workers represented by a union or covered under a project labor or collective bargaining agreement in the wind EPG workforce (12%) was higher than both the energy workforce average (11%) and the national private sector workforce average (7%).
- Workers requesting accommodations for disabilities in the wind EPG workforce (2%) were represented at a similar rate as in the overall energy workforce (2%) but at a lower rate than in the overall national workforce (5%).

- The percentage of formerly incarcerated workers in the wind EPG workforce (2%) was higher than the energy workforce average (1%) but in line with the national workforce average (2%).

Employment by Industry

The construction industry accounted for the largest number of wind EPG employees, with 45,397 workers — up 309 from 2022 (Figure 12). The professional and business services industry reported the largest number of new jobs, at 2,578, translating to 7.9% growth from 2022 to 2023.

Figure 12. Wind EPG Employment

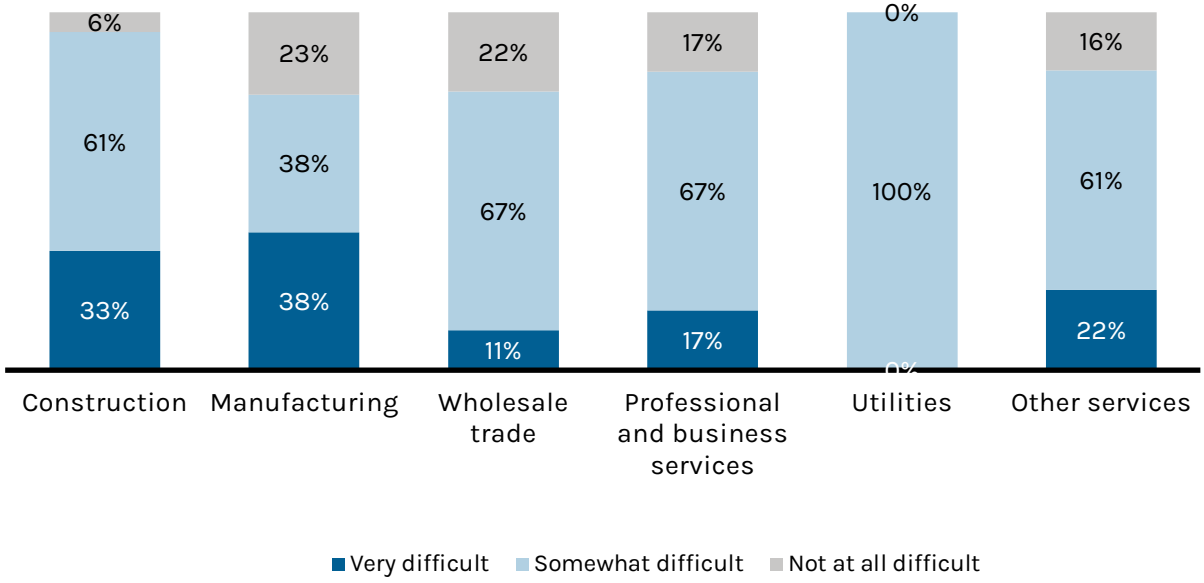


Employer Perspective on Workforce Issues

Current Hiring Difficulty

Within wind EPG, construction industry employers reported significant difficulty hiring workers (Figure 13). Ninety-four percent of construction employers reported at least some difficulty finding qualified workers, with 33% claiming it was "very difficult."[22] Manufacturing and wholesale trade had the lowest difficulty, with 23% and 22% (respectively) of employers reporting hiring to be "not at all difficult." However, manufacturing industry employers also reported the highest rate of "very difficult" hiring, suggesting a wide range of experiences across manufacturing businesses.

Figure 13. Wind EPG Employers' Perceived Hiring Difficulty by Industry



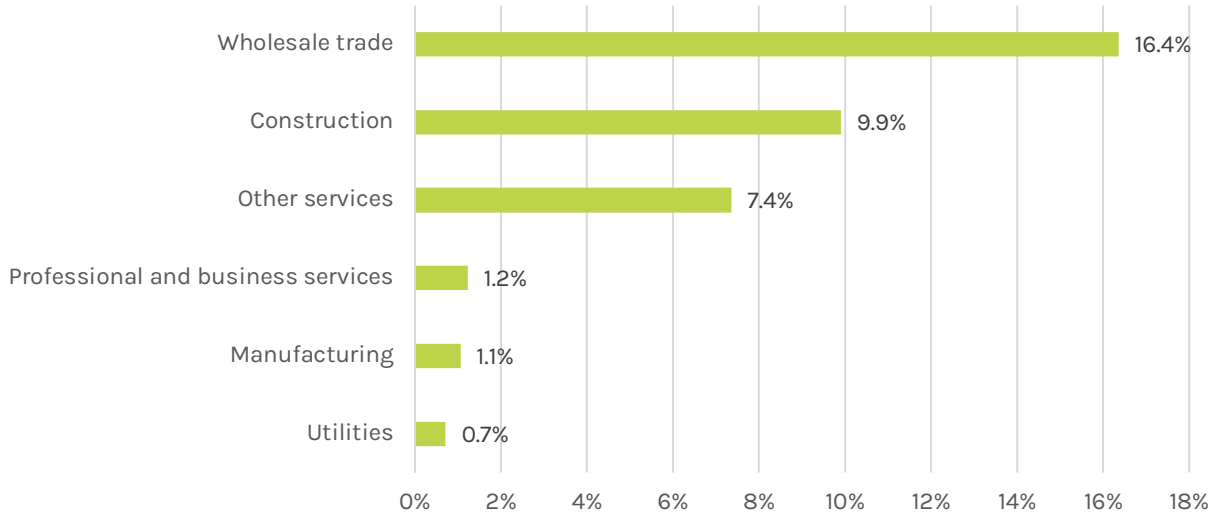
Employment Change by Industry

The previous section highlighted employers' current hiring difficulty across the industry, whereas this section focuses on anticipated employment change by industry within wind EPG. This section also compares anticipated employment change in 2022 to the actual employment change over the last year.

As shown in Figure 14, employers from all industries in wind expect job growth in 2024: wholesale trade employers anticipate the highest level of growth (16.4%), followed by construction (9.9%), other services (7.4%), professional and business services (1.2%), manufacturing (1.1%), and utilities (0.7%).

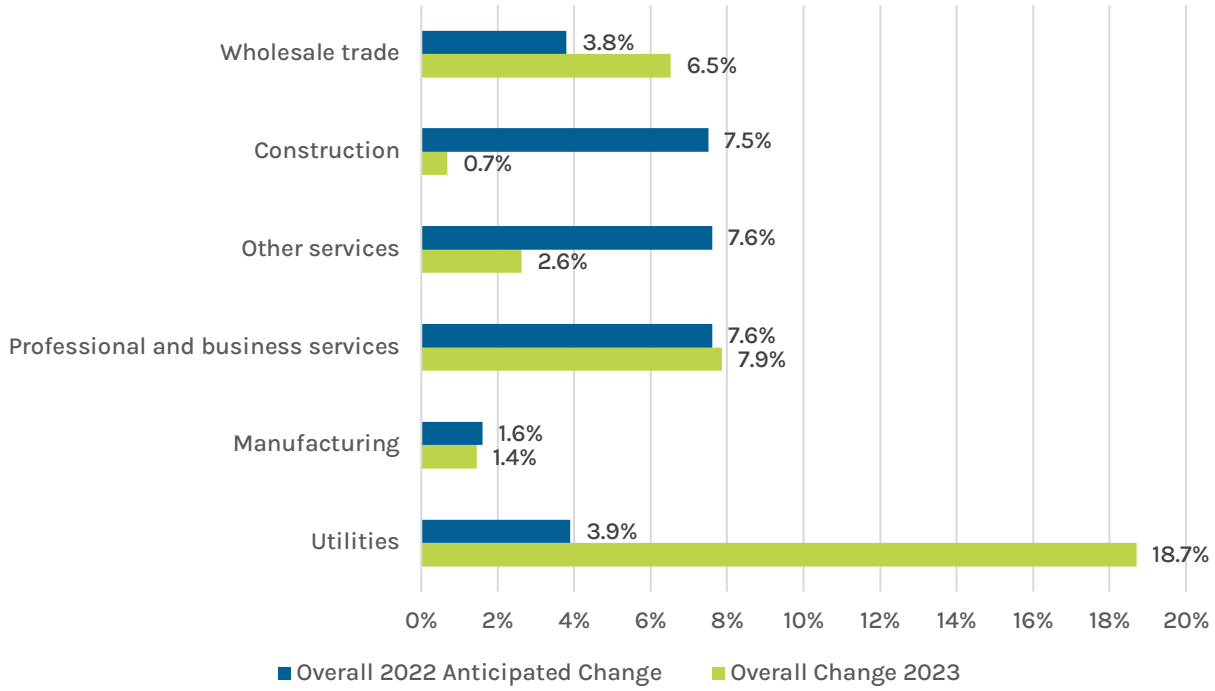
[22] In the previous year, 93% of construction employers reported at least some difficulty hiring qualified workers.

Figure 14. Anticipated 2024 Changes in Wind EPG Employment



All industries in wind EPG anticipated growth from 2022 to 2023 (Figure 15). While all industries expected growth, utilities added jobs more than four times faster than anticipated (18.7% vs. 3.9%). Professional and business services employers added workers at a rate nearly identical to anticipated growth (7.9% actual growth vs. 7.6% anticipated growth).

Figure 15. Wind EPG Actual Employment Change 2022-2023 vs. Anticipated Change 2022



Wind EPG Workforce Demographics

The wind EPG workforce has higher female participation than average in the energy workforce (Table 5). Male workers (69%) accounted for a lower proportion of the wind EPG workforce than the energy workforce average (73%), while female workers in the wind EPG workforce (30%) accounted for a higher proportion than the energy workforce average (26%) but a lower proportion than the overall national workforce average (47%).

The proportion of the wind EPG workforce made up of Hispanic or Latino workers (22%) was higher than the energy workforce average (18%) and higher than the national workforce average (19%).

The proportion of non-white workers in wind EPG jobs (29%) was higher than the energy workforce average (26%) and the national workforce average (24%). This is attributable to a higher-than-average proportion of workers of two or more races in the wind EPG workforce (6%) compared to the energy workforce average (5%), and a higher-than-average proportion of Asian workers in wind EPG jobs (9%) compared to the energy workforce average (7%). The proportion of Native Hawaiian or other Pacific Islander workers in the wind EPG workforce (1%) matched the energy workforce average (1%), while the proportion of American Indian or Alaska Native workers in the wind EPG workforce (1%) was lower than the energy workforce average (2%).

The proportion of veterans in wind EPG jobs (9%) was the same as the energy workforce average (9%) but higher than the overall U.S. workforce average (5%). The proportion of formerly incarcerated workers in the wind EPG workforce (2%) was higher than the energy workforce average (1%) but similar to the national workforce average (2%). The percentage of workers requesting accommodations for disabilities in the wind EPG workforce (2%) was the same as the energy workforce average (2%) but lower than the national workforce average (5%).

The proportion of workers under the age of 30 in the wind EPG workforce (29%) was the same as the energy workforce average (29%) but higher than the overall U.S workforce average (22%). Workers between the ages of 30 and 54 were more represented in the wind EPG workforce (54%) than in the overall energy workforce (52%) and the national workforce (53%). The proportion of workers aged 55 or older in the wind EPG workforce (16%) was lower than both the energy workforce average (18%) and the national workforce average (23%).

The proportion of workers represented by a union or covered under a project labor or collective bargaining agreement in the wind EPG workforce (12%) was higher than the energy workforce average (11%) and overall national private sector average (7%).

Table 5. Wind Electric Power Generation Workforce Demographics and Characteristics

	Number of Workers	Wind EPG Average	Energy Workforce Average	National Workforce Average
Male	90,500	69%	73%	53%
Female	39,904	30%	26%	47%
Gender Nonbinary	923	<1%	<1%	n/a
Hispanic or Latino	28,594	22%	18%	19%
Not Hispanic or Latino	102,733	78%	82%	81%
American Indian or Alaska Native	1,913	1%	2%	1%
Asian	12,253	9%	7%	7%
Black or African American	10,738	8%	9%	13%
Native Hawaiian or Other Pacific Islander	1,704	1%	1%	<1%
White	93,892	71%	74%	76%
Two or More Races	7,840	6%	5%	3%
Unknown Race	3,012	2%	2%	n/a
Veterans	11,762	9%	9%	5%
18 to 29	38,741	29%	29%	22%
30 to 54	71,546	54%	52%	53%
55 and Over	21,040	16%	18%	23%
Disability	3,199	2%	2%	5%
Formerly Incarcerated	2,733	2%	1%	2%
Represented by Unions, Collective Bargaining Agreements, and/or Project Labor Agreements	16,258	12%[23]	11%	7%

National sources: BLS (2023a, 2023b, 2023c, 2023d), Jobs EQ (2023), Prison Policy (2018)

[23] It should be noted that unionization rates vary by state.

Coal Electric Power Generation

Coal EPG[24] employed 63,180 workers in 2023, down 871 from the 64,051 employed in 2022 (-1.4%). The decline in coal EPG has slowed significantly from the -9.6% drop between 2021 and 2022.

Trends and Key Takeaways

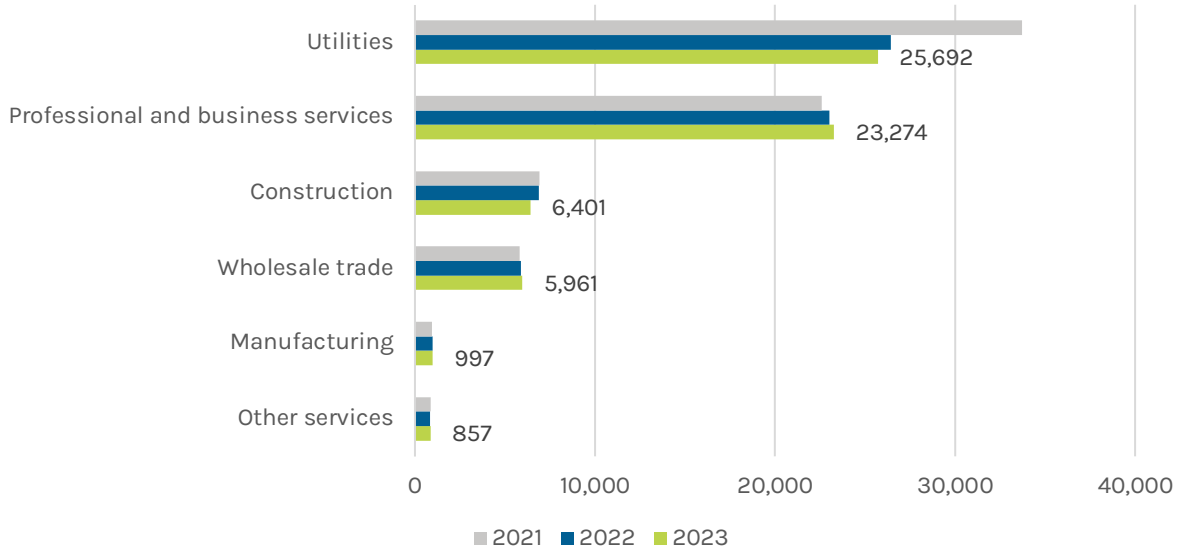
- The largest job declines were in the utilities industry, with 724 fewer jobs in 2023 than in 2022 (-2.7%). Construction jobs in coal EPG (-7.1%) also declined in the past year.
- Jobs increased slightly in the manufacturing, wholesale trade, other services, and professional and business services industries, by 341 workers altogether.
- Wholesale trade businesses anticipate high job growth in 2023 (13.4%).
- Coal EPG's workforce had higher participation of women (34%) than the energy workforce average (26%) but lower participation than the national workforce as a whole (47%).
- Hispanic or Latino workers were less represented in the coal EPG workforce than in the energy and national workforces (16% compared to 18% and 19%, respectively).
- The coal EPG workforce had a higher percentage of non-white workers (29%) than the energy workforce average (26%) and the national workforce average (24%). This is partially attributable to Asian workers being more concentrated in the coal EPG workforce (10% compared to 7%). The percentage of American Indian or Alaska Native workers in the coal EPG workforce was the same as the energy workforce average (2%).
- Black or African American workers were more represented in the coal EPG workforce (10%) than they were in the rest of the energy workforce (9%). The proportion of Black or African American workers in the coal EPG workforce is lower than the national workforce average of 13%.
- The percentage of workers in the coal EPG workforce represented by a union or covered under a project labor or collective bargaining agreement (16%) was higher than the energy workforce average (11%) and the overall national private sector workforce average (7%).
- Formerly incarcerated workers were more represented in the coal EPG workforce (2%) than in the overall energy workforce (1%) but were on par with the national workforce average (2%).
- The proportion of workers requesting accommodations for disabilities in the coal EPG workforce (2%) was the same as the overall energy workforce average (2%) and lower than the national workforce average (5%).

[24] This is solely coal electricity generation. Coal extraction is included in the Fuels and Multi-Sectors sections of this report.

Employment by Industry

The largest number of coal EPG employees were in the utilities industry, with 25,692 workers (Figure 16). Utilities also reported the largest decrease in jobs from 2022 to 2023, shrinking by 724 positions (-2.7%).

Figure 16. Coal EPG Employment by Industry

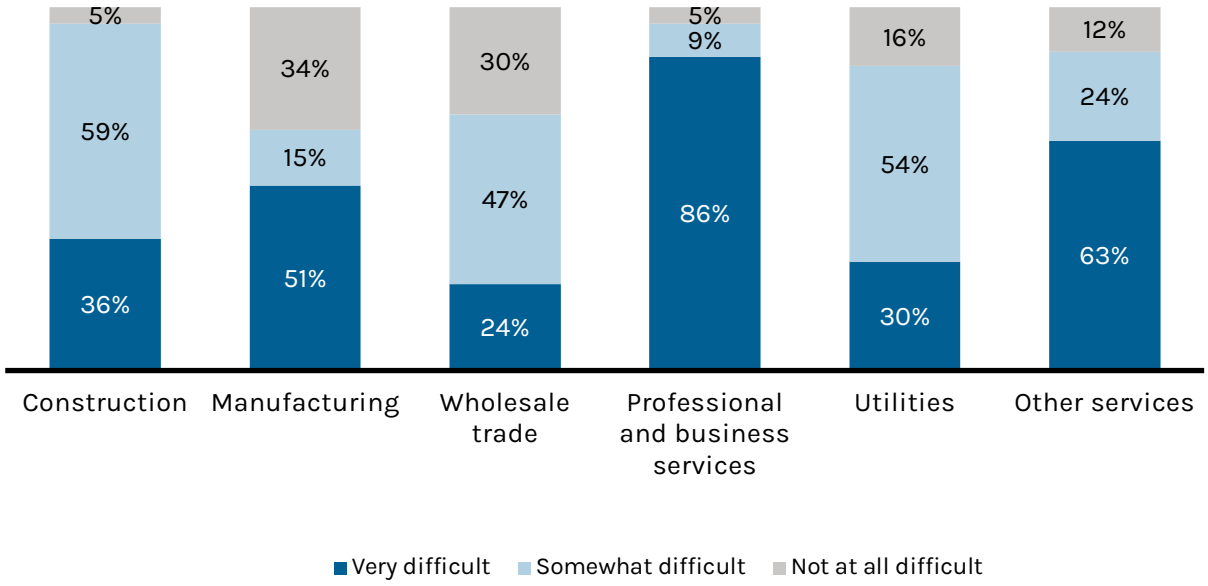


Employer Perspective on Workforce Issues

Current Hiring Difficulty

Within coal EPG industries, construction and professional and business services reported the highest hiring difficulty (Figure 17). All employers that attempted to hire workers in 2023 reported finding qualified workers was "very difficult" or "somewhat difficult." Manufacturing employers reported the least difficulty, with 34% reporting hiring was "not at all difficult."

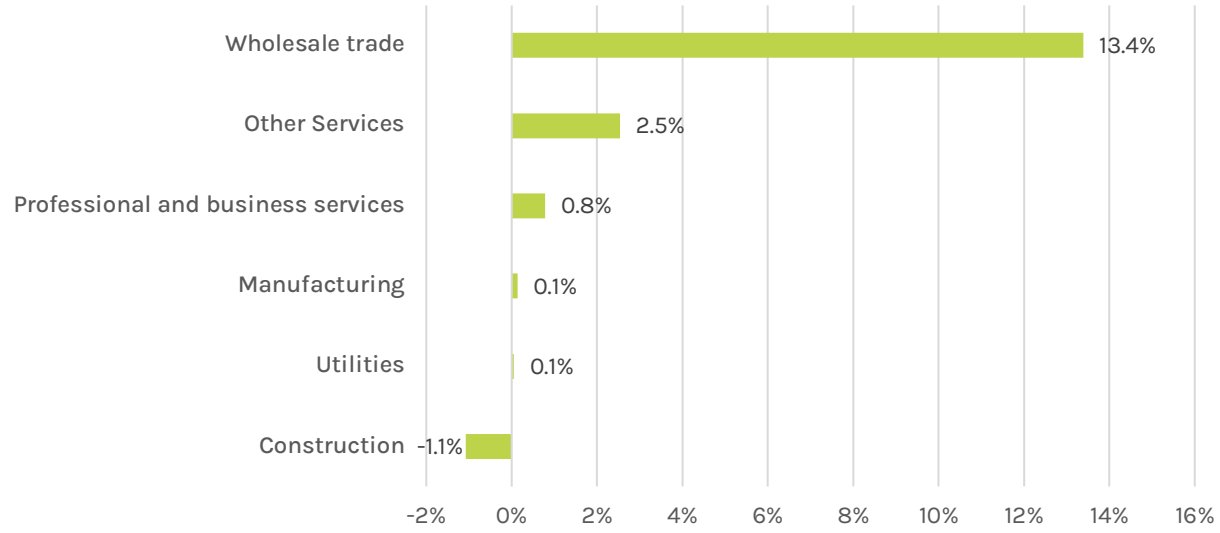
Figure 17. Coal EPG Hiring Difficulty by Industry



Employment Change by Industry

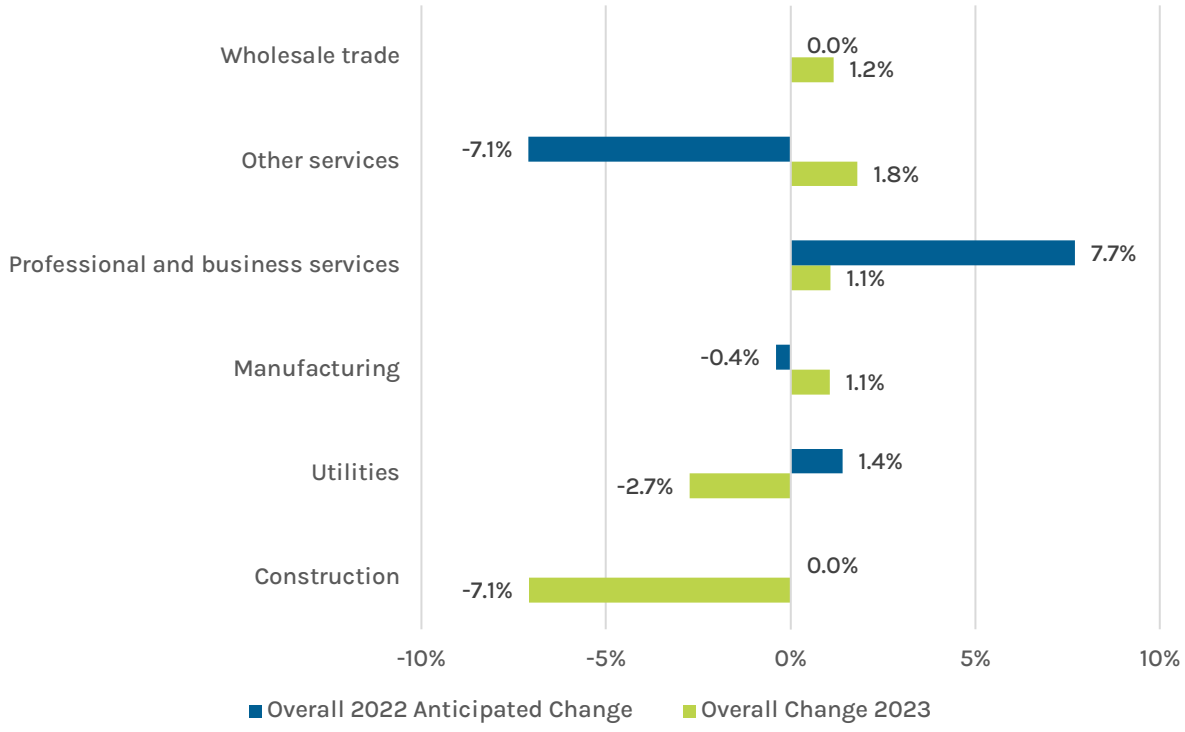
The previous section highlighted employers' current hiring difficulty across industry, whereas this section focuses on anticipated employment change by industry within coal EPG. This section also compares anticipated employment change in 2022 to the actual employment change over the last year. As illustrated in Figure 18, only construction employers within coal EPG expect to contract in employment through 2024 (-1.1%), while all other industries anticipate positive growth: wholesale trade anticipates robust growth (13.4%), followed by other services (2.5%), professional and business services (0.8%), manufacturing (0.1%), and utilities (0.1%).

Figure 18. Anticipated 2024 Changes in Coal Electric Power Generation Employment



Construction and utilities expected to maintain or grow 2022 employment levels through 2023. However, construction (-7.1%) and utilities (-2.7%) businesses shed jobs from 2022 to 2023. While other services businesses expected to shed jobs, total employment in the industry grew by 1.8% (Figure 19).

Figure 19. Coal EPG Actual Employment Change 2022-2023 vs. Anticipated Employment Change 2022



Coal EPG Workforce Demographics

As with previous years, male workers made up a smaller proportion of the coal EPG workforce (66%) than the overall energy workforce (73%) but a higher proportion than the national workforce (53%). Female workers make up a larger proportion of the coal EPG workforce (34%) than the overall energy workforce (26%) (Table 6).

The proportion of non-white workers in the coal EPG workforce was 29%, higher than the energy workforce average of 26% and the national workforce average of 24%. This is attributable to higher-than-average proportions of Asian workers in the coal EPG workforce (10%) than in the overall energy workforce (7%). The concentration of Black or African American workers in the coal EPG workforce (10%) was higher than the energy workforce average (9%) but lower than the national workforce average (13%).

The concentration of veterans in the coal EPG workforce (7%) was lower than the energy workforce average (9%) but higher than the overall U.S. workforce average (5%). The proportion of formerly incarcerated workers in the coal EPG workforce (2%) was higher than the energy workforce average (1%) but the same as the national workforce average (2%). The proportion of the coal EPG workforce requesting accommodations for disabilities (2%) was the same as the energy workforce average (2%) but lower than the national workforce average (5%).

The percentage of workers under the age of 30 in the coal EPG workforce (25%) was lower than in the overall energy workforce (29%), while the percentage of workers between the ages of 30 and 54 in the coal EPG workforce (55%) was higher than the energy workforce average (52%). Similarly, the percentage of workers aged 55 or older in the coal EPG workforce (20%) was higher than the energy workforce average (18%).

The concentration of workers represented by a union or covered under a project labor or collective bargaining agreement in the coal EPG workforce (16%) was higher than the energy workforce average (11%) and the national private sector average (7%).

The proportion of the coal EPG workforce made up of Hispanic or Latino workers (16%) was lower than the energy workforce average (18%) and the national workforce average (19%).

Table 6. Coal EPG Workforce Demographics and Characteristics

	Number of Workers	Coal EPG Average	Energy Workforce Average	National Workforce Average
Male	41,705	66%	73%	53%
Female	21,207	34%	26%	47%
Gender Nonbinary	268	<1%	<1%	n/a
Hispanic or Latino	10,078	16%	18%	19%
Not Hispanic or Latino	53,102	84%	82%	81%
American Indian or Alaska Native	1,078	2%	2%	1%
Asian	6,012	10%	7%	7%
Black or African American	6,561	10%	9%	13%
Native Hawaiian or Other Pacific Islander	1,074	2%	1%	<1%
White	45,016	71%	74%	76%
Two or More Races	2,000	3%	5%	3%
Unknown Race	1,453	2%	2%	n/a
Veterans	4,575	7%	9%	5%
18 to 29	15,873	25%	29%	22%
30 to 54	34,644	55%	52%	53%
55 and Over	12,663	20%	18%	23%
Disability	1,325	2%	2%	5%
Formerly Incarcerated	1,272	2%	1%	2%
Represented by Unions, Collective Bargaining Agreements, and/or Project Labor Agreements	9,990	16%[25]	11%	7%

National sources: BLS (2023a, 2023b, 2023c, 2023d), Jobs EQ (2023), Prison Policy (2018)

[25] Unionization rates vary by state.

Natural Gas Electric Power Generation

Natural gas EPG,[26] which includes conventional as well as advanced natural gas,[27] employed 123,220 workers in 2023, up 4,713 from 2022 (4.0%). Of these, 78,060 were in advanced natural gas with the remaining 45,160 in conventional natural gas.

Trends and Key Takeaways

- The largest job gains were in the utilities industry, which added 3,046 new jobs (4.8%), followed by professional and business services (860 jobs), wholesale trade (560), construction (208), and other services (48). Manufacturing employment was static between 2022 and 2023.
- Natural gas EPG industries that anticipate relatively high growth in 2024 include professional and business services (10.8%), wholesale trade (7.7%), and construction (4.4%).
- Male workers in the natural gas EPG workforce (65%) were less highly represented than in the overall energy workforce, (73%) but more highly represented than in the overall energy workforce (53%).
- The percentage of non-white workers in the natural gas EPG workforce (31%) was higher than the energy workforce average (26%) and the economy-wide workforce average (24%). This is partially attributable to a higher proportion of Asian workers in the natural gas EPG workforce (10%) compared to the national workforce average (7%) and a higher proportion of workers of two or more races in the natural gas EPG workforce (6%) compared to the national workforce average (3%).
- Black or African American workers were employed at a higher rate in the natural gas EPG workforce (11%) than the overall energy workforce (9%) but at a lower rate than in the economy-wide workforce (13%).
- Veterans were less represented in the natural gas EPG workforce (8%) than in the overall energy workforce (9%) but are more represented when compared to the overall national workforce (5%).
- The percentage of workers in the natural gas EPG workforce represented by a union or covered under a project labor or collective bargaining agreement (17%) was higher than the energy workforce average (11%) and significantly higher than the national private sector average (7%).

[26] The employment numbers in this section do not include fuels (such as extraction). These are included in the Fuels and Multi-Sector sections of this report.

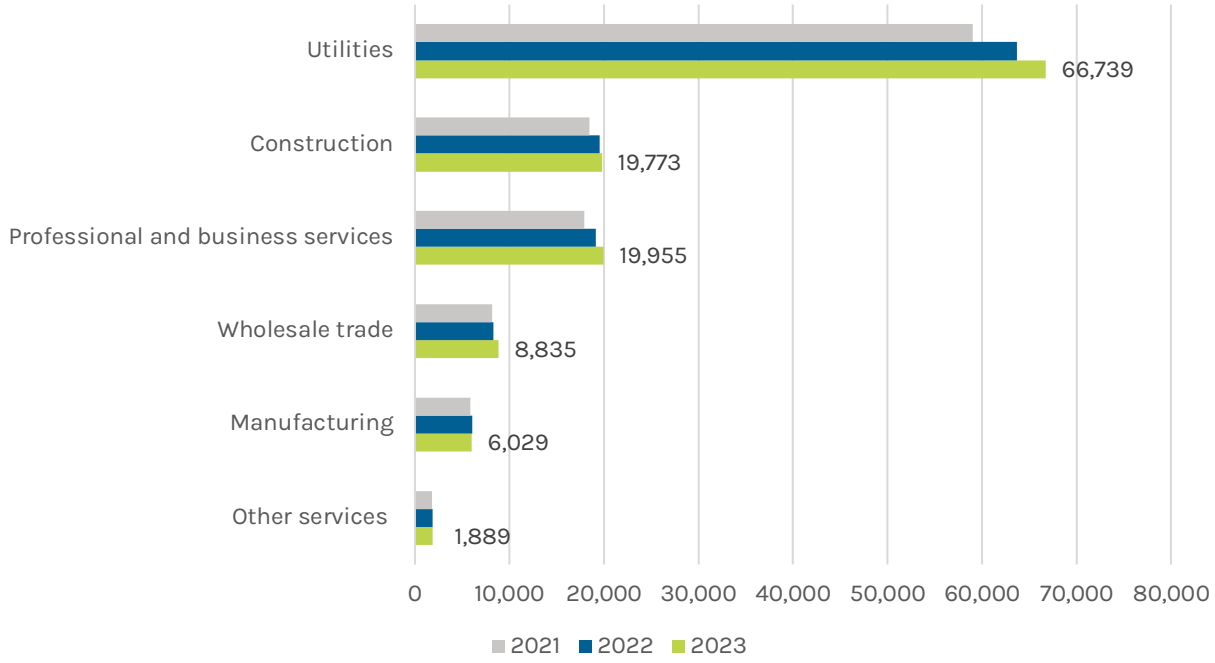
[27] Includes efficient, low emission, leak free natural gas, including systems that use any of the following technologies: high efficiency compressor; advanced low NOx combustion technology; first application of closed loop steam cooling in an industrial gas turbine; advanced turbine blade and vane materials; high temperature TBC and abradable coatings; advanced row 4 turbine blades; 3-D aero technology; and advanced brush seal.

- Workers requesting accommodations for disabilities in the natural gas EPG workforce (2%) were similarly represented as in the overall energy workforce (2%) but less represented than in the national workforce (5%).
- The percentage of formerly incarcerated workers in the natural gas EPG workforce (2%) was slightly higher than the overall energy workforce (1%) but the same as the national workforce average (2%).

Employment by Industry

The largest number of natural gas EPG employees was in the utilities industry, with 66,739 workers (Figure 20). The utilities industry also reported the largest number of new jobs within natural gas EPG (3,046 jobs), translating to 4.8% growth. Wholesale trade businesses in natural gas EPG experienced the greatest percentage growth in jobs (6.8%).

Figure 20. Natural Gas EPG Employment by Industry

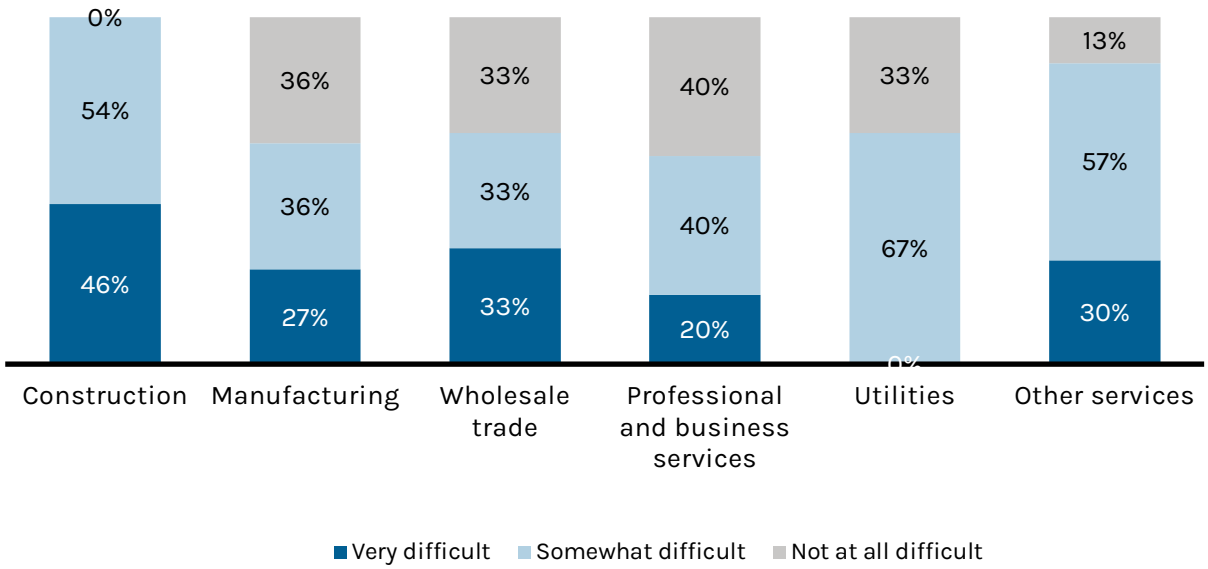


Employer Perspective on Workforce Issues

Current Hiring Difficulty

Within natural gas EPG industries, construction employers reported the greatest difficulty hiring, with 100% indicating at least some difficulty (Figure 21). Professional and business services and manufacturing employers had the lowest reported difficulty, with 40% and 36%, respectively, reporting that hiring was "not at all difficult."

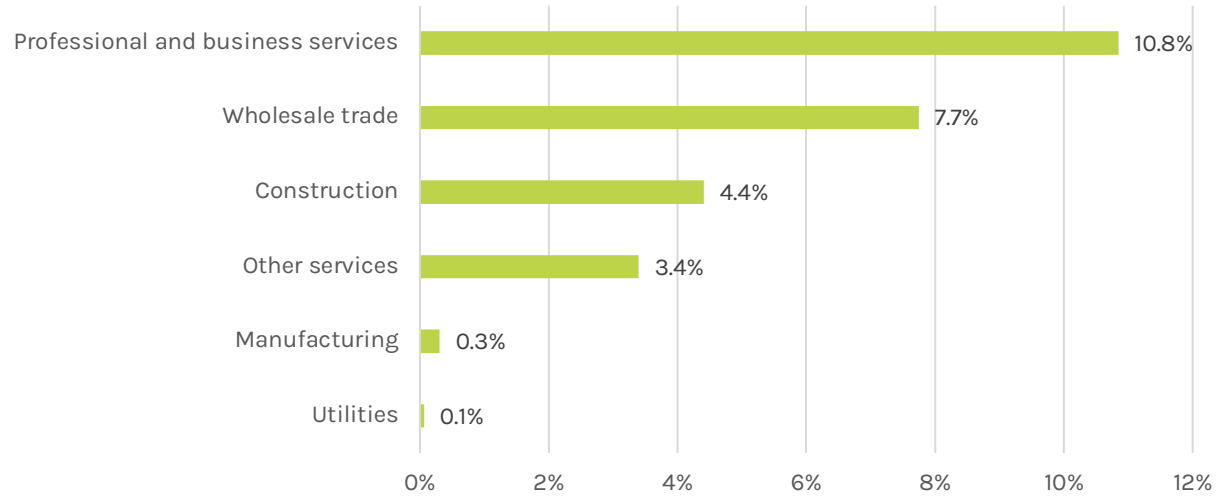
Figure 21. Natural Gas EPG Hiring Difficulty by Industry



Employment Change by Industry

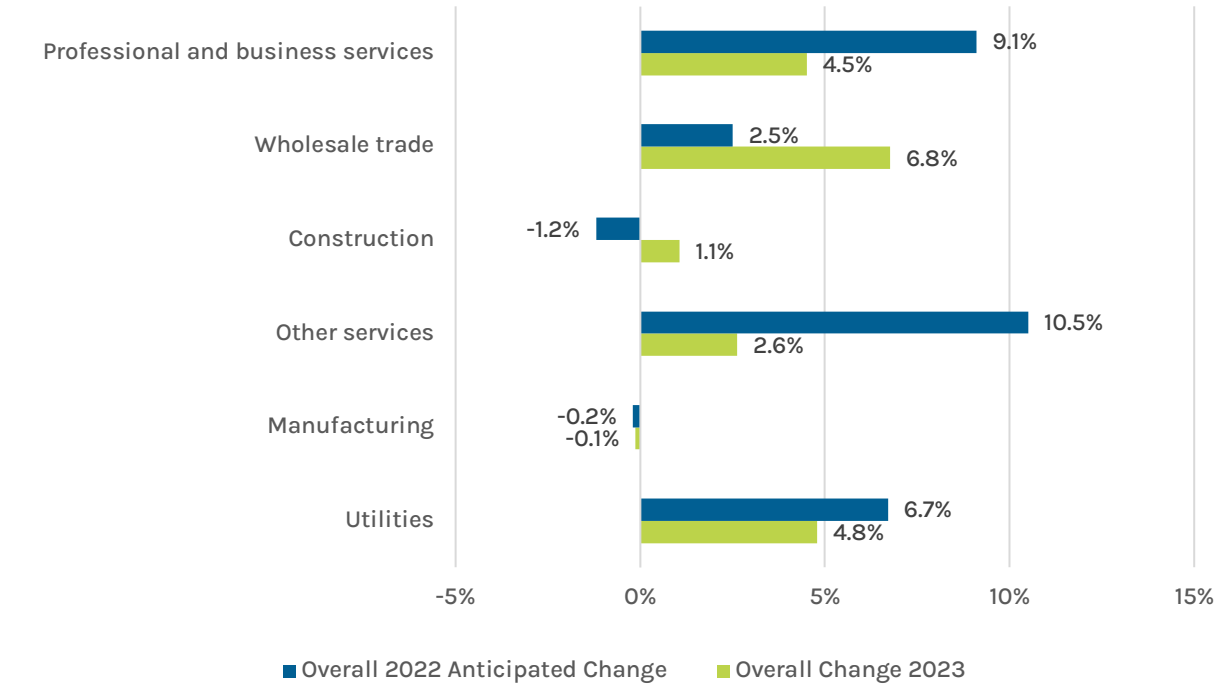
The previous section highlighted employers' current hiring difficulty across industry, whereas this section focuses on anticipated employment change by industry within natural gas EPG. This section also compares anticipated employment change in 2022 to the actual employment change over the last year. As shown in Figure 22, employers in all industries in natural gas EPG anticipate job growth in 2024: professional and business services employers predict the highest level of growth (10.8%), followed by wholesale trade (7.7%), construction (4.4%), other services (3.4%), manufacturing (0.3%), and utilities (0.1%).

Figure 22. Anticipated 2024 Changes in Natural Gas EPG Employment



Only construction and manufacturing employers expected declines in jobs from 2022 to 2023 (Figure 23). Five of six industries within natural gas EPG registered job growth between 2022 and 2023, ranging from 1.1% in construction to 6.8% in wholesale trade. Manufacturing employment remained relatively flat, declining by 0.1% from 2022 to 2023.

Figure 23. Natural Gas EPG Actual Employment Change 2022-2023 vs. Anticipated Employment Change 2022



Natural Gas EPG Workforce Demographics

Males in the natural gas EPG workforce (65%) were less highly represented than in the overall energy workforce (73%) but more highly represented than in the national workforce (53%) (Table 7).

The proportion of the natural gas EPG workforce made up of Hispanic or Latino workers (19%) was higher than the overall energy workforce average (18%) but was on par with the U.S. workforce average (19%).

The proportion of non-white workers in the natural gas EPG workforce was 31%, higher than the 26% energy workforce average and the 24% national workforce average. This is attributable to a higher-than-average proportion of workers of two or more races in the natural gas EPG workforce (6%) compared to the overall energy workforce (5%) and a higher-than-average proportion of Asian workers in the natural gas EPG workforce (10%) compared to the overall energy workforce (7%). The proportions of Native Hawaiians or other Pacific Islanders in the natural gas EPG workforce (1%) and American Indians or Alaska Natives in the natural gas EPG workforce (2%) were the same as the overall energy workforce.

Formerly incarcerated individuals were more highly represented in the natural gas EPG workforce (2%) than in the overall energy workforce (1%) but were similarly represented in the overall U.S. workforce (2%). The proportion of veterans in the natural gas EPG workforce (8%) was lower than in the overall energy workforce (9%) but higher than the national workforce average (5%). The proportion of workers requesting accommodations for disabilities in the natural gas EPG workforce (2%) was the same as the energy workforce average (2%) but lower than the national workforce average (5%).

There is a lower share of workers under the age of 30 in the natural gas EPG workforce (26%) as compared to the overall energy workforce (29%). There is also a lower share of workers aged 55 or older in the natural gas EPG workforce (16%) as compared to the overall energy workforce (18%). The concentration of workers represented by a union or covered under a project labor or collective bargaining agreement in the natural gas EPG workforce (17%) was higher than the energy workforce average (11%) and the national private sector average (7%).

Table 7. Natural Gas Electric Power Generation Workforce Demographics and Characteristics

	Number of Workers	Natural Gas EPG Average	Energy Workforce Average	National Workforce Average
Male	80,217	65%	73%	53%
Female	42,473	34%	26%	47%
Gender Nonbinary	530	<1%	<1%	n/a
Hispanic or Latino	23,549	19%	18%	19%
Not Hispanic or Latino	99,671	81%	82%	81%
American Indian or Alaska Native	1,857	2%	2%	1%
Asian	12,025	10%	7%	7%
Black or African American	13,113	11%	9%	13%
Native Hawaiian or Other Pacific Islander	1,446	1%	1%	<1%
White	84,748	69%	74%	76%
Two or More Races	7,891	6%	5%	3%
Unknown Race	2,164	2%	2%	n/a
Veterans	10,419	8%	9%	5%
18 to 29	32,549	26%	29%	22%
30 to 54	70,829	57%	52%	53%
55 and Over	19,841	16%	18%	23%
Disability	2,869	2%	2%	5%
Formerly Incarcerated	2,214	2%	1%	2%
Represented by Unions, Collective Bargaining Agreements, and/or Project Labor Agreements	21,123	17%[28]	11%	7%

National sources: BLS (2023a, 2023b, 2023c, 2023d), Jobs EQ (2023), Prison Policy (2018)

[28] Unionization rates vary by state.

Nuclear Electric Power Generation

Nuclear EPG businesses[29] employed 58,517 workers in 2023, up 1,596 from 2022 (2.8%) but 2,400 fewer than in 2019, when employment was 60,916.

Trends and Key Takeaways

- Jobs increased in five industries. Professional and business services had the largest number of new jobs, at 1,079 (11.1%), and was the second largest industry in nuclear EPG (10,819 workers), following utilities (41,241), and ahead of wholesale trade (2,499), construction (2,150), manufacturing (1,726), and other services (82).
- Nuclear EPG employers in the wholesale trade (13.4%), other services (6.3%), and professional and business services (0.8%) industries anticipate growth in 2024.
- Nuclear EPG's workforce had a smaller share of male workers (65%) compared to the overall energy workforce (73%), but a larger share than the national workforce average (53%). Nuclear EPG's workforce had a larger share of female workers (34%) compared to the overall energy workforce (26%) but a smaller share compared to the national workforce average (47%).
- The nuclear EPG workforce trends older than the energy workforce average. The percentage of workers aged 18 to 29 in the nuclear EPG workforce (23%) is lower than the energy workforce average (29%) and close to the national workforce average (22%). The percentage of workers aged 30 to 54 in the nuclear EPG workforce (60%) is higher when compared to the overall energy workforce average (52%) and the national workforce average (53%).
- The nuclear EPG workforce included a higher percentage of non-white workers (33%) than the energy workforce average (26%) and the national workforce average (24%). This is attributable to a higher share of Asian workers in the nuclear EPG workforce (9%) compared to the overall energy workforce average (7%), and a higher share of American Indian or other Alaska Native workers in the nuclear EPG workforce (3%) compared to the overall energy workforce average (2%).
- Hispanic or Latino workers were less represented in the nuclear EPG workforce (15%) than in the overall energy workforce (18%) and the U.S. workforce (19%).
- Black or African American workers in the nuclear EPG workforce (11%) were more highly represented than in the overall energy workforce (9%) but slightly less represented than in the national workforce overall (13%).
- Veterans in the nuclear EPG workforce (7%) were less represented than in the overall energy workforce (9%) but were more represented when compared to the national workforce overall (5%).

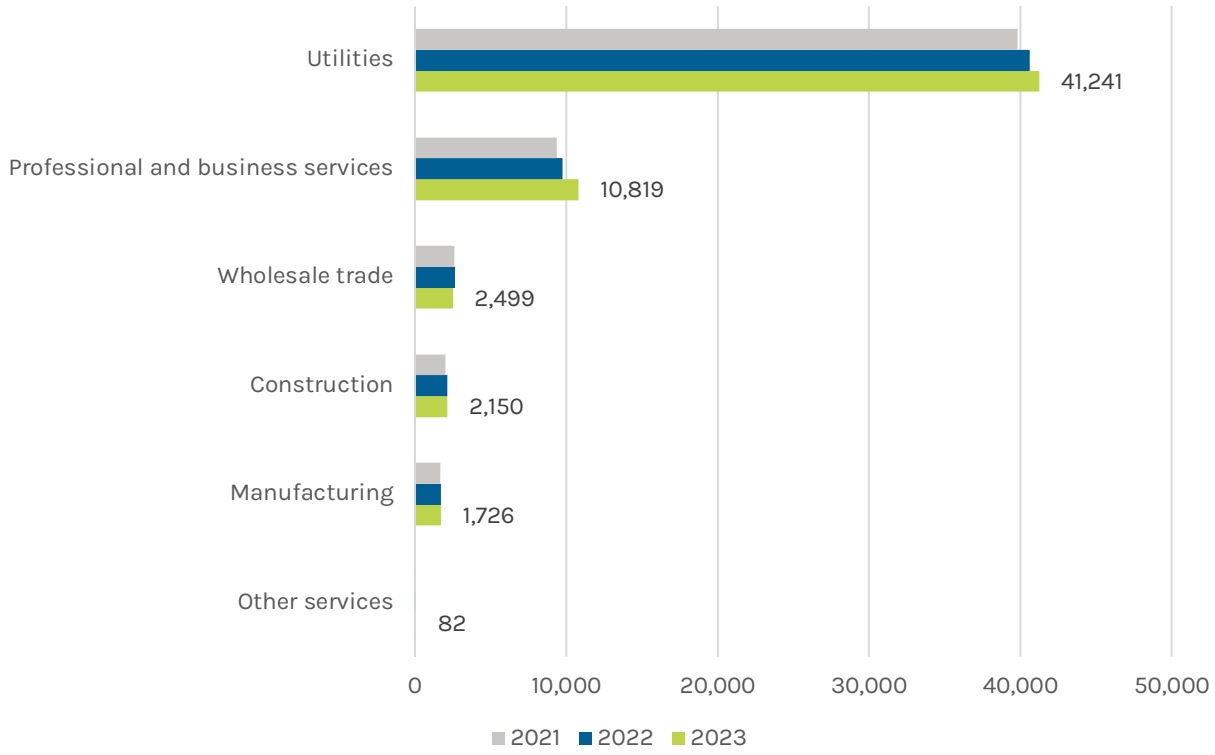
[29] These job numbers do not include extraction, which is covered in the Fuels and Multi-Sector sections of this report.

- At 19%, the nuclear EPG workforce was once again the most unionized (represented by a labor union or covered under a collective bargaining agreement or a project labor agreement) energy technology, higher than the overall energy workforce average of 11% and the national private sector average of 7%.
- Formerly incarcerated workers in the nuclear EPG workforce (2%) were more highly represented than in the overall energy workforce (1%) but at the same rate as in the national workforce (2%).
- Workers requesting accommodations for disabilities in the nuclear EPG workforce (1%) were less represented than in the energy workforce (2%) and the national workforce (5%).

Employment by Industry

The largest number of nuclear EPG employees was in utilities, with 41,241 workers (Figure 24). Utilities employment increased by 636 workers (1.6%) from 2022 to 2023. Professional and business services employment grew by 1,079 new positions (11.1%) followed by construction, which added 30 new jobs (1.4%).

Figure 24. Nuclear EPG Employment by Industry

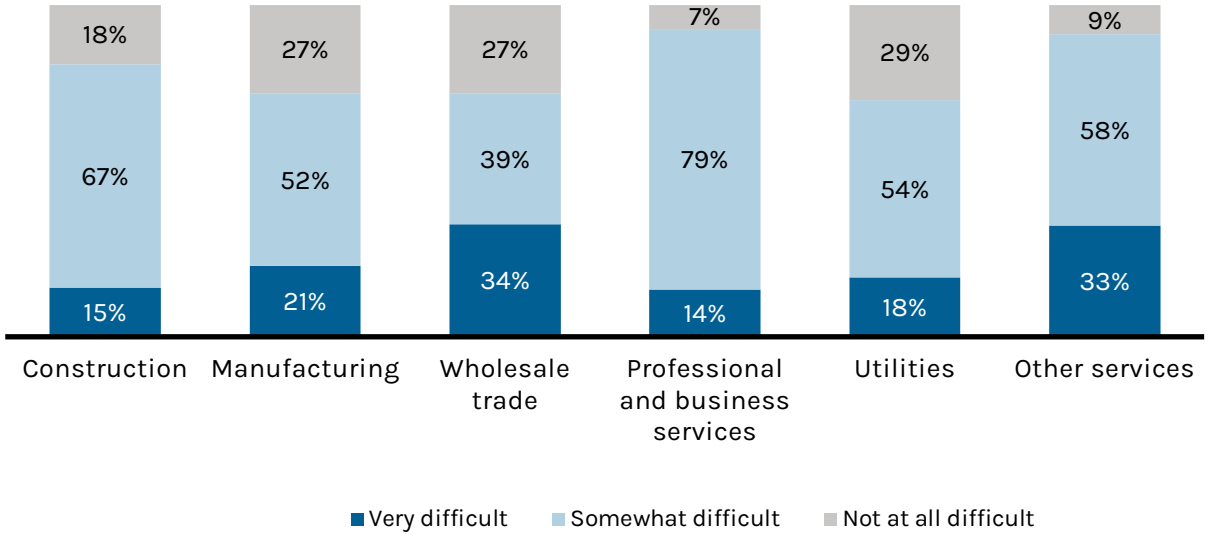


Employer Perspective on Workforce Issues

Current Hiring Difficulty

Within nuclear EPG industries, professional and business services employers reported the greatest difficulty hiring workers (Figure 25), with approximately 93% reporting at least some difficulty finding qualified workers. While utilities reported the lowest level of difficulty hiring, 71% of this industry still reported at least some hiring difficulty, highlighting the employment challenges in this category.

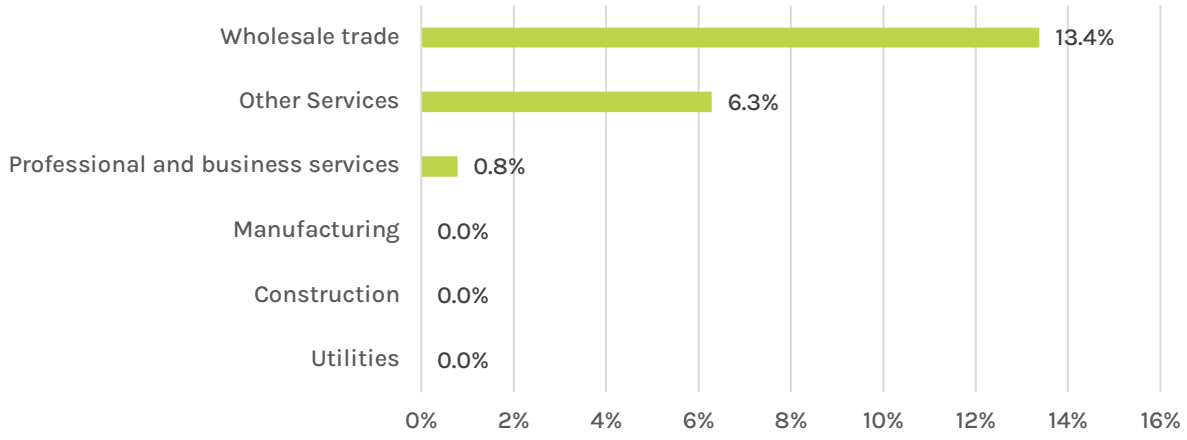
Figure 25. Nuclear Electric Power Generation Employers' Perceived Hiring Difficulty by Industry



Employment Change by Industry

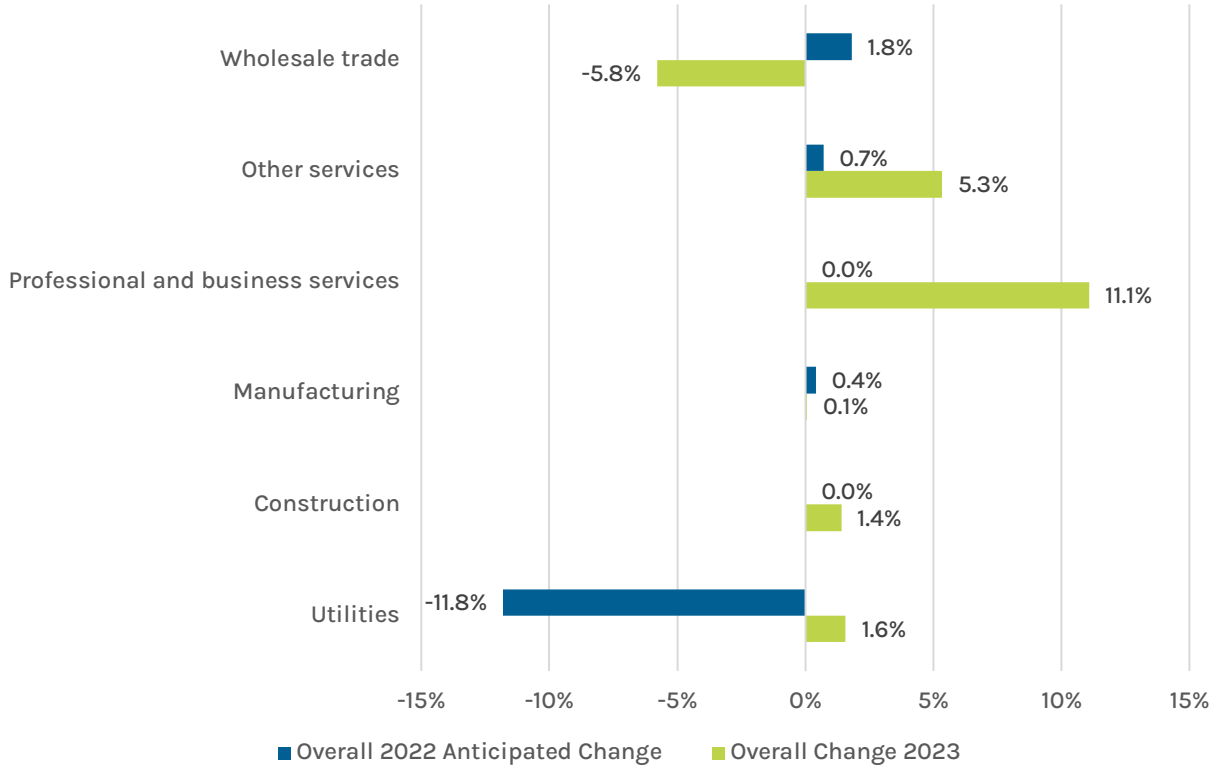
The previous section highlighted employers' current hiring difficulty across industry, whereas this section focuses on anticipated employment change by industry within nuclear EPG. This section also compares anticipated employment change in 2022 to the actual employment change over the last year. Wholesale trade (13.4%), other services (6.3%), and professional and business services (0.8%) employers in nuclear EPG anticipate growth through 2024, while those in manufacturing, construction, and utilities expect no increase in employment (Figure 26).

Figure 26. Anticipated 2024 Changes in Nuclear EPG Employment



Utilities employers experienced job growth from 2022 to 2023 despite expecting declines, and wholesale trade employers underperformed their 2022 growth expectations (Figure 27).

Figure 27. Nuclear EPG Actual Employment Change 2022–2023 vs. Anticipated Employment Change 2022



Nuclear EPG Workforce Demographics

The nuclear EPG workforce had a larger share of female workers (34%) than the energy workforce average (26%) but a smaller share than the national workforce average (47%). The nuclear EPG workforce had a smaller share of male workers (65%) than the energy workforce average (73%) but a larger share than the national workforce average (53%) (Table 8).

The proportion of non-white workers in the nuclear EPG workforce was 33%, higher than the overall energy workforce average of 26% and the national workforce average of 24%. This is attributable to a higher-than-average proportion of Asian workers in the nuclear EPG workforce (9%) as compared to the overall energy workforce (7%) and a higher-than-average proportion of American Indian or Alaska Native workers in the nuclear EPG workforce (3%) as compared to the overall energy workforce (2%).

The concentration of Hispanic or Latino workers in the nuclear EPG workforce (15%) is lower than the energy workforce average (18%) and the U.S. workforce average (19%). Black or African American workers in the nuclear EPG workforce (11%) were more represented than in the overall energy workforce (9%) but less so when compared to the national workforce overall (13%).

Formerly incarcerated individuals in the nuclear EPG workforce (2%) were more highly represented than in the overall energy workforce (1%) but had similar representation in the overall national workforce (2%). Veterans were less highly represented in the nuclear EPG workforce (7%) than in the overall energy workforce (9%) but were more represented than in the national workforce (5%). Workers requesting accommodations for disabilities in the nuclear EPG workforce (1%) were less represented than in the overall energy workforce (2%) and the national workforce (5%).

The proportion of workers between 30 and 54 years old in the nuclear EPG workforce (60%) was higher than the rest of the energy workforce (52%). The nuclear EPG workforce also had fewer workers under the age of 30 (23%) than the overall energy workforce (29%). In addition, the nuclear EPG workforce had a smaller share of workers aged 55 or older (17%) compared to the overall energy workforce (18%).

The concentration of workers represented by a union or covered under a project labor or collective bargaining agreement in the nuclear EPG workforce (19%) was higher than the energy workforce average (11%) and the national private sector average (7%).

Table 8. Nuclear Electric Power Generation Workforce Demographics and Characteristics

	Number of Workers	Nuclear EPG Average	Energy Workforce Average	National Workforce Average
Male	38,155	65%	73%	53%
Female	19,696	34%	26%	47%
Gender Nonbinary	665	1%	<1%	n/a
Hispanic or Latino	8,990	15%	18%	19%
Not Hispanic or Latino	49,526	85%	82%	81%
American Indian or Alaska Native	1,937	3%	2%	1%
Asian	5,316	9%	7%	7%
Black or African American	6,650	11%	9%	13%
Native Hawaiian or Other Pacific Islander	700	1%	1%	<1%
White	39,495	67%	74%	76%
Two or More Races	2,926	5%	5%	3%
Unknown Race	1,504	3%	2%	n/a
Veterans	4,127	7%	9%	5%
18 to 29	13,689	23%	29%	22%
30 to 54	35,132	60%	52%	53%
55 and Over	9,696	17%	18%	23%
Disability	803	1%	2%	5%
Formerly Incarcerated	1,215	2%	1%	2%
Represented by Unions, Collective Bargaining Agreements, and/or Project Labor Agreements	11,316	19%[30]	11%	7%

National sources: BLS (2023a, 2023b, 2023c, 2023d), Jobs EQ (2023), Prison Policy (2018)

[30] Unionization rates vary by state.

Water Power Electric Power Generation[31]

Water power EPG includes traditional facilities, such as dams, as well as smaller, low-impact hydropower facilities and marine and hydrokinetic power. In 2023, water power EPG businesses employed 68,372 workers, up 2,100 (3.2%) from 2022 and up 5,241 from 2020.

Most water power EPG employment (56,641 jobs) was in traditional hydropower. The remaining 11,730 jobs were in low-impact hydropower.[32]

Trends and Key Takeaways

- For the second year in a row, the largest job gains were in the utilities industry, with 997 new jobs (5.3%), followed by construction (590 jobs), professional and business services (413), and manufacturing (93). Other services and wholesale trade remained flat from 2022 to 2023.
- Water power EPG employers in every industry anticipate job growth in 2023, led by wholesale trade (13.4%).
- The percentage of workers in water power EPG represented by a union or covered under a project labor or collective bargaining agreement (13%) was higher than the energy workforce average (11%) and the national private sector average (7%).
- The water power EPG workforce had a smaller share of male workers (71%) compared to the overall energy workforce (73%) and a larger share of female workers (29%) compared to the overall energy workforce (26%).
- Non-white workers in the water power EPG workforce (30%) were more highly represented than in the overall energy workforce (26%) and the national workforce (24%). This is largely attributable to Asian workers being more represented in the water power EPG workforce (10%) than in the overall energy workforce (7%).
- Hispanic or Latino workers in the water power EPG workforce (18%) were similarly represented in the overall energy workforce (18%) but were less represented than in the overall U.S. workforce (19%).
- Black or African American workers in the water power EPG workforce (11%) were more highly represented than in the overall energy workforce (9%) but less highly represented than in the national workforce (13%).
- The proportion of veterans working in water power EPG (9%) was the same as the energy workforce average (9%) and higher than the national workforce average (5%).

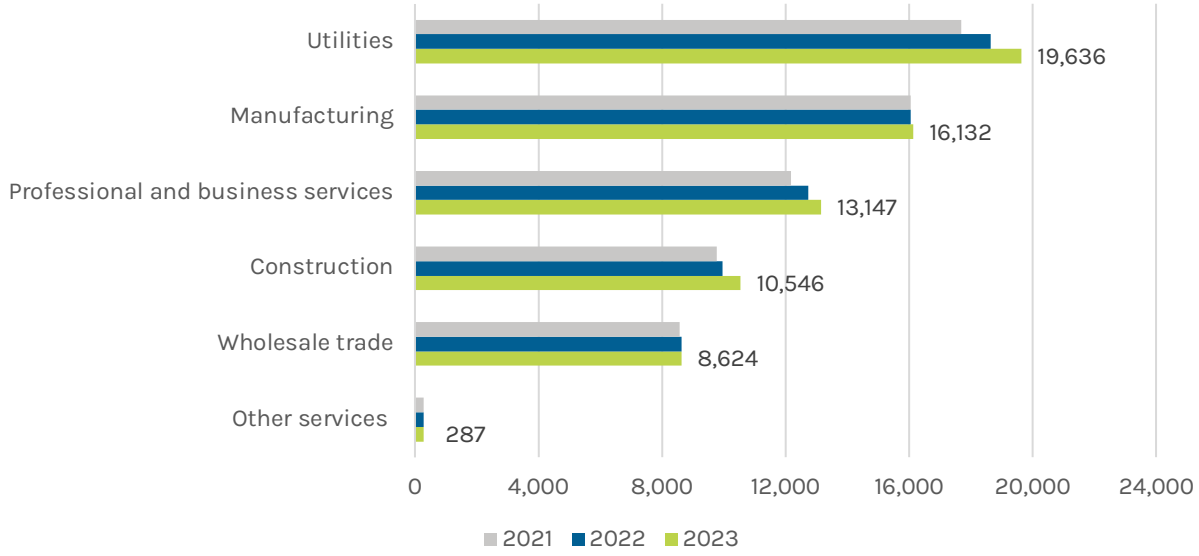
[31] Marine and hydrokinetic employees are included in overall employment totals for this section, however, responses from marine and hydrokinetic employers are excluded from difficulty and anticipated growth calculations.
[32] This report includes marine and hydrokinetics in low-impact hydropower. This is due to low employment numbers in marine and hydrokinetics that cannot be reported separately due to statistical significance.

- The proportion of workers requesting accommodations for disabilities in the water power EPG workforce (2%) was the same as in the overall energy workforce (2%) and lower than the U.S. workforce average of 5%. The percentage of formerly incarcerated workers in the water power EPG workforce (3%) was higher than the energy workforce average (1%) and the national workforce average (2%).

Employment by Industry

The utilities industry had the largest number of water power EPG employees, with 19,636 workers (Figure 28). Utilities added the highest number of jobs, at 997, while construction had the highest job growth rate (5.9%) from 2022 to 2023. Wholesale trade employment was essentially flat (0%) from 2022 to 2023.

Figure 28. Water Power EPG Employment by Industry

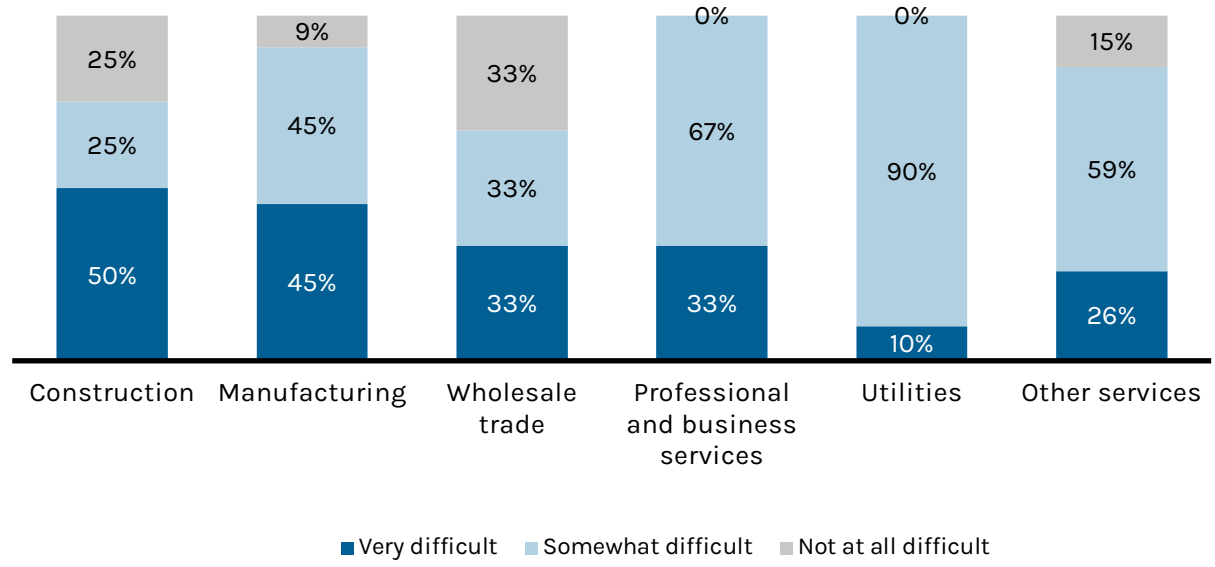


Employer Perspective on Workforce Issues

Current Hiring Difficulty

Professional and business services and utilities employers reported the greatest difficulty hiring workers (Figure 29), with nearly all of the employers in these industries reporting at least some difficulty finding qualified workers. Construction employers had the highest percentage of employers reporting that hiring was “very difficult” among all water power EPG industries, at 50%. Wholesale trade reported the least difficulty hiring, with 33% stating that it was “not at all difficult,” although 67% still reported hiring difficulty.

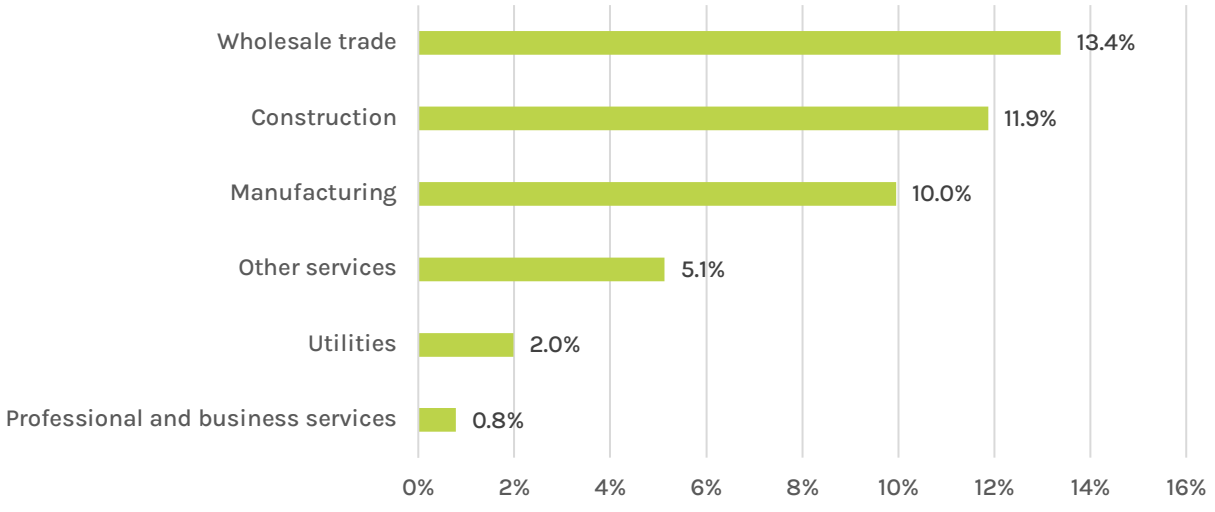
Figure 29. Water Power EPG Employers' Perceived Hiring Difficulty by Industry



Employment Change by Industry

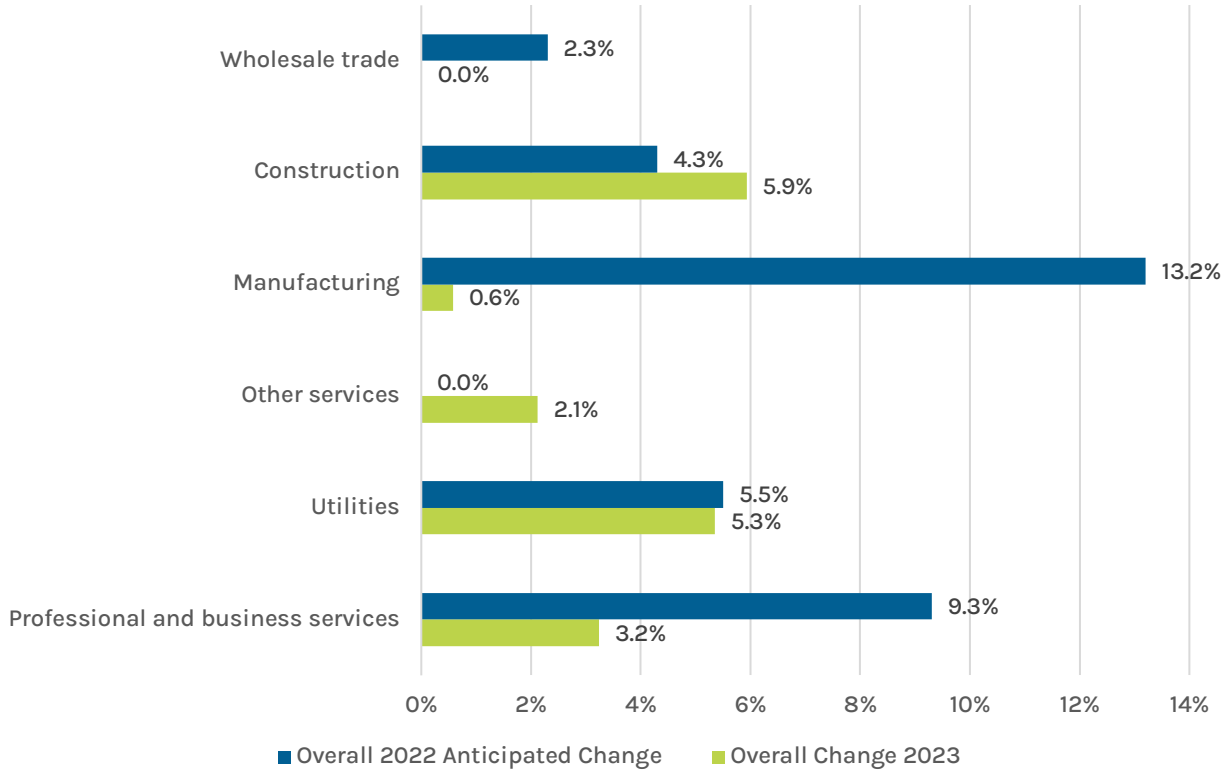
The previous section highlighted employers' current hiring difficulty across industry, whereas this section focuses on anticipated employment change by industry within water power EPG. This section also compares anticipated employment change in 2022 to the actual employment change over the last year. Wholesale trade establishments anticipate strong job growth in 2024 (13.4%), as do businesses engaged in construction (11.9%) and manufacturing (10%) (Figure 30).

Figure 30. Anticipated 2024 Changes in Water Power EPG Employment



From 2022 to 2023, wholesale trade, manufacturing, professional and business services, and utilities businesses did not grow as expected, while construction and other services businesses grew more rapidly than expected (Figure 31).

Figure 31. Water Power EPG Actual Employment Change 2022-2023 vs. Anticipated Employment Change 2022



Water Power EPG Workforce Demographics

The water power EPG workforce had a higher concentration of female workers (29%) than the overall energy workforce (26%), but a lower concentration than the national workforce (47%). The water power EPG workforce had a smaller share of male workers (71%) than the overall energy workforce (73%) but a higher share than the national workforce average (53%) (Table 9).

The percentage of non-white workers in the water power EPG workforce was 30%, which is higher than the energy workforce average of 26% and the national workforce average of 24%. This is attributable to a higher-than-average proportion of Asian workers in the water power EPG workforce (10%) compared to the overall energy workforce (7%) and a higher-than-average proportion of Black or African American workers in the water power EPG workforce (11%) compared to the overall energy workforce (9%). Workers of American Indian or Alaska Native descent were similarly represented in the water power EPG workforce (2%) and the overall energy workforce (2%). Similarly, Native Hawaiian or other Pacific Islanders were equally represented in the water power EPG workforce (1%) and the overall energy workforce (1%). Individuals of two or more races in the water power EPG workforce (4%) were less highly represented than in the overall energy workforce (5%). The percentage of Hispanic or Latino workers in the water power EPG workforce (18%) was the same as the energy workforce average (18%) and lower than the U.S. workforce average (19%).

The proportion of veterans in the water power EPG workforce (9%) was the same as the energy workforce average (9%) and nearly double the national workforce average of 5%. Formerly incarcerated individuals in the water power EPG workforce (3%) were more highly represented than in the overall energy workforce (1%) and the national workforce (2%). The proportion of workers requesting accommodations for disabilities in the water power EPG workforce (2%) was the same as the energy workforce average (2%) but lower than the national workforce average (5%).

The water power EPG workforce tended to be more middle-aged than the overall energy workforce, with 55% of workers aged between 30 and 54 years old compared with the 52% energy workforce average. The water power EPG workforce had fewer workers under the age of 30 (26%) than the overall energy workforce (29%), and more workers aged 55 or older (19%) compared to the overall energy workforce (18%).

The concentration of workers represented by a union or covered under a project labor or collective bargaining agreement in the water power EPG workforce (13%) was higher than the energy workforce average (11%) and the national private sector average (7%).

Table 9. Water Power Electric Power Generation Workforce Demographics and Characteristics

	Number of Workers	Water Power EPG Average	Energy Workforce Average	National Workforce Average
Male	48,371	71%	73%	53%
Female	19,621	29%	26%	47%
Gender Nonbinary	379	<1%	<1%	n/a
Hispanic or Latino	12,164	18%	18%	19%
Not Hispanic or Latino	56,208	82%	82%	81%
American Indian or Alaska Native	1,205	2%	2%	1%
Asian	6,955	10%	7%	7%
Black or African American	7,365	11%	9%	13%
Native Hawaiian or Other Pacific Islander	853	1%	1%	<1%
White	47,925	70%	74%	76%
Two or More Races	2,728	4%	5%	3%
Unknown Race	1,356	2%	2%	n/a
Veterans	6,212	9%	9%	5%
18 to 29	18,106	26%	29%	22%
30 to 54	37,407	55%	52%	53%
55 and Over	12,858	19%	18%	23%
Disability	1,459	2%	2%	5%
Formerly Incarcerated	1,975	3%	1%	2%
Represented by Unions, Collective Bargaining Agreements, and/or Project Labor Agreements	8,842	13%[33]	11%	7%

National sources: BLS (2023a, 2023b, 2023c, 2023d), Jobs EQ (2023), Prison Policy (2018)

[33] Unionization rates vary by state.

Combined Heat and Power Electric Power Generation

Combined heat and power (CHP) EPG employed 30,643 workers in 2023, up 925 (3.1%) from 2022 and up 2,536 (9%) from 2020.

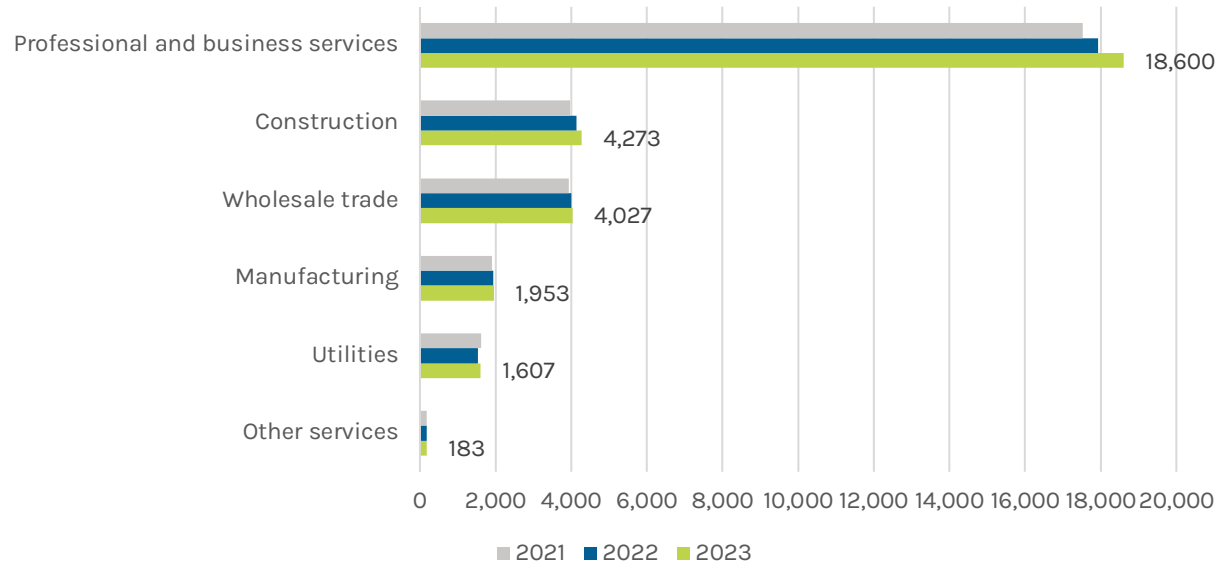
Trends and Key Takeaways

- The largest job gains were in the professional and business services industry, which added 679 new jobs (3.8%). Construction businesses added the second largest number of employees from 2022 to 2023 (133 workers or 3.2%). Utilities businesses expanded by the greatest percentage, adding 67 jobs and increasing 4.4%.
- CHP EPG employers in five out of six industries anticipate growth in 2024, with only professional and business services businesses anticipating a decline.
- The percentage of workers in CHP EPG represented by a union or covered under a project labor or collective bargaining agreement (13%) was higher than the overall energy workforce average (11%) and the national private sector average (7%).
- The CHP EPG workforce had a larger share of female workers (30%) than in the overall energy workforce (26%), but a smaller share than the national workforce average (47%). The CHP EPG workforce had a smaller share of male workers (69%) than in the overall energy workforce (73%), but a larger share than the national workforce average (53%).
- The percentage of non-white workers in the CHP EPG workforce (26%) was similar to the energy workforce average (26%) and higher than the national workforce average (24%).
- Black or African American workers were underrepresented in the CHP EPG workforce, making up 8% of the workforce compared to 9% of the overall energy workforce and 13% of the U.S. workforce overall.
- Hispanic or Latino workers constituted a larger share of the CHP EPG workforce (20%) than the overall energy workforce (18%) and the national workforce (19%).
- Veterans were more highly represented in the CHP EPG workforce (11%) than in the energy workforce (9%) and national workforce overall (5%).
- The proportion of workers requesting accommodations for disabilities in the CHP EPG workforce (2%) was the same as the energy workforce average (2%) and lower than the U.S. economy-wide workforce average (5%).
- Formerly incarcerated workers were more highly represented in the CHP EPG workforce (2%) than in the overall energy workforce (1%) but were similarly represented in the national workforce (2%).

Employment by Industry

The professional services industry had the largest number of CHP EPG employees, with 18,600 workers (Figure 32). This industry also gained the largest number of new jobs in 2023 (679 jobs or 3.8%). Utilities experienced the highest job growth rate (4.4%). Every industry had more employees in 2023 than in 2020, except for utilities, which had 1,607 employees in 2023, compared to 1,664 in 2020.

Figure 32. CHP EPG Employment by Industry



Employer Perspective on Workforce Issues

Current Hiring Difficulty

Within CHP EPG, the construction industry reported the greatest difficulty hiring workers (Figure 33), with 95% indicating that it was “very difficult” or “somewhat difficult” to find employees, down slightly from 100% in 2022. Wholesale trade businesses had the highest percentage of employers reporting that it was “very difficult” to find workers (29%). Manufacturing reported the least difficulty hiring, with 38% of employers indicating it was “not at all difficult” hiring qualified workers.

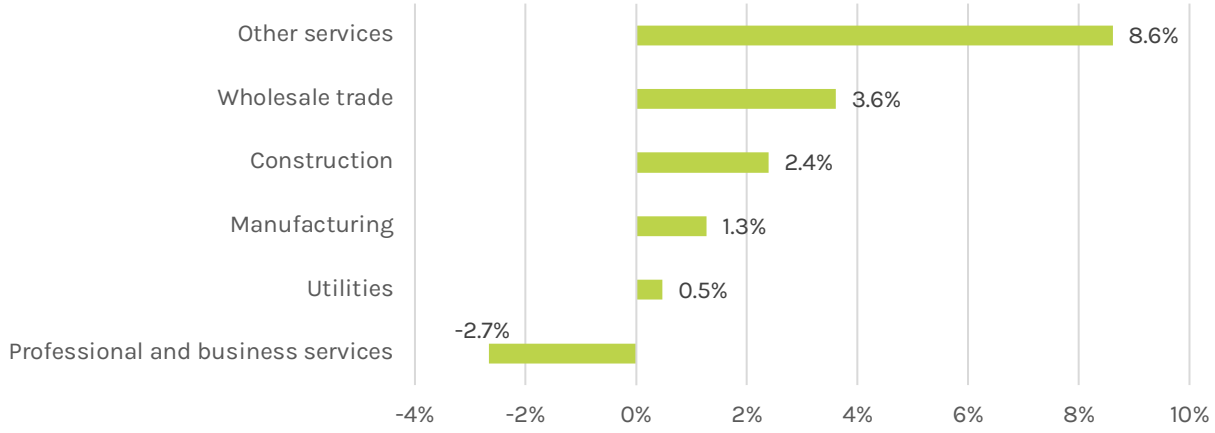
Figure 33. CHP EPG Employers' Perceived Hiring Difficulty

Employment Change by Industry

The previous section highlighted employers' current hiring difficulty across industry, whereas this section focuses on anticipated employment change by industry within CHP EPG. This section also compares anticipated employment change in 2022 to actual employment change over the last year.

Employers in the other services (8.6%) and wholesale trade (3.6%) industries expect above-average job growth 2024, while businesses in construction (2.4%), manufacturing (1.3%), and utilities (0.5%) expect below-average job growth (Figure 34).[34] Professional and business services businesses in CHP EPG anticipate losing employment over 2024.

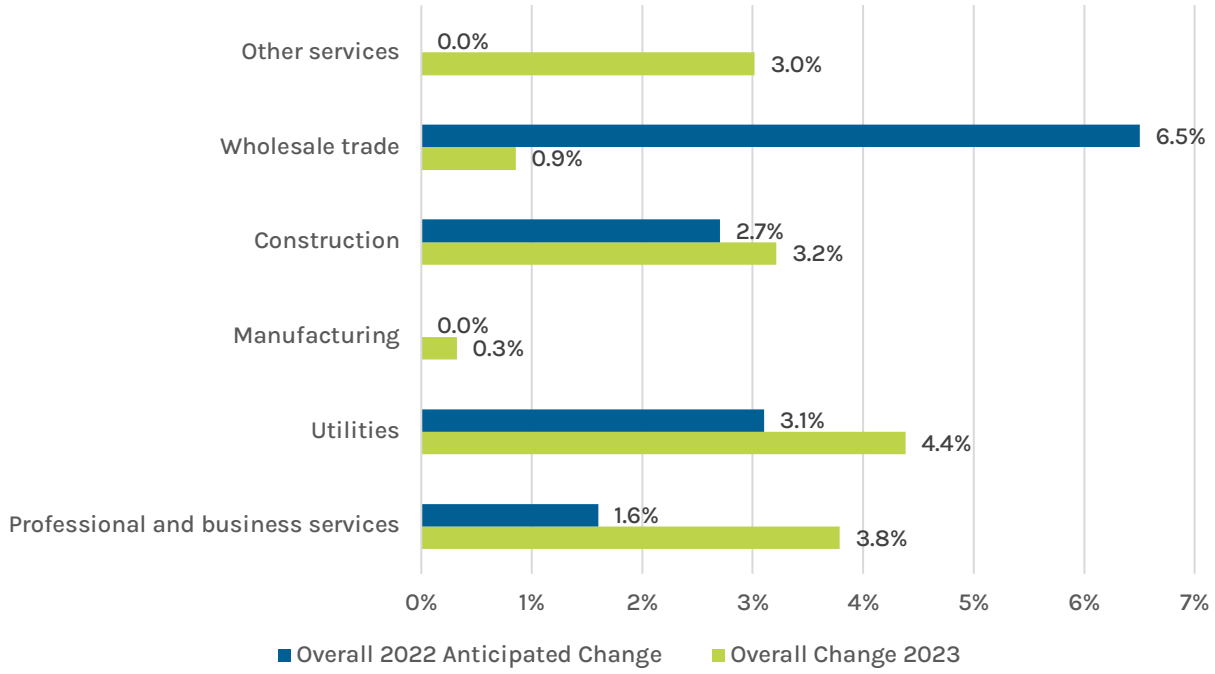
Figure 34. Anticipated 2024 Changes in CHP EPG Employment



[34] Average growth refers to CHP EPG overall growth from 2022 to 2023 (3.1%).

Most industries in CHP EPG grew faster than expected in 2023, except for wholesale trade (Figure 35). Utilities experienced the fastest job growth from 2022 to 2023 after losing employment in the previous year.

Figure 35. CHP EPG Actual Employment Change 2022-2023 vs. Anticipated Employment Change 2022



CHP EPG Demographics

Demographics for the CHP EPG workforce are displayed in Table 10. The CHP EPG workforce had a smaller share of male workers (69%) compared to the overall energy workforce average (73%) but a larger share than the national workforce average (53%). The CHP EPG workforce had a larger share of female workers (30%) than the overall energy workforce average (26%) but a lower share than the national workforce average (47%).

The percentage of non-white workers employed in the CHP EPG workforce (26%) was the same as the national energy workforce average (26%) and higher than the national workforce average (24%). This is attributable to a higher-than-average proportion of workers of unknown race[35] in the CHP EPG workforce (3%) compared to the energy workforce average (2%) and a higher-than-average proportion of Asian workers in the CHP EPG workforce (8%) compared to the energy workforce average (7%). American Indian or Alaska Native workers in the CHP EPG workforce (1%) were less highly represented than in the overall energy workforce (2%). The proportion of the CHP EPG workforce made up of Hispanic or Latino workers (20%) was higher than the energy workforce average (18%) and the national workforce average (19%).

[35] As reported by employers.

Black or African American workers in the CHP EPG workforce (8%) were less highly represented than in the overall energy workforce (9%) and the U.S. workforce overall (13%).

The proportion of veterans in the CHP EPG workforce (11%) was higher than in the overall energy workforce (9%) and the national workforce (5%). The share of formerly incarcerated workers in the CHP EPG workforce (2%) is on par with the national workforce average (2%) and higher than the energy workforce average (1%). The proportion of workers requesting accommodations for disabilities in the CHP EPG workforce (2%) was the same as the energy workforce average (2%) but lower than the overall U.S. workforce average (5%).

The CHP EPG workforce was older than the overall energy workforce, with 22% of workers aged 55 and over compared to 18% for the overall energy workforce. The proportion of workers under the age of 30 in the CHP EPG workforce (28%) was lower than in the overall energy workforce (29%), and the proportion of workers between the ages of 30 and 54 in the CHP EPG workforce (50%) was lower than in the overall energy workforce (52%).

The concentration of workers represented by a union or covered under a project labor or collective bargaining agreement in the CHP EPG workforce (13%) was higher than the energy workforce average (11%) and the national private sector average (7%).

Table 10. Combined Heat and Power Electric Power Generation Workforce Demographics and Characteristics

	Number of Workers	CHP EPG Average	Energy Workforce Average	National Workforce Average
Male	21,218	69%	73%	53%
Female	9,326	30%	26%	47%
Gender Nonbinary	99	<1%	<1%	n/a
Hispanic or Latino	6,163	20%	18%	19%
Not Hispanic or Latino	24,480	80%	82%	81%
American Indian or Alaska Native	357	1%	2%	1%
Asian	2,554	8%	7%	7%
Black or African American	2,314	8%	9%	13%
Native Hawaiian or Other Pacific Islander	267	<1%	1%	<1%
White	22,641	74%	74%	76%
Two or More Races	1,615	5%	5%	3%
Unknown Race	900	3%	2%	n/a
Veterans	3,355	11%	9%	5%
18 to 29	8,494	28%	29%	22%
30 to 54	15,465	50%	52%	53%
55 and Over	6,683	22%	18%	23%
Disability	705	2%	2%	5%
Formerly Incarcerated	681	2%	1%	2%
Represented by Unions, Collective Bargaining Agreements, and/or Project Labor Agreements	3,895	13%[36]	11%	7%

National sources: BLS (2023a, 2023b, 2023c, 2023d), Jobs EQ (2023), Prison Policy (2018)

[36] Unionization rates vary by state.

Oil Electric Power Generation

Oil EPG,[37] primarily related to peaking plants,[38] employed 12,337 workers in 2023, up 318 (2.6%) from 2022.

Trends and Key Takeaways

- The largest job gains were in the professional and business services industry, which added 154 new jobs (3.6%), followed by wholesale trade (108 jobs), and utilities (43 jobs). Other services and manufacturing employment within oil EPG remained static.
- Utilities (7.1%), other services (5.3%), wholesale trade (3.2%), and manufacturing (2.8%) businesses anticipate job growth in 2024.
- The percentage of workers in oil EPG represented by a union or covered under a project labor or collective bargaining agreement (10%) was lower than the energy workforce average (11%) but higher than the overall national private sector average (7%).
- Oil EPG workers were predominantly male (73%), similar to the overall energy workforce (73%) and significantly higher than the U.S. workforce average (53%).
- The proportion of non-white workers in the oil EPG workforce (28%) was higher than the energy workforce average (26%) and the national workforce average (24%). This is attributable to Asian workers being more concentrated in the oil EPG workforce (10%) than in the energy workforce overall (7%).
- The proportion of workers that were two or more races in the oil EPG workforce (5%) was similar to the overall energy workforce average (5%). Similarly, the proportion of workers of Native Hawaiian or Pacific Islander descent in the oil EPG workforce (1%) was the same as the energy workforce average (1%). American Indian or Alaska Native workers were less highly represented in the oil EPG workforce (1%) than in the overall energy workforce (2%).
- Oil EPG businesses employed Black or African American workers at similar rate (9%) to the overall energy workforce (9%), though below the economy-wide average (13%).
- The same proportion of veterans working in oil EPG (9%) was the same as the energy workforce overall (9%) but was higher than the national workforce average (5%).
- Workers requesting accommodations for disabilities in the oil EPG workforce (3%) were employed at a higher rate compared to the overall energy workforce (2%) but at a lower rate than in the national workforce (5%).

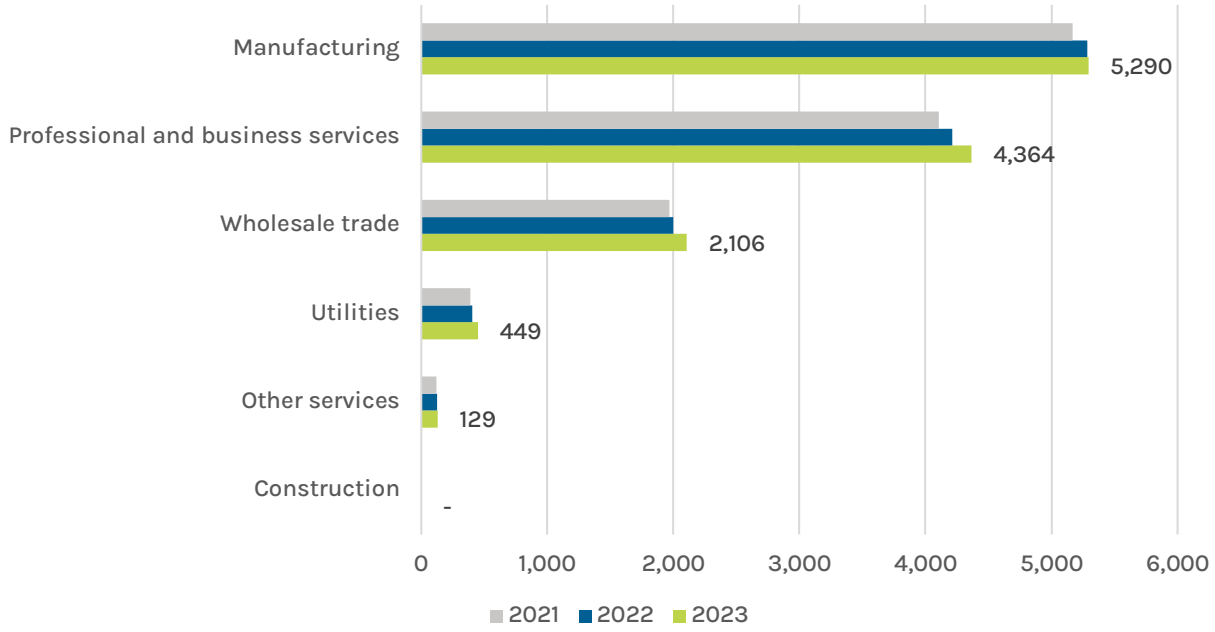
[37] These job numbers do not include extraction, which is covered in the Fuels and Multi-Sector sections of this report.
[38] These are also known as "peaker plants."

- The percentage of formerly incarcerated individuals in the oil EPG workforce (2%) was higher than in the overall energy workforce (1%) but on par with the U.S. workforce (2%).

Employment by Industry

The largest number of oil EPG employees was in the manufacturing industry, which accounted for 5,290 workers (Figure 36). The professional and business services industry had the largest job gains, with 154 new jobs (3.6%) from 2022 to 2023.

Figure 36. Oil EPG Employment by Industry

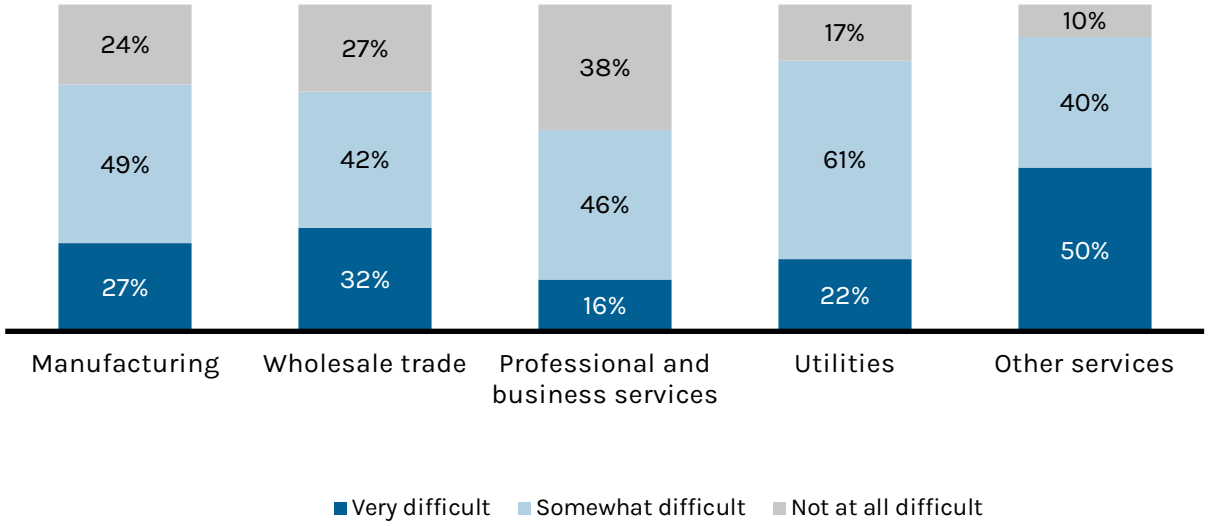


Employer Perspective on Workforce Issues

Current Hiring Difficulty

The other services industry reported the highest hiring difficulty, with 90% of respondents indicating it was “very difficult” or “somewhat difficult” to find employees (Figure 37). Professional and business services had the lowest hiring difficulty, with 38% of employers reporting that it was “not at all difficult” to find workers.

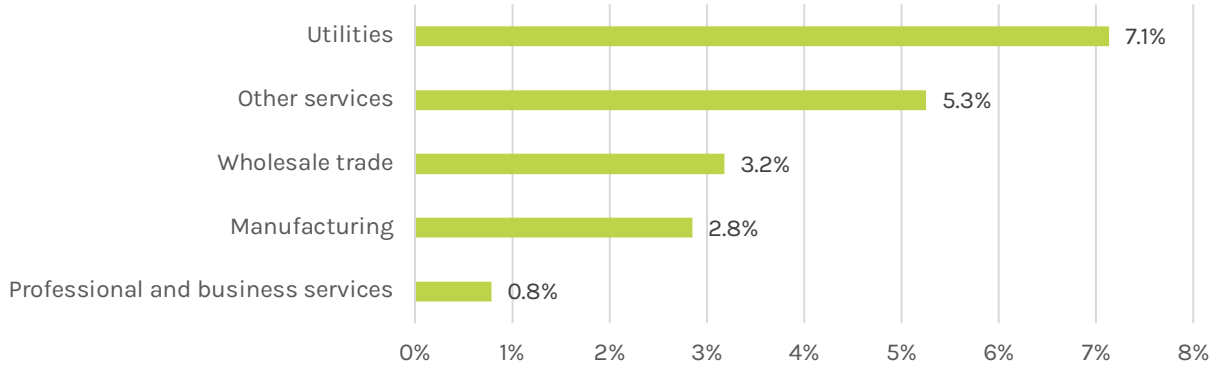
Figure 37. Oil EPG Employers' Perceived Hiring Difficulty by Industry



Employment Change by Industry

The previous section highlighted employers' current hiring difficulty across industry, whereas this section focuses on anticipated employment change by industry within oil EPG. This section also compares anticipated employment change in 2022 to the actual employment change over the last year. As shown in Figure 38, employers across all industries expect to grow over 2024. Utilities (7.1%), other services (5.3%), wholesale trade (3.2%), and manufacturing (2.8%) employers expect above-average job growth,[39] while professional and business services (0.8%) expect lower than average growth in the next year.

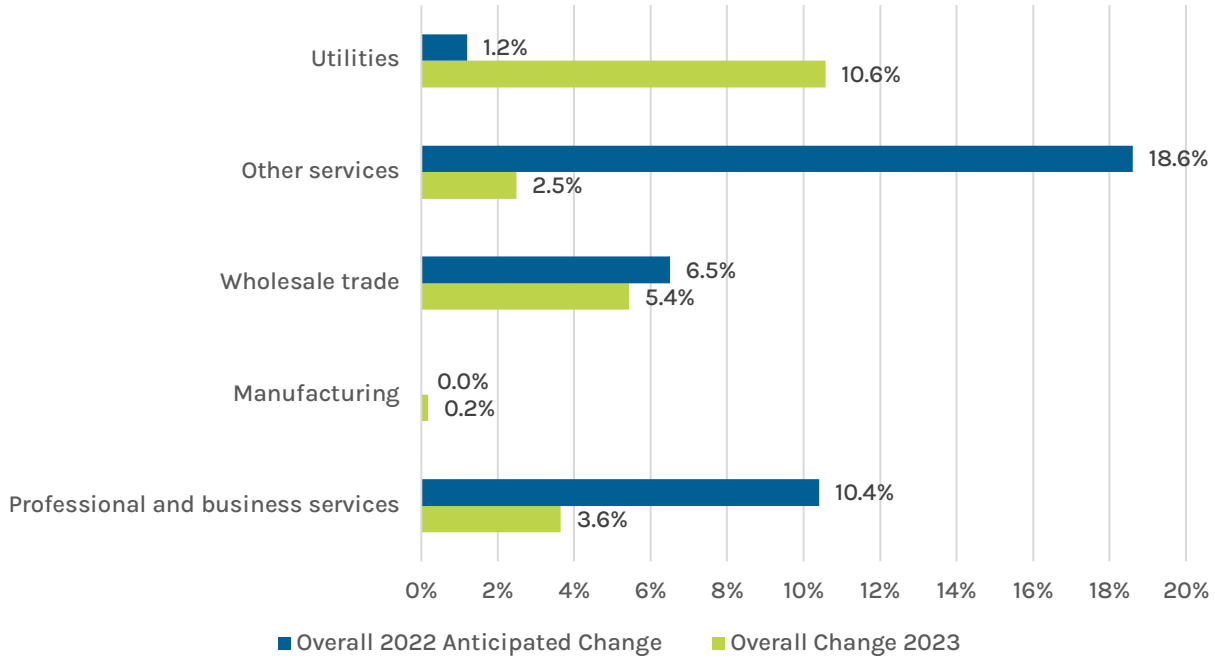
Figure 38. Anticipated 2024 Changes in Oil EPG Employment



[39] "Above-average" refers to anticipated growth higher than historical growth for a technology (2.6% for oil EPG, 2022 to 2023).

Utilities employers exceeded growth expectations, while wholesale trade, professional and business services, and other services businesses did not grow as anticipated (Figure 39). Manufacturing predicted no growth and experienced flat growth (0.2%) from 2022 to 2023.

Figure 39. Oil EPG Actual Employment Change 2022-2023 vs. Anticipated Employment Change 2022



Oil EPG Workforce Demographics

Male workers made up 73% of the oil EPG workforce compared to 73% of the overall energy workforce and 53% of the national workforce overall (Table 11).

The proportion of non-white workers in oil EPG (28%) was higher than the energy workforce average (26%) and the national workforce average (24%). This is attributable to a higher-than-average proportion of Asian workers in the oil EPG workforce (10%) compared to the overall energy workforce (7%). The proportion of workers of two or more races in the oil EPG workforce (5%) was the same as the overall energy workforce (5%), and the proportion of Native Hawaiian or other Pacific Islander workers in the oil EPG workforce (1%) was the same as in the overall energy workforce (1%). American Indian or Alaska Native workers in the oil EPG workforce (1%) were less represented than in the overall energy workforce (2%). The proportion of the oil EPG workforce made up of Hispanic or Latino workers (19%) was slightly higher than the overall energy workforce average (18%), but similar to the overall U.S. workforce (19%).

The concentration of veterans in the oil EPG workforce (9%) was the same as the energy workforce average (9%) and higher than the national workforce average (5%). The oil EPG workforce age distribution was comparable to that of the overall energy workforce, albeit

slightly higher in workers aged between 30 and 54 years old (53% for the oil EPG workforce as compared to 52% for the energy workforce as a whole) and slightly lower in workers aged 55 or older (17% for the oil EPG workforce as compared to 18% for the energy workforce as a whole).

The concentration of oil EPG workers represented by a union or covered under a project labor or collective bargaining agreement (10%) was lower than the energy workforce average (11%) but higher than the national private sector average (7%).

Table 11. Oil EPG Workforce Demographics and Characteristics

	Number of Workers	Oil EPG Average	Energy Workforce Average	National Workforce Average
Male	8,972	73%	73%	53%
Female	3,351	27%	26%	47%
Gender Nonbinary	14	<1%	<1%	n/a
Hispanic or Latino	2,325	19%	18%	19%
Not Hispanic or Latino	10,012	81%	82%	81%
American Indian or Alaska Native	183	1%	2%	1%
Asian	1,181	10%	7%	7%
Black or African American	1,116	9%	9%	13%
Native Hawaiian or Other Pacific Islander	159	1%	1%	<1%
White	8,922	72%	74%	76%
Two or More Races	587	5%	5%	3%
Unknown Race	193	2%	2%	n/a
Veterans	1,066	9%	9%	5%
18 to 29	3,637	29%	29%	22%
30 to 54	6,576	53%	52%	53%
55 and Over	2,124	17%	18%	23%
Disability	329	3%	2%	5%
Formerly Incarcerated	239	2%	1%	2%
Represented by Unions, Collective Bargaining Agreements, and/or Project Labor Agreements	1,258	10%[40]	11%	7%

National sources: BLS (2023a, 2023b, 2023c, 2023d), Jobs EQ (2023), Prison Policy (2018)

[40] Unionization rates vary by state.

Bioenergy Electric Power Generation

Bioenergy EPG employed 12,857 workers in 2023, representing static growth from 2022 (0.1%).

Trends and Key Takeaways

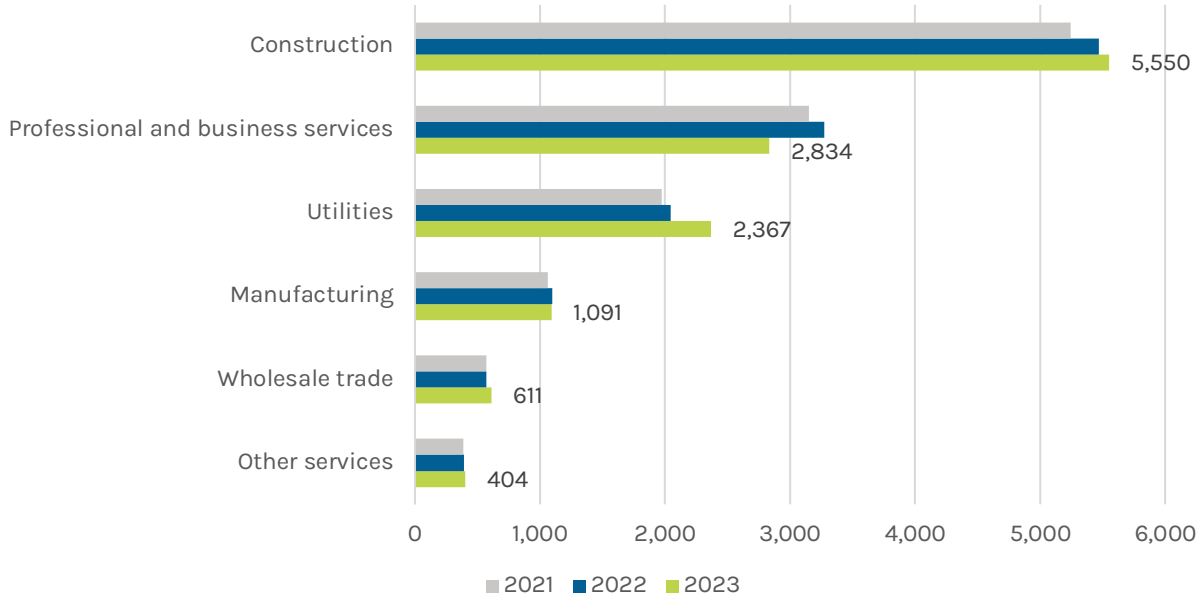
- The largest job gains were in the utilities industry, which added 321 new jobs (15.7%), followed by construction (82 jobs), and wholesale trade (38). Professional and business services jobs decreased by 436, a decline of 13.3%.
- Businesses across all industries in bioenergy EPG expect to see above-average job growth through 2024.[41]
- The percentage of workers in bioenergy EPG represented by a union or covered under a project labor or collective bargaining agreement (12%) was slightly higher than the overall energy workforce (11%) and higher than the national private sector average (7%).
- The bioenergy EPG workforce employed a higher percentage of women (31%) than the overall energy workforce (26%) but lower than the economy-wide workforce average (47%).
- The percentage of non-white workers in bioenergy EPG (28%) was higher than the energy workforce average (26%) and the national workforce average (24%). This is partially attributable to Asian workers being more concentrated in the bioenergy EPG workforce (9%) than in the overall energy workforce (7%).
- The percentage of American Indian or Alaska Native workers in bioenergy EPG (2%) was the same as the overall energy workforce average (2%).
- Bioenergy EPG businesses employed Black or African American workers at a higher rate (10%) than energy employers overall (9%) but at a lower rate than the national workforce average (13%).
- Hispanic or Latino workers were slightly more represented in the bioenergy EPG workforce (19%) than in the overall energy workforce (18%).
- Veterans were more represented in the bioenergy EPG workforce (11%) than in the energy workforce overall (9%) and the national workforce overall (5%).
- Workers requesting accommodations for disabilities were more represented in the bioenergy EPG workforce (3%) than in the overall energy workforce (2%) but were less represented when compared to the overall U.S. workforce (5%).
- The percentage of formerly incarcerated workers in the bioenergy EPG workforce (1%) was the same as the overall energy workforce average (1%) and lower than the national workforce average as a whole (2%).

[41] Average growth refers to past growth for bioenergy EPG (0.1%).

Employment by Industry

The construction industry had the largest number of bioenergy EPG employees, with 5,550 workers (Figure 40). Utilities added the largest number of new jobs (321 jobs or a 15.7% growth rate), while professional and business services lost the largest number of workers (-436 jobs or -13.3%).

Figure 40. Bioenergy EPG Employment by Industry

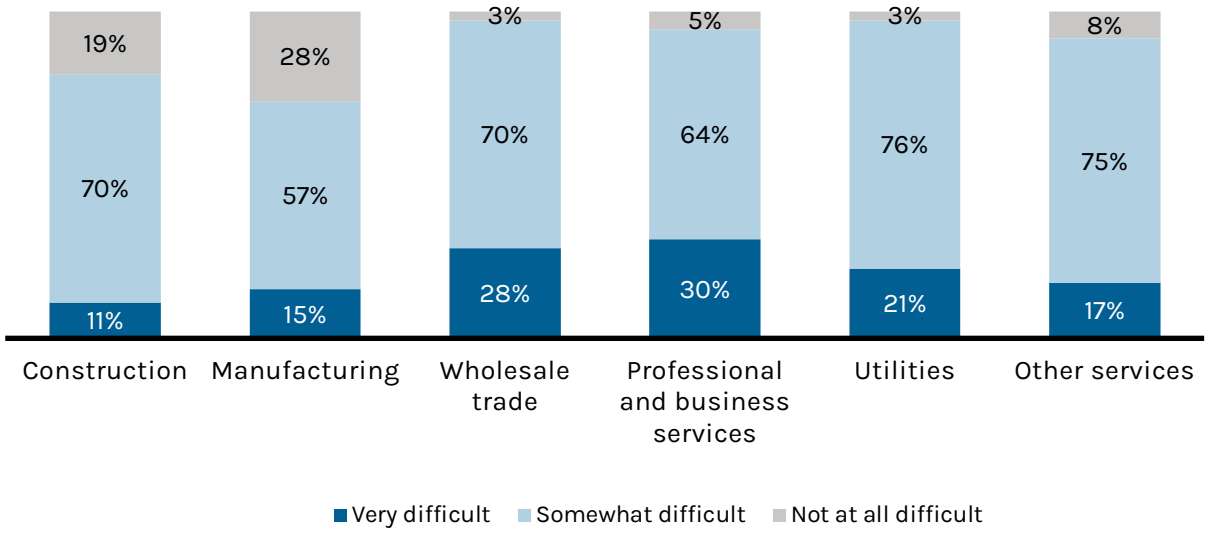


Employer Perspective on Workforce Issues

Current Hiring Difficulty

Within bioenergy EPG, utilities and wholesale trade employers reported the greatest difficulty hiring workers (Figure 41) with 97% of these employers reporting at least some difficulty finding qualified workers. Manufacturing businesses reported the lowest difficulty, with 28% reporting hiring was “not at all difficult.”

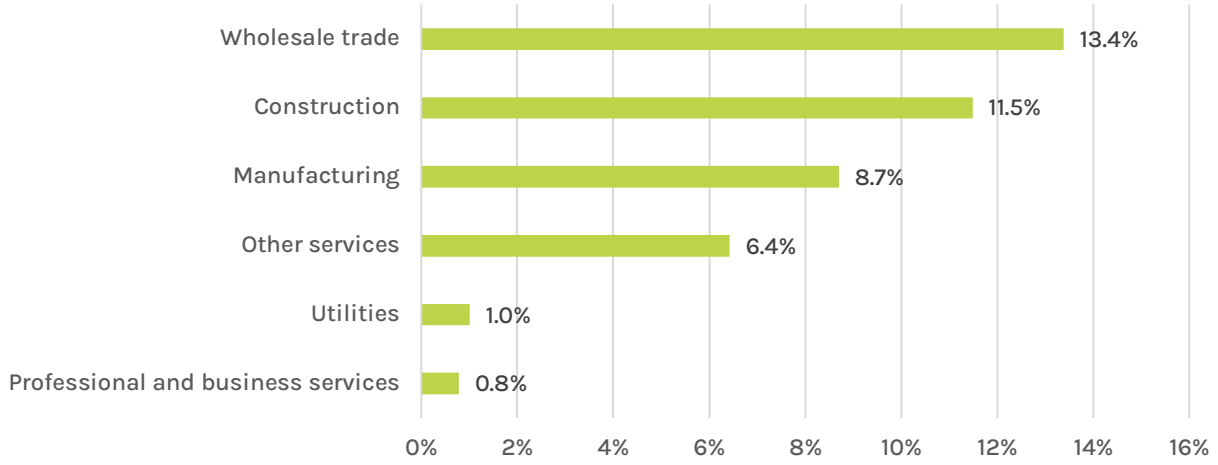
Figure 41. Bioenergy EPG Employers' Perceived Hiring Difficulty



Employment Change by Industry

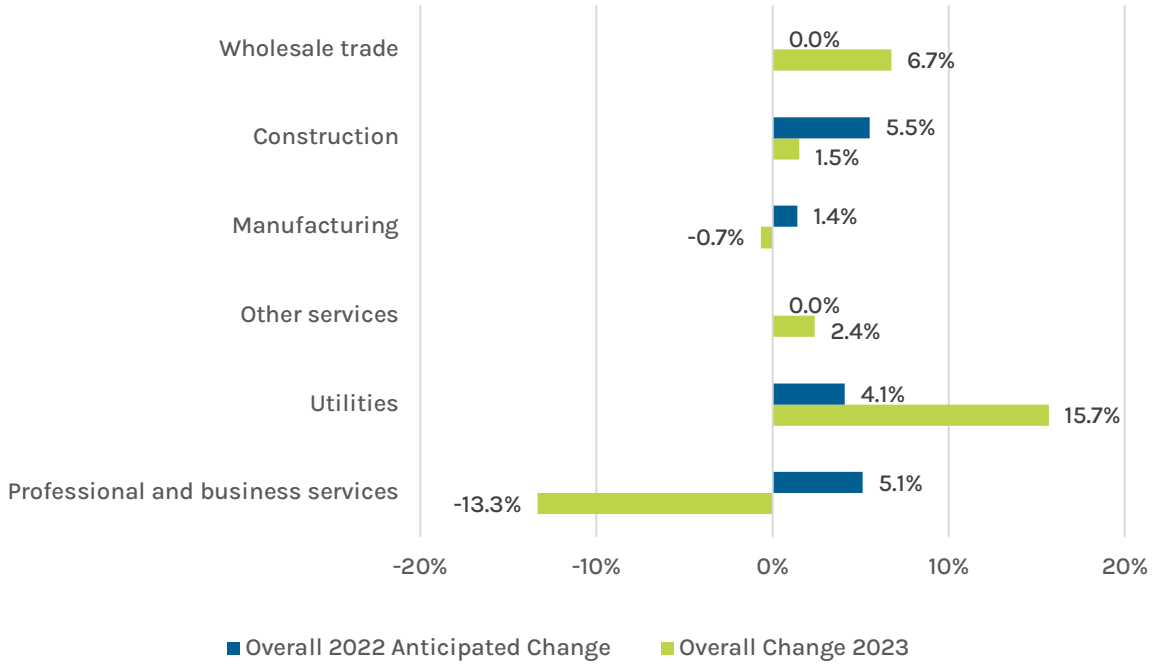
The previous section highlighted employers' current hiring difficulty across industry, whereas this section focuses on anticipated employment change by industry within bioenergy EPG. This section also compares anticipated employment change in 2022 to actual employment change over the last year. As illustrated in Figure 42, all industries in bioenergy EPG expect job growth in 2024: wholesale trade employers predict the highest level of growth (13.4%), followed by construction (11.5%), manufacturing (8.7%), other services (6.4%), utilities (1%), and professional and business services (0.8%).

Figure 42. Anticipated 2024 Changes in Bioenergy EPG Employment



Growth in 2023 exceeded expectations in half of all industries in bioenergy EPG: utilities, wholesale trade, and other services. Construction, manufacturing, and professional and business services either grew slower than predicted or lost employment from 2022 to 2023 (Figure 43).

Figure 43. Bioenergy EPG Actual Employment Change 2022-2023 vs. Anticipated Employment Change 2022



Bioenergy EPG Workforce Demographics

Bioenergy EPG employers employed female workers at a higher rate (31%) than the energy sector overall (26%) but at a lower rate than the national workforce (47%) (Table 12).

The proportion of the bioenergy EPG workforce made up of Hispanic or Latino workers (19%) was slightly higher than the energy workforce average (18%) and similar to the U.S. workforce average (19%).

Bioenergy EPG businesses employed non-white workers at a higher rate (28%) than the energy workforce (26%) and the national workforce (24%). This is attributable to higher-than-average proportions of Asian workers in the bioenergy EPG workforce (9%) than in the overall energy workforce (7%). American Indian or Alaska Native workers were similarly represented in the bioenergy workforce (2%) compared to the overall energy workforce (2%).

The proportion of veterans working in bioenergy EPG (11%) was higher than the energy workforce average (9%) and the national workforce average (5%). Individuals requesting accommodations for disabilities were employed in the bioenergy EPG workforce at a higher

rate (3%) than the overall energy workforce average (2%) and at lower rate than the economy-wide average (5%). The share of formerly incarcerated individuals working in bioenergy EPG (1%) was the same as in the overall energy workforce (1%) and lower than the national workforce average (2%). The share of workers represented by a union or covered under a project labor or collective bargaining agreement in bioenergy EPG (12%) was higher than the energy workforce average overall (11%) and even higher than the national private sector average (7%).

Workers under the age of 30 were less highly represented in the bioenergy EPG workforce (27%) than the overall energy workforce (29%), while workers aged 50 or older were more represented in the bioenergy EPG workforce (21%) than the overall energy workforce (18%).

Table 12. Bioenergy Workforce Demographics and Characteristics

	Number of Workers	Bioenergy EPG Average	Energy Workforce Average	National Workforce Average
Male	8,659	67%	73%	53%
Female	4,005	31%	26%	47%
Gender Nonbinary	193	1%	<1%	n/a
Hispanic or Latino	2,498	19%	18%	19%
Not Hispanic or Latino	10,359	81%	82%	81%
American Indian or Alaska Native	195	2%	2%	1%
Asian	1,123	9%	7%	7%
Black or African American	1,318	10%	9%	13%
Native Hawaiian or Other Pacific Islander	172	1%	1%	<1%
White	9,293	72%	74%	76%
Two or More Races	424	3%	5%	3%
Unknown Race	337	3%	2%	n/a
Veterans	1,431	11%	9%	5%
18 to 29	3,471	27%	29%	22%
30 to 54	6,634	52%	52%	53%
55 and Over	2,751	21%	18%	23%
Disability	339	3%	2%	5%
Formerly Incarcerated	180	1%	1%	2%
Represented by Unions, Collective Bargaining Agreements, and/or Project Labor Agreements	1,581	12%[42]	11%	7%

National sources: BLS (2023a, 2023b, 2023c, 2023d), Jobs EQ (2023), Prison Policy (2018)

[42] Unionization rates vary by state.

Other Electric Power Generation

"Other EPG" technologies — which include geothermal generation, generation from incineration of "other fuels" (waste, etc.), and employment that cannot be classified into other EPG categories — employed 53,854 workers in 2023, up 2,653 from 2022 (5.2%).

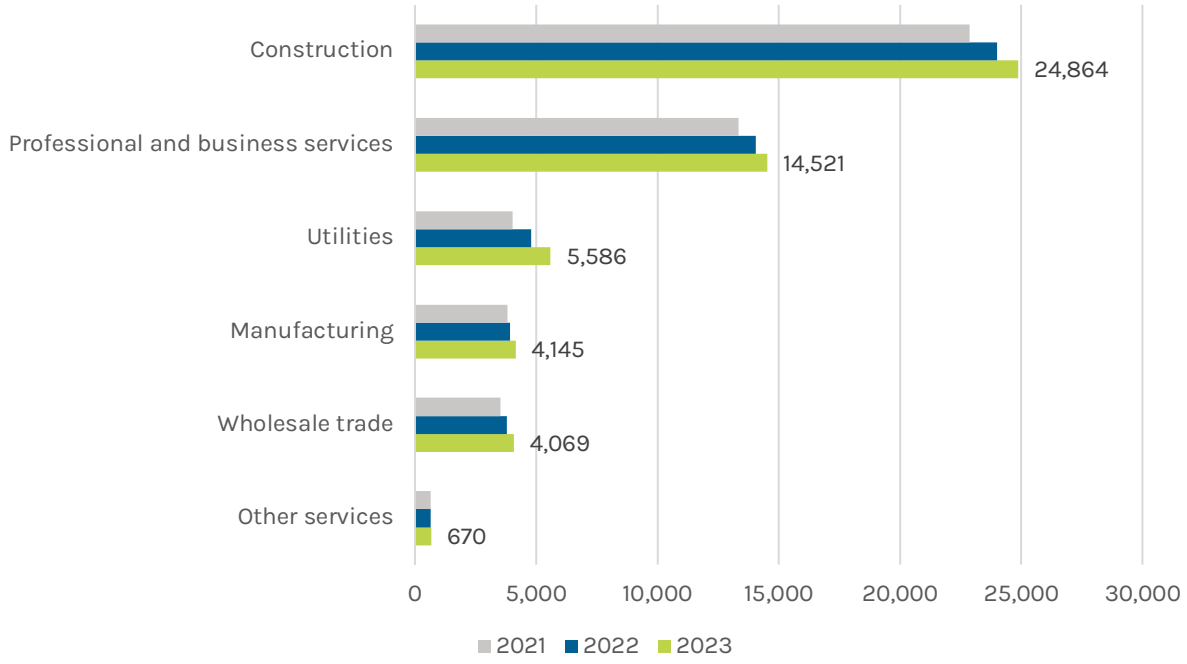
Trends and Key Takeaways

- The largest absolute job gains were in the construction industry, which added 864 new jobs (3.6%), followed by utilities (784 jobs), professional and business services (472), wholesale trade (289), and manufacturing (226). Other services employment within "other EPG" was relatively flat from 2022 to 2023.
- Other services businesses expect the highest job growth in 2023 (13.8%).
- The percentage of workers represented by a union or covered under a project labor or collective bargaining agreement in the "other EPG" workforce (5%) was lower than the energy workforce average (11%) and lower than the national private sector average (7%).
- The workforce in "other EPG" had higher female employee representation (30%) than the overall energy workforce (26%) and lower male employee representation (69%) compared to the overall energy workforce (73%).
- The proportion of Hispanic or Latino workers in "other EPG" (19%) was slightly higher than the overall energy workforce average (18%) but similar to the national workforce overall (19%).
- The percentage of non-white workers in the "other EPG" workforce (27%) was slightly higher than the energy workforce average (26%) and the U.S. overall workforce average (24%).
- The share of American Indian or Alaska Native workers in the "other EPG" workforce (1%) was lower than the energy workforce average (2%).
- Veterans were less highly represented in the "other EPG" workforce (7%) compared to the energy workforce average (9%) but were more highly represented than the national workforce average (5%).
- Those requesting accommodations for disabilities in the "other EPG" workforce (3%) were more highly represented than in the overall energy workforce (2%), but at a lower rate than the economy-wide average (5%).
- The percentage of formerly incarcerated workers in the "other EPG" workforce (2%) was higher than the energy workforce average (1%) but similar to the national workforce average (2%).

Employment by Industry

The largest number of "other EPG" employees were in the construction industry, which accounted for 24,864 workers (Figure 44). Construction businesses added the largest number of new jobs from 2022 to 2023 (864 jobs or 3.6%), while utilities grew at the fastest rate, expanding 16.3% (784 jobs).

Figure 44. "Other EPG" Employment by Industry

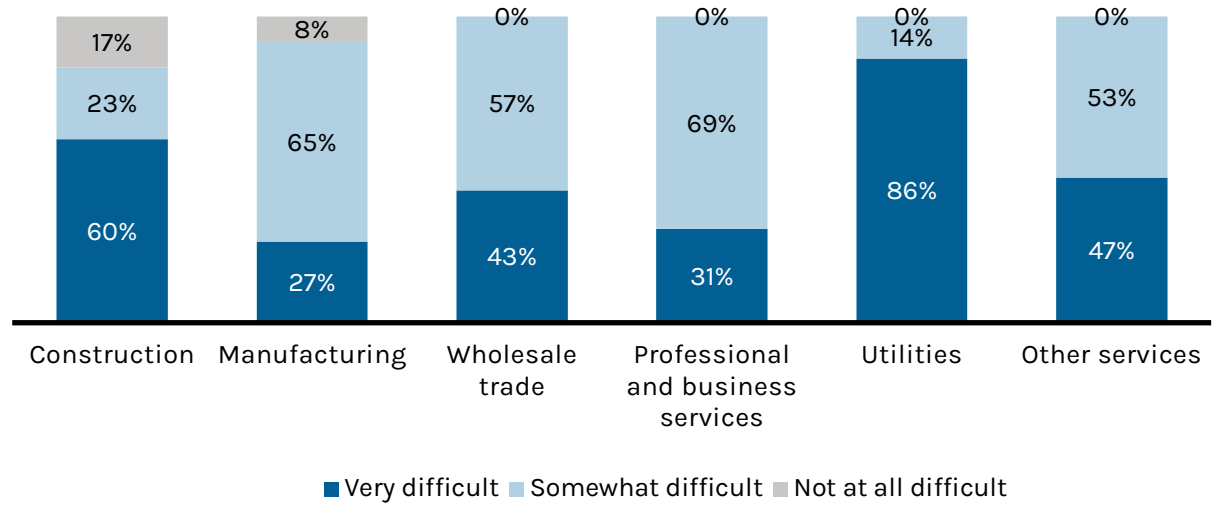


Employer Perspective on Workforce Issues

Current Hiring Difficulty

Within "other EPG" industries, utilities employers reported the greatest difficulty hiring workers (Figure 45) with 86% of utilities employers reporting that hiring was "very difficult."

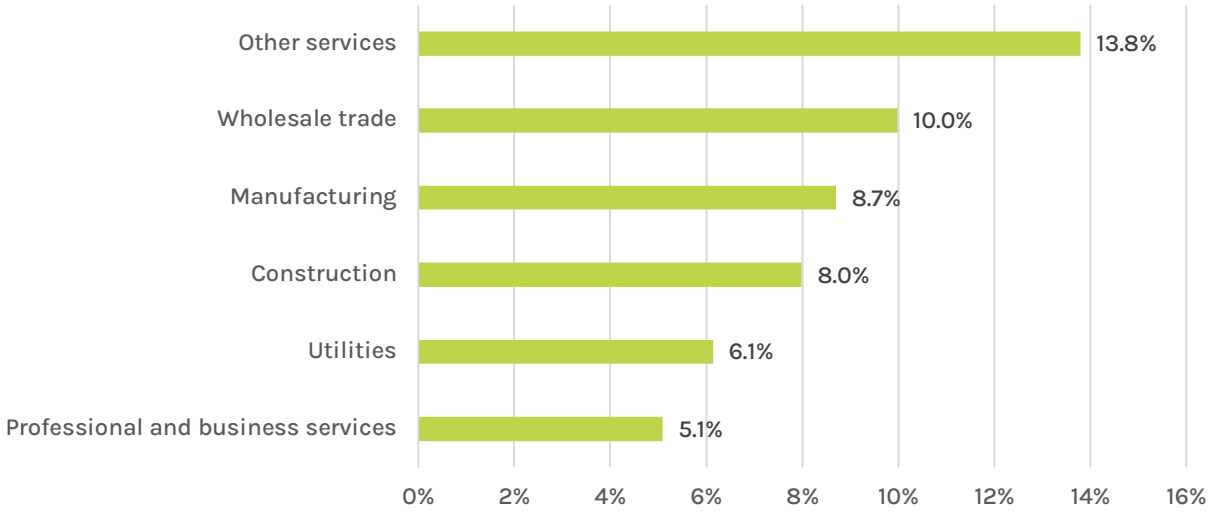
Figure 45. "Other EPG" Employers' Perceived Hiring Difficulty



Employment Change by Industry

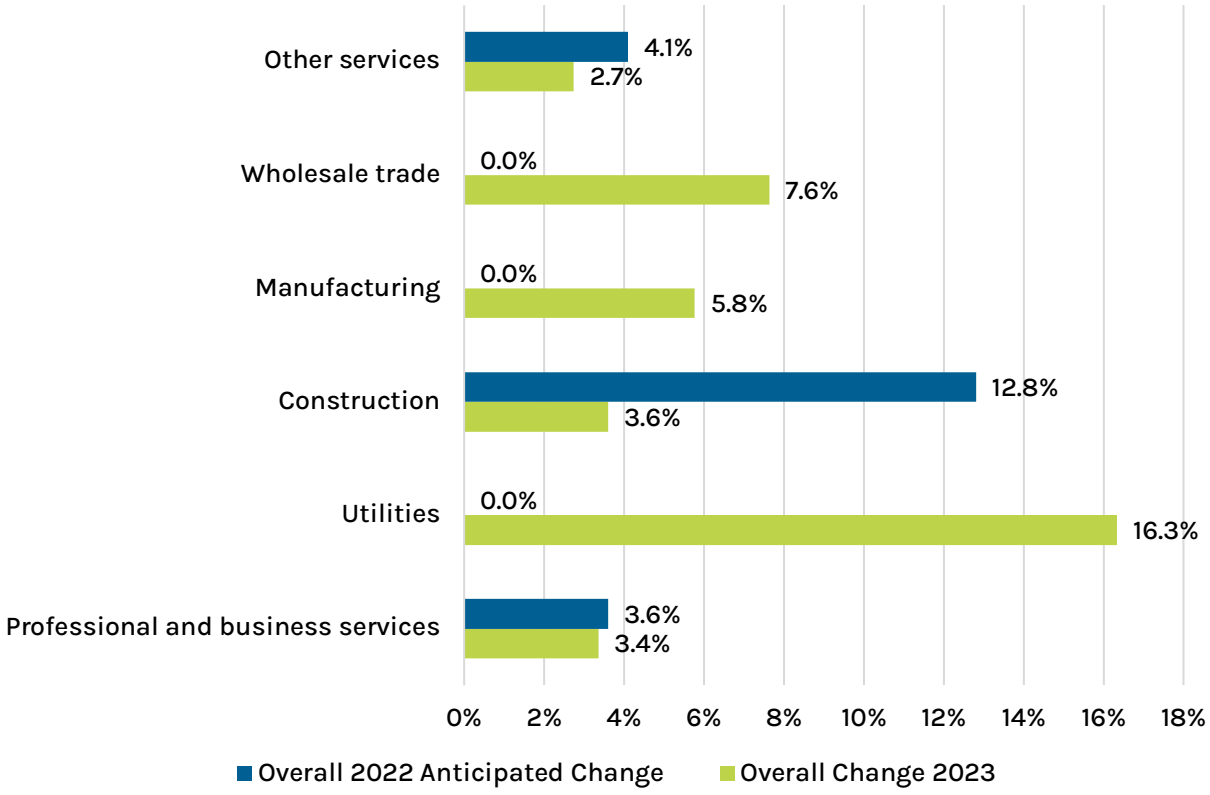
The previous section highlighted employers' current hiring difficulty across industry, whereas this section focuses on anticipated employment change by industry within "other EPG". This section also compares anticipated employment change in 2022 to actual employment change over the last year. As shown in Figure 46, all industries in "other EPG" anticipate growth through 2024: other services businesses predict the highest level of growth (13.8%), followed by wholesale trade (10%), manufacturing (8.7%), construction (8%), utilities (6.1%), and professional and business services (5.1%).

Figure 46. Anticipated 2024 Changes in "Other EPG" Employment



Job growth in 2023 exceeded expectations in three of six industry categories in "other EPG": utilities, wholesale trade, and manufacturing. Employers in those industries within "other EPG" predicted no growth over 2023. Construction, other services, and professional and business services experienced slower actual job growth from 2022 to 2023 compared to employer predictions in 2022 (Figure 47).

Figure 47. "Other EPG" Actual Employment Change 2022-2023 vs. Anticipated Employment Change 2022



"Other EPG" Workforce Demographics

Female workers on the "other EPG" workforce (30%) were more highly represented than in the overall energy workforce (26%) but at a lower rate than the national workforce average (47%). Male workers in the "other EPG" workforce (69%) were less highly represented than in the overall energy workforce (73%) but at a higher rate than in the national workforce (53%) (Table 13).

The proportion of the "other EPG" workforce made up of Hispanic or Latino workers (19%) was slightly higher than the overall energy workforce (18%) and on par with the U.S. workforce overall (19%).

The share of non-white workers in "other EPG" (27%) was higher than the energy workforce average (26%) and the national workforce average (24%).

Veterans working in "other EPG" (7%) were less highly represented than in the overall energy workforce (9%) but more highly represented than in the national workforce (5%). Workers represented by a union or covered under a project labor or collective bargaining agreement were less represented in "other EPG" (5%) when compared to the energy workforce as a whole (11%) and the national private sector as a whole (7%).

The proportion of workers under the age of 30 in "other EPG" (30%) was slightly higher than the overall energy workforce average (29%), while workers between the ages of 30 and 54 were more highly represented in the "other EPG" workforce (56%) than the overall energy workforce average (52%) and workers aged 55 or older were less represented in "other EPG" (14%) than in the overall energy workforce (18%).

Table 13. "Other EPG" Workforce Demographics and Characteristics

	Number of Workers	"Other EPG" Average	Energy Workforce Average	National Workforce Average
Male	37,305	69%	73%	53%
Female	16,241	30%	26%	47%
Gender Nonbinary	309	<1%	<1%	n/a
Hispanic or Latino	10,012	19%	18%	19%
Not Hispanic or Latino	43,842	81%	82%	81%
American Indian or Alaska Native	728	1%	2%	1%
Asian	5,340	10%	7%	7%
Black or African American	3,968	7%	9%	13%
Native Hawaiian or Other Pacific Islander	674	1%	1%	<1%
White	39,425	73%	74%	76%
Two or More Races	2,703	5%	5%	3%
Unknown Race	1,026	2%	2%	n/a
Veterans	3,943	7%	9%	5%
18 to 29	16,242	30%	29%	22%
30 to 54	30,260	56%	52%	53%
55 and Over	7,352	14%	18%	23%
Disability	1,419	3%	2%	5%
Formerly Incarcerated	902	2%	1%	2%
Represented by Unions, Collective Bargaining Agreements, and/or Project Labor Agreements	2,571	5%[43]	11%	7%

National sources: BLS (2023a, 2023b, 2023c, 2023d), Jobs EQ (2023), Prison Policy (2018)

[43] Unionization rates vary by state.

Transmission, Distribution & Storage

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Transmission, Distribution, and Storage

Transmission, distribution, and storage (TDS) includes a wide variety of industries, activities, and technologies related to constructing, operating, and maintaining energy transportation and storage infrastructure. Traditional transmission and distribution technologies are split between transmission and distribution of electricity and transportation of fuels. This includes employment associated with electric power transmission lines, pipeline construction, fuel distribution and transport, and the manufacture of equipment used for electrical transmission. Transportation of fuels is captured in pipeline transportation and commodity flows, which include truck, rail, air, and water transport. Employment pertaining to the storage of electricity and fuels is also included in this technology sector. Employment related to storage technologies such as batteries[44], pumped storage, compressed air, and other utility-scale storage methods is reported in this chapter. The TDS sector includes both legacy power lines and newer technologies such as microgrids and smart grids. In addition to the construction and operation of electricity and fuel transmission, distribution, and storage infrastructure, the TDS technology sector includes manufacturers and other suppliers, and various professional and technical service providers.

The TDS sector received unprecedented public investment in 2023, with nearly $5 billion of funding commitments from the Department of Energy in late October alone.[45] These investments include $3.5 billion in grant funding for projects in 44 states to strengthen the grid, $1.3 billion in new transmission lines in six states, and $750 million in block grants[46] to states to invest in strengthening and modernizing the grid.[47] These commitments are projected to continue to increase employment in this sector for years to come.[48]

[44] Battery storage is defined as using a cell or connected group of cells to convert chemical energy into electrical energy by reversible chemical reactions and that may be recharged by passing a current through it in the direction opposite to that of its discharge. For definitions of other energy technologies, please refer to Appendix K.

[45] FACT SHEET: Biden-Harris Administration Announces Historic Investment to Bolster Nation's Electric Grid Infrastructure, Cut Energy Costs for Families, and Create Good-paying Jobs, available at: https://www.whitehouse.gov/briefing-room/statements-releases/2023/10/30/fact-sheetbiden-harris-administration-announces-historic-investment-to-bolster-nations-electric-grid-infrastructure-cut-energy-costs-for-families-and-create-good-paying-jobs/.

[46] A formula grant is a non-competitive funding opportunity to a specific group of applicants, in this case to states and Indian tribes. A formula is used to allocate funds to the eligible applicants. Source: DOE

[47] Id.

[48] See generally, Net Zero America Project, available at: https://netzeroamerica.princeton.edu/?explorer=year&state=national&table=2020&limit=200; Potential Reconciliation Climate Policies: An Economic Impact Analysis Report, available at: https://www.nature.org/content/dam/tnc/nature/en/documents/TNC_Climate_Modeling_Report_National.pdf.

TRENDS AND KEY TAKEAWAYS

- TDS employment grew by 52,017 jobs (3.8%) in 2023, well ahead of TDS growth in the previous year (29,937, or 2.2%).
- Traditional transmission and distribution, including electric bulk power transmission and control, electric power distribution, and natural gas distribution, added the most jobs of any TDS technology, at 52,515 (5.4%). This was followed by electric vehicle (EV) charging and other electric power transmission and distribution[49], with 8,752 added jobs (7.7%); smart grid, with 1,435 added jobs (5.8%); other grid modernization, with 1,054 added jobs (5.1%); and microgrid, with 788 added jobs (4%).
- Commodity flows or the truck, rail, air, and water transportation of fuels experienced decreased employment by 16,382 jobs, or -11.6%.
- Battery storage jobs (which include 14,000 jobs in battery manufacturing) made up 80.3% of all storage technology jobs and added 2,779 jobs (3.8%) in 2023.
- By industry, the largest employment gains in TDS were in construction, with 34,805 added jobs (7.3%). This was followed by utilities, with 17,965 added jobs (4.3%); professional and business services, with 6,447 added jobs (4.7%); manufacturing, with 3,716 added jobs (4.6%); and other services, with 353 added jobs (2.4%).
- Renewable energy and efficiency enabling TDS technologies grew by 6,519 jobs from 2022 to 2023 (4.9%) and outpaced TDS growth overall (3.8%).
- The percentage of workers represented by a union or covered under a project labor or collective bargaining agreement in TDS (21%) was considerably higher than the overall energy workforce average (11%) and the overall U.S. private sector average (7%).
- All six TDS industries anticipate growth in 2024. Growth estimates range from 3.5% for utilities to 9.2% for construction.
- The TDS workforce was disproportionately male (74%), just above the male concentration of the overall energy workforce (73%), and considerably higher than the national workforce overall (53%).

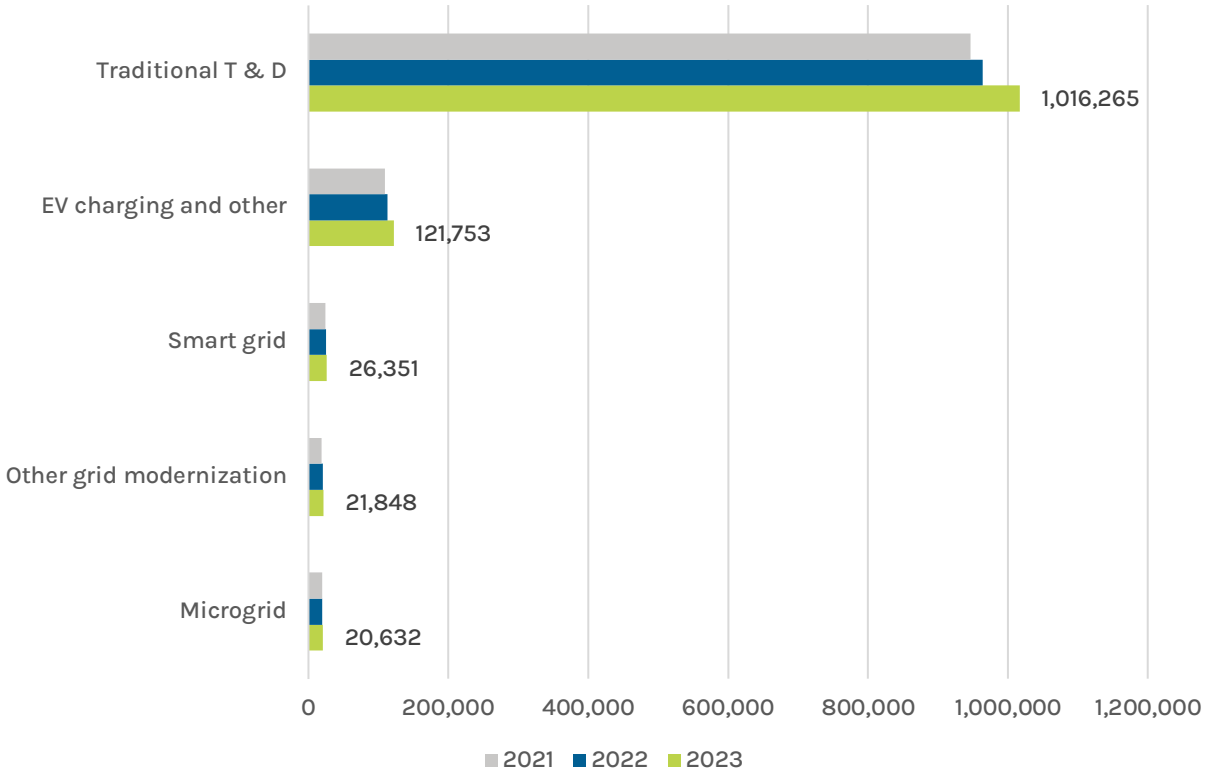
[49] Electric power transmission and distribution employment that cannot be placed in one of traditional transmission and distribution, smart grid, microgrid, other grid modernization, or electric vehicle charging based on employer response.

- The percentage of non-white workers in TDS (30%) was higher than the energy workforce average (26%) and higher than the national workforce average (24%). This is attributable to the TDS workforce's higher concentration of Asian workers (9%) relative to the overall energy workforce average (7%), as well as the TDS workforce's modestly higher concentration of Black or African American workers (10%) compared to the overall energy workforce average (9%), and the TDS workforce's modestly higher concentration of American Indian or Alaska Native workers (3%) compared to the overall energy workforce average (2%).
- The proportion of Hispanic or Latino workers in TDS (18%) was the same as the overall energy workforce average (18%) and slightly lower than the U.S. economy average (19%).
- Veterans were less highly represented in the TDS workforce (7%) than in the overall energy workforce (9%) but were more highly represented than in the national workforce (5%).
- Individuals requesting accommodations for disabilities in TDS (2%) were represented at a similar rate as the energy workforce average (2%) but at a lower rate than in the national workforce overall (5%).
- The percentage of formerly incarcerated workers in TDS (1%) was the same as the energy workforce average (1%) and lower than the national workforce average (2%).

EMPLOYMENT BY TECHNOLOGY, INDUSTRY, AND OCCUPATION

In 2023, TDS employed more than 1.4 million workers, representing a 3.8% increase from 2022. As shown in Figure 48, traditional transmission and distribution drove this change, increasing from 963,750 to 1,016,265 (5.4%).[50] [51]

Figure 48. Transmission and Distribution Employment by Technology [52]

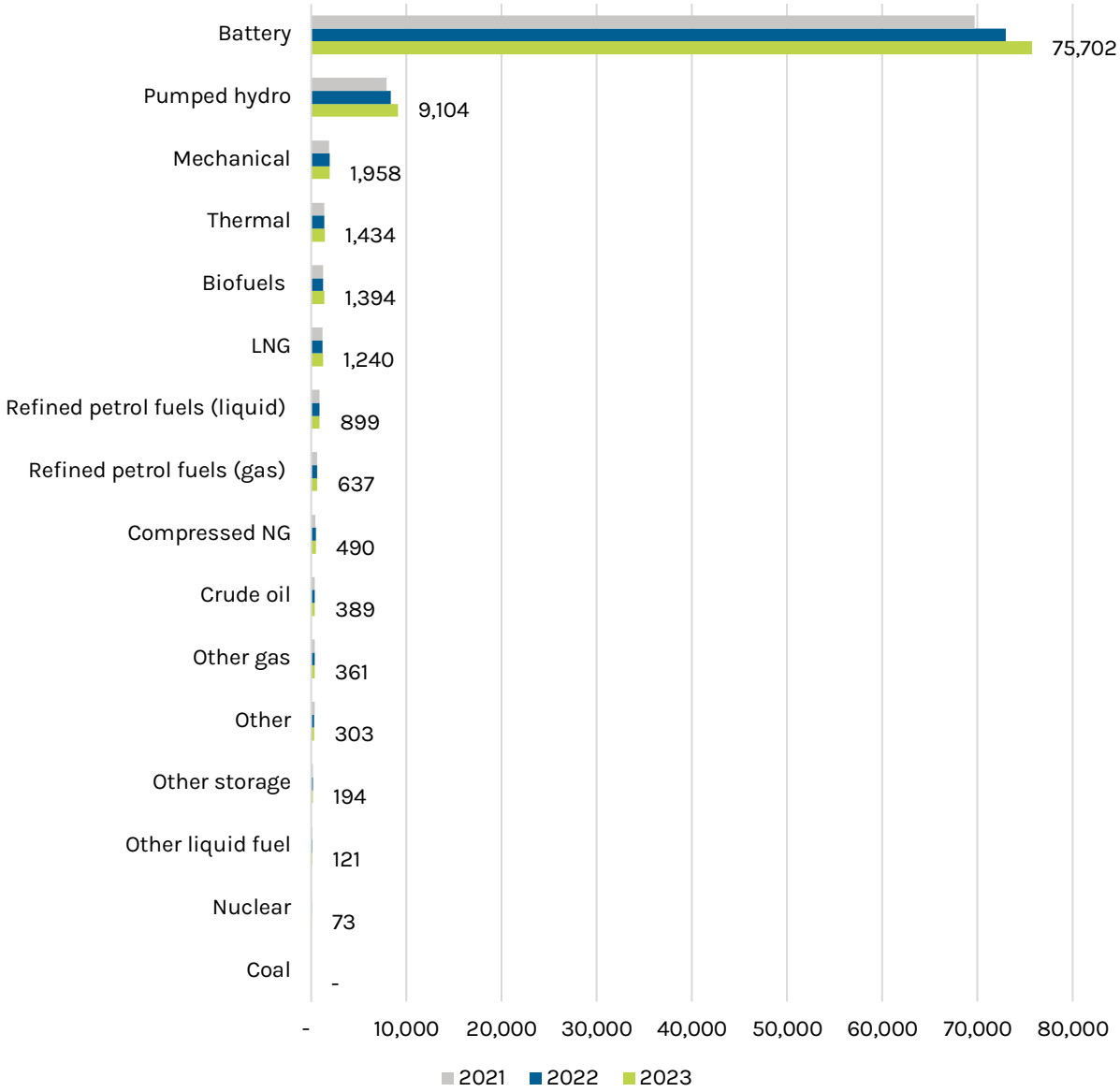


[50] Figure 48 does not include commodity flows (air, water, truck, and rail transportation of fuels), which are associated with transmission and distribution yet not assignable to any one specific technology. This accounted for 124,453 jobs in 2023.
[51] Appendix B contains definitions of each technology.
[52] EV charging and other is a combination of EV charging (2,788 workers) and other TDS (118,964 workers). EV charging is defined as stations that charge vehicles which use one or more electric motors for propulsion with no onboard generator or non-electric motor. Other TDS refers to any transmission, distribution, and storage that is not captured in the categories listed previously or a category that is used when unable to split employment into a single transmission, distribution, and storage category where employees spend "more of their time." Please see Appendix K for definitions of other technologies.

Within the storage category, battery storage had the most jobs, employing 75,702 workers (Figure 49). Just under one-fifth (14,028, or 18.5%) of battery storage jobs are in manufacturing.

Battery storage accounted for more than eight times the 9,104 employed in pumped storage hydropower, the next largest storage sector in terms of jobs. Storage employment in other technologies (excluding coal, which did not employ anyone) ranged from 73 employees in nuclear storage[53] to 1,958 in mechanical storage.

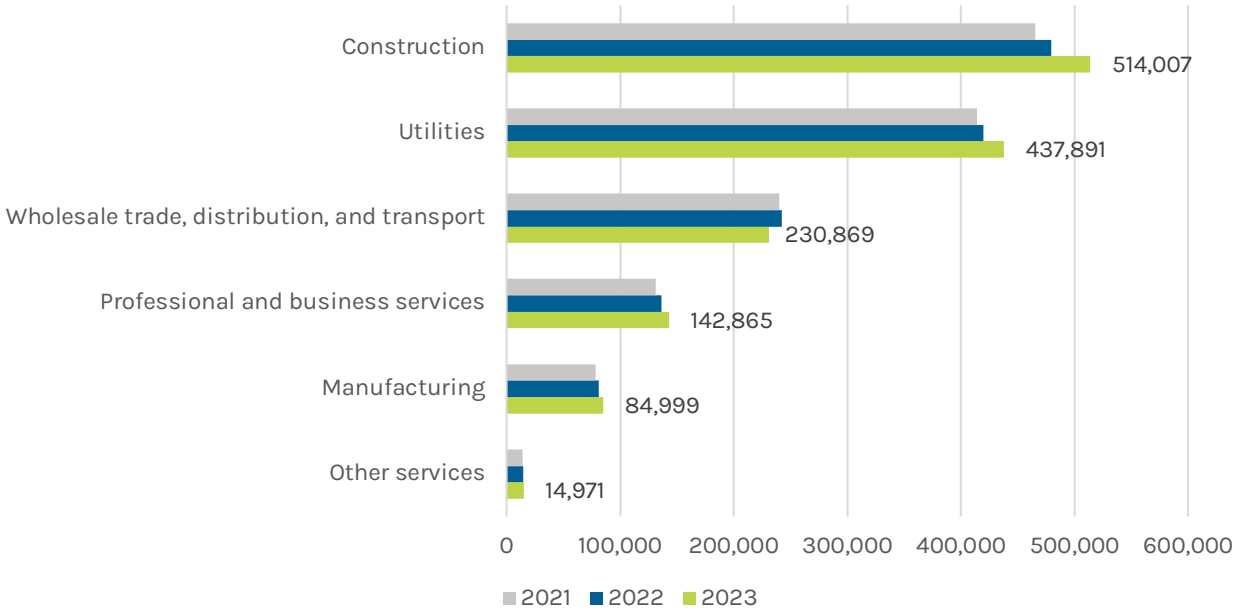
Figure 49. Storage Employment by Technology



[53] Storage of spent nuclear fuel. For definitions of other energy technologies, refer to Appendix K.

The largest share of TDS employment in 2023 was in the construction industry, with 514,007 workers (Figure 50). Construction also added the largest number of new jobs from 2022 to 2023 (34,805 added jobs), more than double the 13,989 added by the industry from 2021 to 2022. Utilities grew by the second most jobs, adding 17,965 workers, or growing by 4.3%.

Figure 50. TDS Employment by Industry



Of the TDS technologies, "other grid modernization" had the highest concentration of workers in construction, with 76% of all workers, followed by "other fuels" storage, with 66% (Table 14). Higher percentages of jobs in construction generally represent growth and expansion of the particular technology, although they could also represent decommissioning activity. While some construction industry businesses remain engaged in TDS operations through maintenance and repair contracts, the more significant numbers of construction jobs occur during the build out phase. Only traditional transmission and distribution technologies for both electricity and natural gas had employment in utilities.

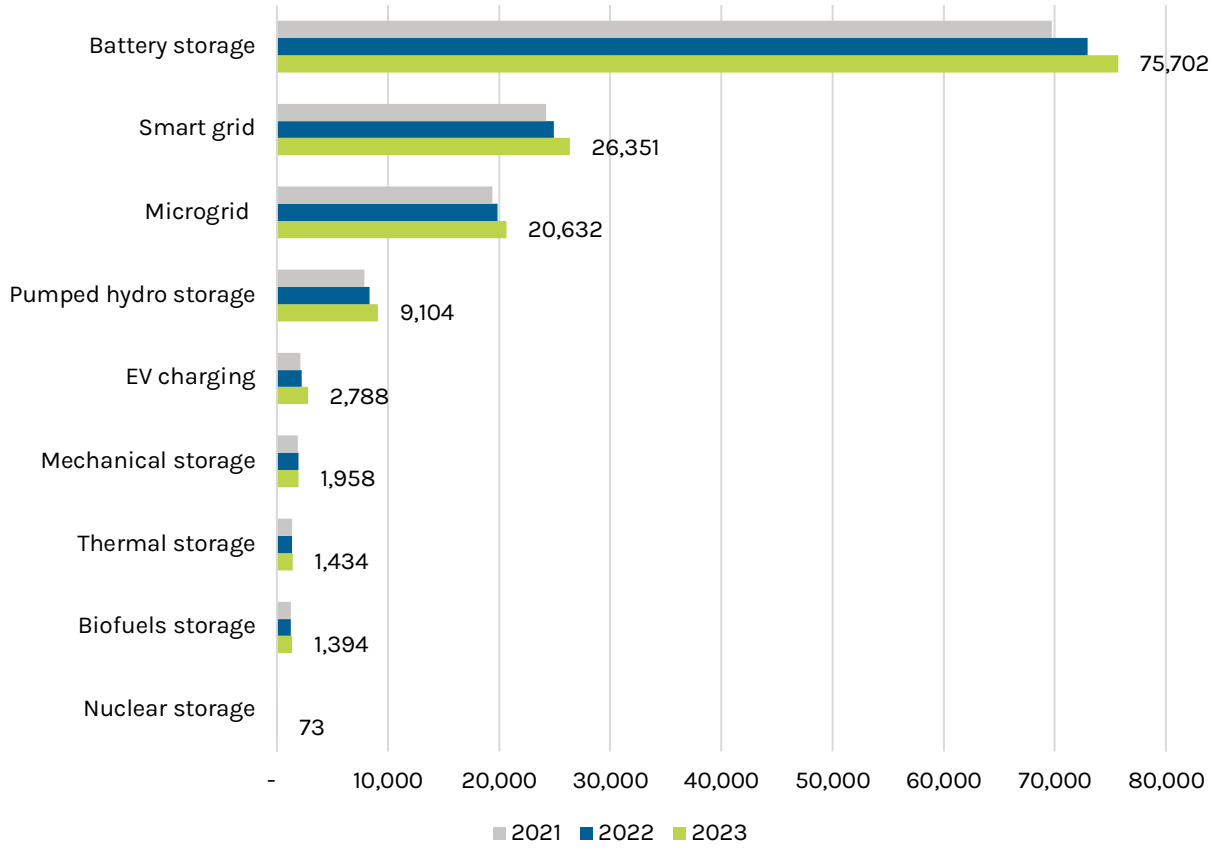
Table 14. TDS Employment Distribution by Technology and Industry[54]

	Utilities	Construction	Manufacturing	Wholesale Trade, Distribution, & Transport	Professional & Business Services	Pipeline	Other Services
Traditional Transmission & Distribution, Electricity	**46%**	29%	6%	5%	12%	0%	2%
Traditional Transmission & Distribution, Petroleum	0%	26%	0%	**61%**	0%	13%	0%
Traditional Transmission & Distribution, Natural Gas	**46%**	41%	0%	0%	0%	13%	0%
Traditional Transmission & Distribution, Coal	0%	0%	0%	**100%**	0%	0%	0%
Traditional Transmission & Distribution, "Other Fuels"	0%	0%	0%	**100%**	0%	0%	0%
Pumped Storage Hydropower	0%	**39%**	27%	4%	17%	13%	1%
Battery Storage	0%	**52%**	19%	11%	17%	0%	1%
"Other Storage"	0%	34%	**41%**	1%	21%	0%	2%
Petroleum Storage	0%	**62%**	14%	2%	0%	0%	22%
Natural Gas Storage	0%	31%	16%	13%	**40%**	0%	1%
"Other Fuels" Storage	0%	**66%**	0%	0%	32%	0%	3%
Smart Grid	0%	**46%**	6%	6%	41%	0%	1%
Microgrid	0%	**56%**	18%	8%	15%	0%	3%
"Other Grid Modernization"	0%	**76%**	9%	1%	13%	0%	1%
EV Charging	0%	**45%**	6%	20%	22%	0%	6%
Other	0%	**63%**	13%	1%	23%	0%	0%

[54] Bolded cells indicate the industry with the largest share of employment for each technology (row).

Clean energy TDS technologies, which include electricity storage, advanced grid technologies, clean fuels storage, and electric vehicle charging, grew from 132,917 jobs in 2022 to 139,436 jobs in 2023 (Figure 51), an increase of 6,519 jobs (4.9%).

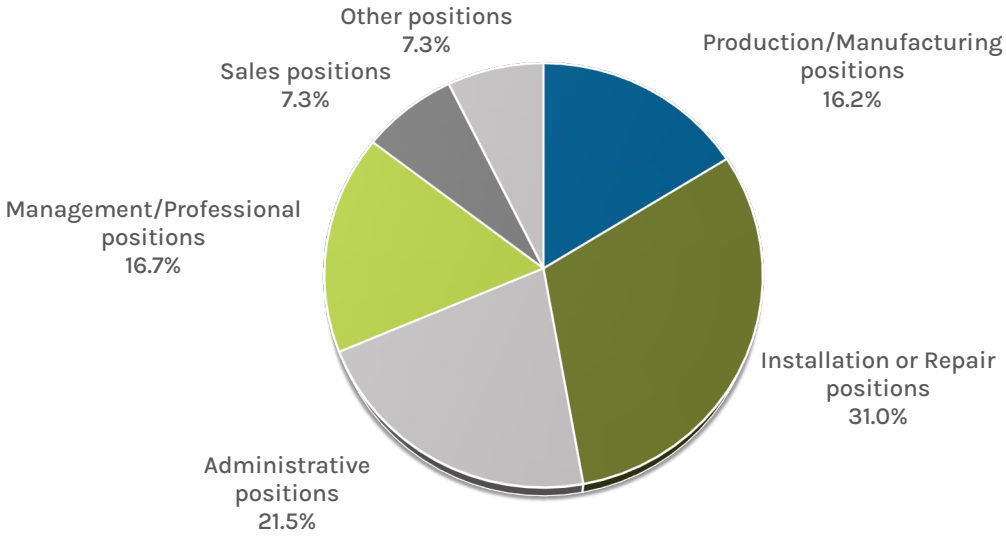
Figure 51. Clean Energy TDS Jobs



Workers with the same occupation can work in different industries. For example, the construction industry includes many installation or repair occupations, but utilities and other industries also employ people in these occupations. For this reason, different trends show up if parsing the data by industry or occupation. It can be useful to show energy employment data and trends by both.

In terms of jobs by occupation across all industries, the largest occupational category of workers within TDS was installation or repair positions, accounting for 31.0% (Figure 52). This was followed by administrative positions (21.5%) and management and professional positions (16.7%). The proportion of occupational categories employed in TDS were relatively unchanged year-over-year.

Figure 52. Worker Occupations in TDS

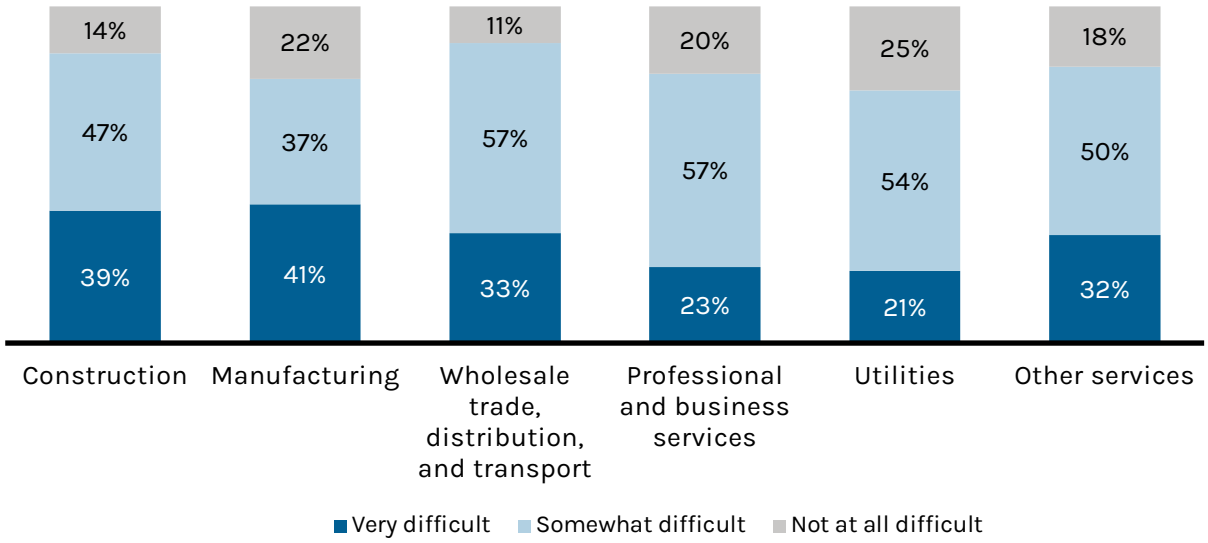


Employer Perspective on Workforce Issues

Current Hiring Difficulty

Within TDS industries, wholesale trade, distribution, and transport businesses reported the greatest difficulty hiring workers. (Figure 53) About 89% of these employers reported at least some difficulty finding qualified workers, with a third (33%) claiming it was "very difficult." About 41% of manufacturing employers and 39% of construction employers reported it was "very difficult" to hire. Utilities reported the least difficulty hiring, with 25% stating that it was "not at all difficult."

Figure 53. TDS Employers' Perceived Hiring Difficulty by Industry



As shown in Table 15, employers in most TDS industries (except utilities and other services) cited lack of experience, training, or technical skills as the most common reason for hiring difficulty. Utilities and other services businesses indicated that insufficient qualifications (certifications or education) were the most common reason for hiring difficulty.

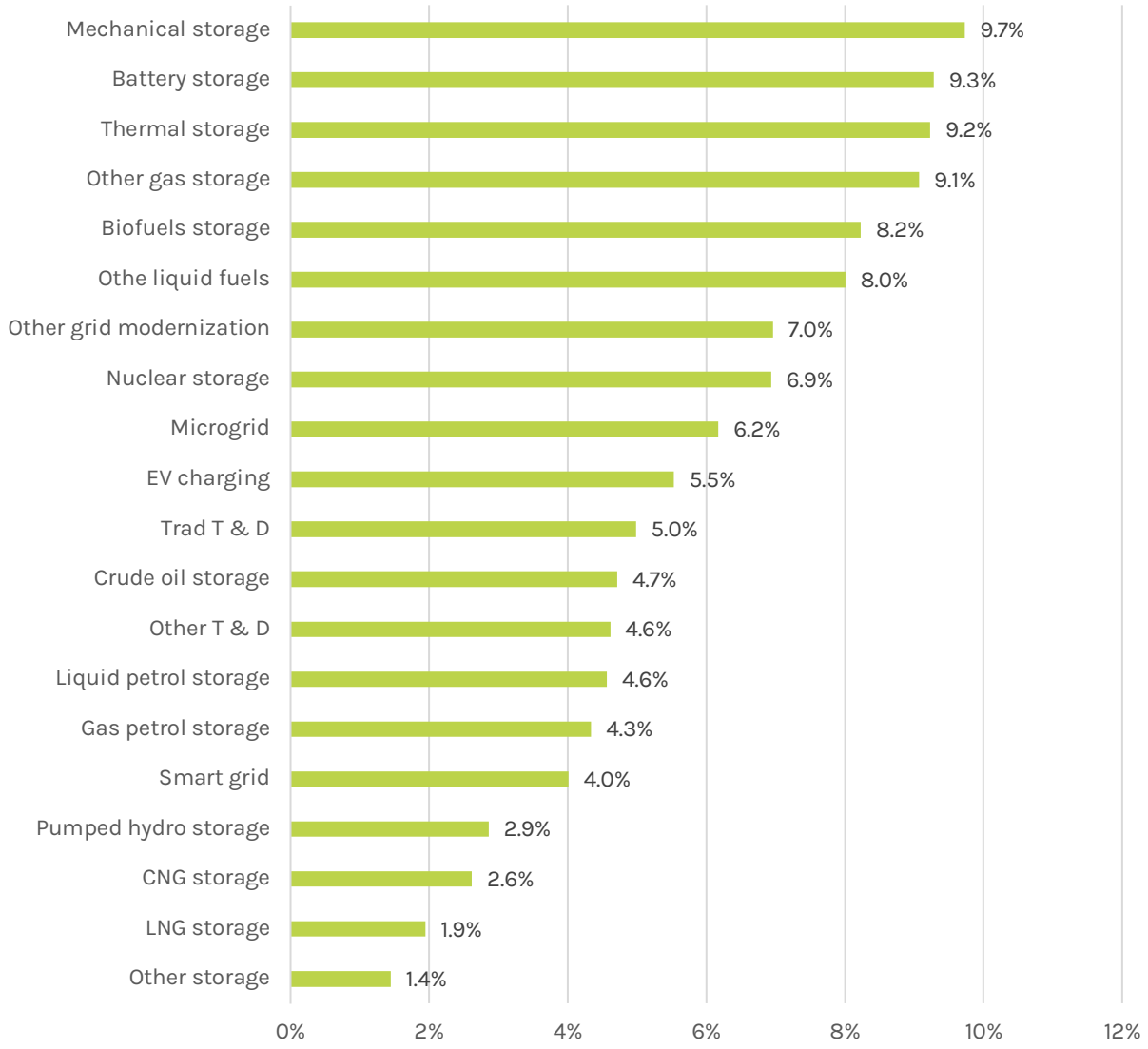
Table 15. TDS Employer Reasons for Hiring Difficulty

Industry	Most Common Reason	Second Most Common Reason	Third Most Common Reason
Utilities	Insufficient qualifications (certifications or education) (46%)	Location (28%)	Lack of experience, training, or technical skills (23%)
Construction	Lack of experience, training, or technical skills (38%)	Insufficient qualifications (certifications or education) (27%)	Competition/ small applicant pool (25%)
Manufacturing	Lack of experience, training, or technical skills (32%)	Insufficient non-technical skills (work ethic, dependability, critical thinking) (32%)	Difficulty finding industry-specific knowledge, skills, and interest (30%)
Wholesale Trade, Distribution, and Transport	Lack of experience, training, or technical skills (41%)	Insufficient qualifications (certifications or education) (33%)	Competition/ small applicant pool (26%)
Professional and Business Services	Lack of experience, training, or technical skills (43%)	Cannot provide competitive wages (35%)	Competition/ small applicant pool (29%)
Other Services	Insufficient qualifications (certifications or education) (36%)	Difficulty finding industry-specific knowledge, skills, and interest (32%)	Lack of experience, training, or technical skills (27%)

Employment Change by Technology and Industry

The previous section highlighted TDS employers' current hiring difficulty across industries, whereas this section focuses on anticipated employment change by technology and industry. This section also compares anticipated employment change in 2022 to the actual employment change over the last year. Of all TDS technologies, mechanical storage businesses anticipate the highest growth rate for 2024, at 9.7% (Figure 54). Battery storage, thermal storage, and "other gas" storage businesses also anticipate growth greater than 9.0% through 2024.

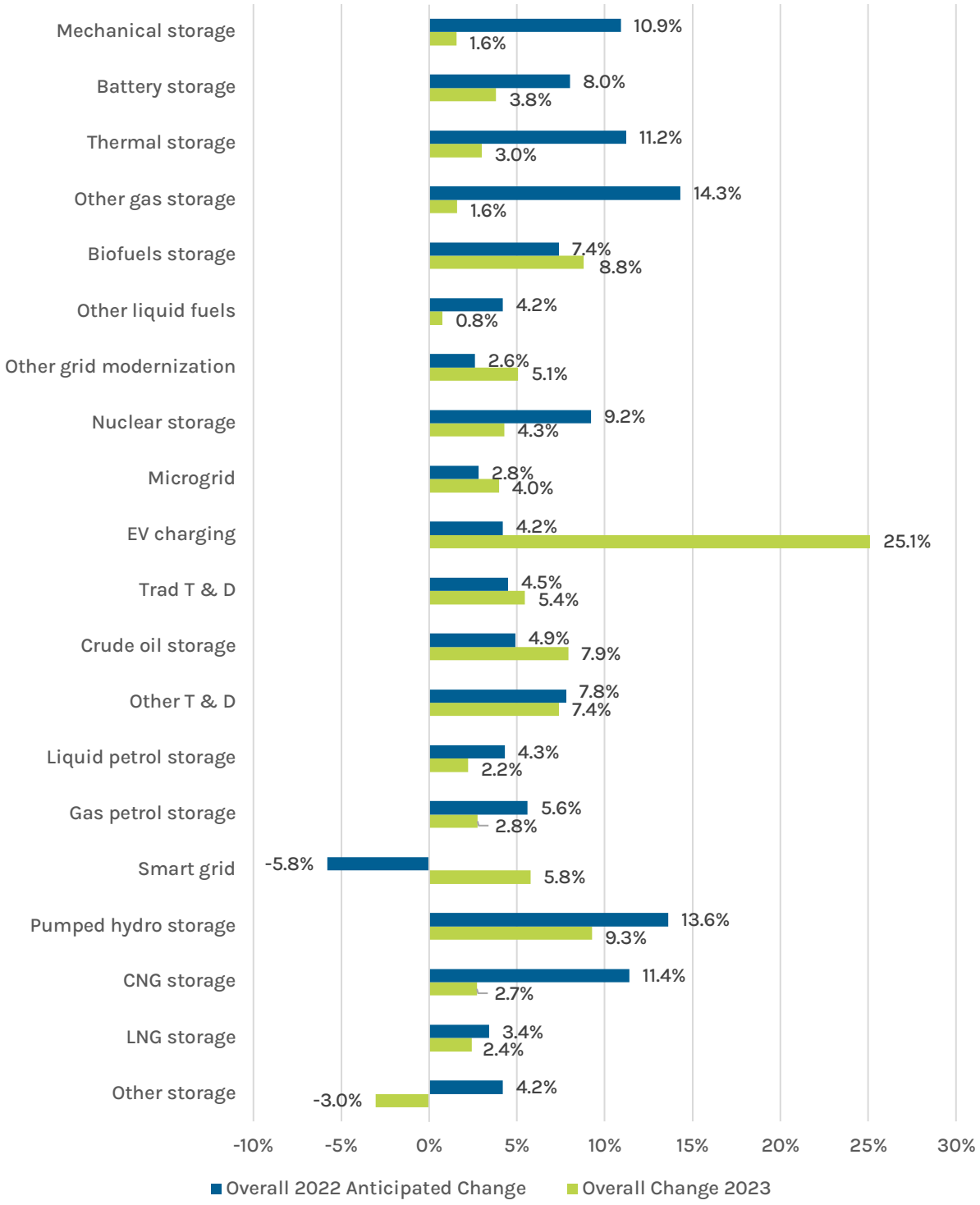
Figure 54. TDS Anticipated Changes in Employment by Technology, 2023-2024[55]



[55] For definitions of technologies, refer to Appendix J: Energy Technology Definitions

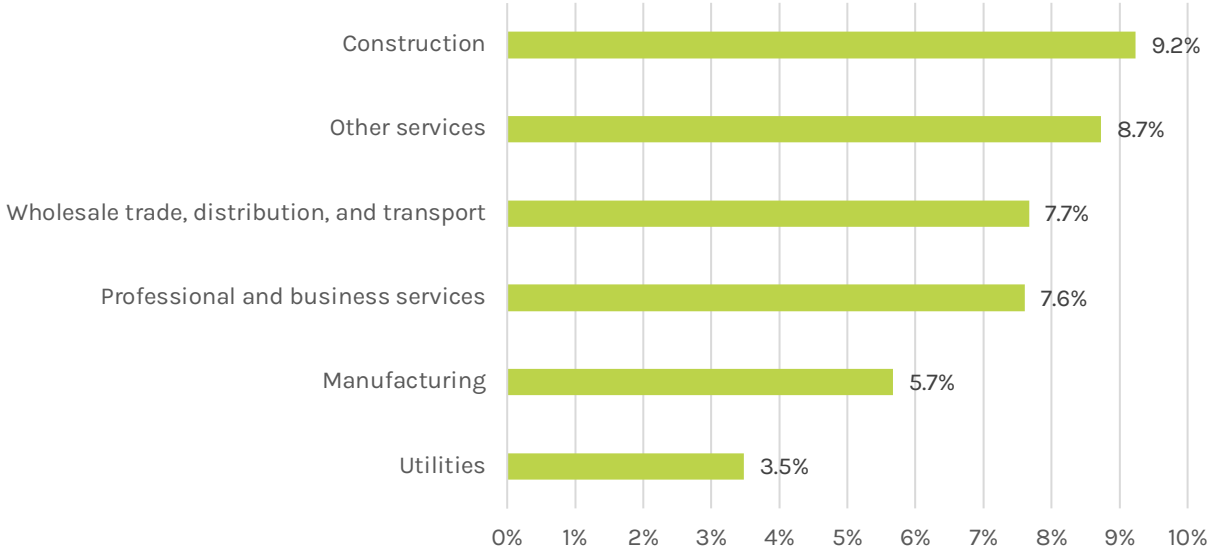
While TDS employers across numerous technologies anticipated growth over the last year, most businesses registered less growth than expected (Figure 55). However, EV charging firms' actual growth (25.1%) outpaced anticipated growth (4.2%) by more than six times.

Figure 55. TDS Actual Employment Change by Technology 2022-2023 vs. Anticipated Employment by Technology 2022



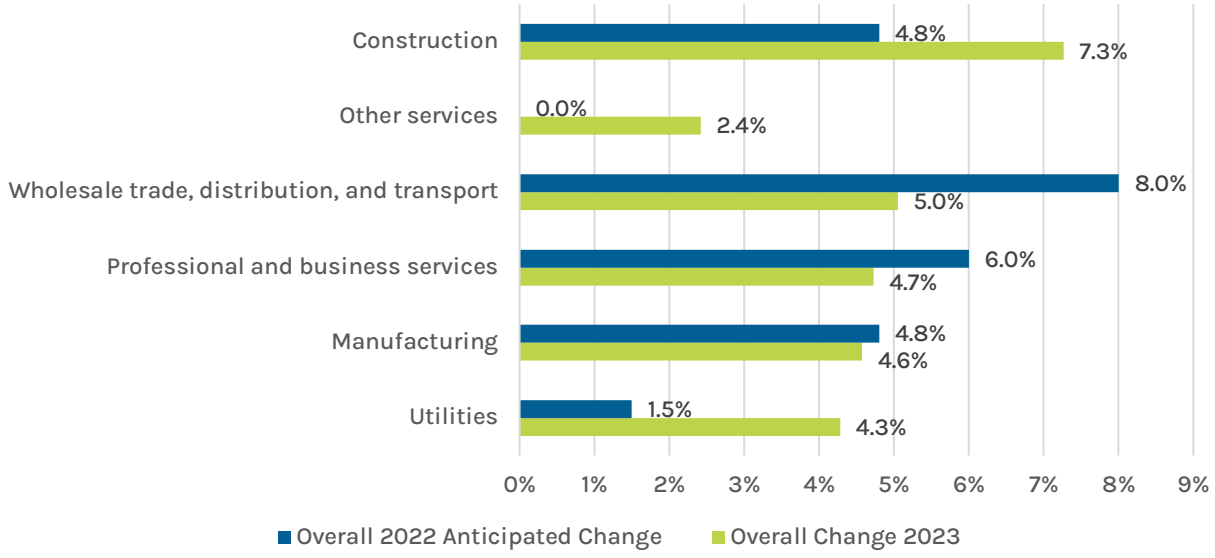
All industries in TDS anticipate an increase in employment in 2024 (Figure 56). Anticipated employment growth rates range from 3.5% in utilities to 9.2% in construction.

Figure 56. TDS Anticipated Employment Changes by Industry, 2023-2024



Looking at the same data by industry rather than technology, five of the six industries within TDS expected growth last year, ranging from 1.5% for utilities to 8.0% for wholesale trade, distribution, and transport (Figure 57). Construction, utilities, and other services within TDS grew faster than expected from 2022 to 2023.

Figure 57. TDS Actual Employment Change by Industry 2022-2023 vs. Anticipated Employment Change by Industry 2022



Transmission, Distribution, and Storage Workforce Demographics

Demographics for the TDS workforce are displayed in Table 16 below. It should be noted that demographic estimates are only available for TDS technologies and industries not including commodity flows (truck, rail, water, and air transport of fuels)[56]. In 2023, the TDS workforce was disproportionately male (74%), slightly higher than the overall energy workforce average (73%) and considerably higher than the national workforce average (53%).

The proportion of the TDS workforce made up of Hispanic or Latino workers (18%) was the same as the energy workforce average (18%), and slightly lower than the national workforce average (19%). TDS is behind both motor vehicles and component parts (20%) and electric power generation (20%) in Hispanic or Latino representation.

The portion of White workers in TDS (70%) was lower than the energy workforce average (74%) and the national workforce average (76%). This is attributable to the higher share of Asian workers in the TDS workforce (9%) as compared to the overall energy workforce (7%), as well as the TDS workforce's higher relative share of Black or African American workers (10%) compared to the overall energy workforce (9%), and the TDS workforce's higher relative share of American Indian and Alaska Native workers (3%) compared to the overall energy workforce (2%).

Veteran workers in TDS (7%) were represented at a lower rate than in the overall energy workforce (9%), but veteran representation was higher when compared to the national workforce overall (5%). The proportion of formerly incarcerated individuals in the TDS workforce (1%) was the same as the energy workforce average (1%) and lower than the national workforce average (2%). The proportion of individuals requesting accommodations for disabilities in the TDS workforce (2%) was the same as energy workforce average (2%) but lower than the 5% estimated in the U.S. workforce overall.

The TDS workforce was mainly composed of middle-aged workers, with a relatively high concentration of workers between ages 30 and 54 (56%), higher than the energy workforce average (52%) and the national workforce average (53%). Workers under the age of 30 are underrepresented in TDS (26%) compared to the energy workforce average (29%) and the national workforce average (22%).

The concentration of workers represented by a union or covered under a project labor or collective bargaining agreement in the TDS workforce (21%) was greater than the energy workforce average (11%) and the national workforce average (7%).

[56] Commodity flows include workers that transport fuels via truck (NAICS 484), rail (NAICS 482), water (NAICS 483), and air (NAICS 481), These NAICS codes are not surveyed and the proportion of employment was calculated by dividing the value of commodity shipments (in millions of dollars) for coal, fuel oil, gas, motor vehicles, petroleum and other coal and petroleum products by total commodity value at the state level by truck, rail, air and water transport. See Appendix A.

Table 16. TDS Workforce Demographics and Characteristics

	Number of Workers	Transmission, Distribution, and Storage Average	Energy Workforce Average	National Workforce Average
Male	956,392	74%	73%	53%
Female	328,119	25%	26%	47%
Gender Nonbinary	16,637	1%	<1%	n/a
Hispanic or Latino	237,809	18%	18%	19%
Not Hispanic or Latino	1,063,340	82%	82%	81%
American Indian or Alaska Native	35,799	3%	2%	1%
Asian	114,247	9%	7%	7%
Black or African American	130,021	10%	9%	13%
Native Hawaiian or Other Pacific Islander	14,157	1%	1%	<1%
White	913,600	70%	74%	76%
Two or More Races	63,576	5%	5%	3%
Unknown Race	30,009	2%	2%	n/a
Veterans	92,002	7%	9%	5%
18 to 29	343,872	26%	29%	22%
30 to 54	727,728	56%	52%	53%
55 and Over	229,548	18%	18%	23%
Disability	30,520	2%	2%	5%
Formerly Incarcerated	17,578	1%	1%	2%
Represented by Unions, Collective Bargaining Agreements, and/or Project Labor Agreements	275,976	21%[57]	11%	7%

National sources: BLS (2023a, 2023b, 2023c, 2023d), Jobs EQ (2023), Prison Policy (2018)

[57] Unionization rates vary by state.

Fuels

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Fuels

Fuels are combusted or, in the case of nuclear, spent in the generation of electricity or heat. Employment in fuels includes any work related to fuel extraction, mining, and processing. This includes businesses that manufacture machinery that supports oil and gas extraction as well as coal mining. Agriculture and forestry workers who support fuel production with biodiesels, corn ethanol, and fuel wood are also included in the employment data for fuels. This category also includes the production of nuclear fuels for power plants. Jobs in electricity as fuel to power vehicles and buildings are reflected in the Electric Power Generation section.[58]

In 2023, fuels employed 1,050,874 workers, up 19,075 from 1,031,799 (1.8%) in 2022. Fuels added fewer jobs in 2023 than it did in the previous year, when it added more than 123,000 workers and increased by 13.6%. Despite slowing in growth, fuels maintained its momentum and even continued to grow modestly. From 2022 to 2023, mining and extraction added 1,765 jobs, for a growth rate of 0.4%.

TRENDS AND KEY TAKEAWAYS

- Employment in fuels grew by 19,075 jobs to a total of 1,050,874, or 1.8% growth from 2022 to 2023, which was the lowest growth among all other major energy categories — EPG (4.0%), TDS (3.8%), energy efficiency (3.4%), and motor vehicles and component parts (2.3%).
- Businesses working with clean energy fuels such as corn ethanol, woody biomass/cellulosic biofuel, and “other biofuels” added 2,578 jobs, growing 2.2% from 2022 to 2023.
- Onshore and offshore petroleum added the most jobs of all fuel technologies, increasing by 6,481 jobs (1.2%). Onshore and offshore natural gas added 5,283 jobs (2.0%), followed by coal, with 2,239 added jobs (3.5%).
- The manufacturing industry had the largest employment gains, with 8,453 added jobs (3.7%). This was followed by professional and business services, with 4,583 added jobs (2.6%); wholesale trade, with 1,910 added jobs (1.4%); construction, with 1,894 added jobs (9.7%); mining and extraction, with 1,765 added jobs (0.4%); agriculture and forestry, with 448 added jobs (1.2%); and other services, with 21 added jobs (1.1%).
- Six out of seven industries within fuels expect job growth through 2024, ranging from 1.5% in wholesale trade to 9.9% in construction. Agriculture expects to maintain employment levels through 2024.

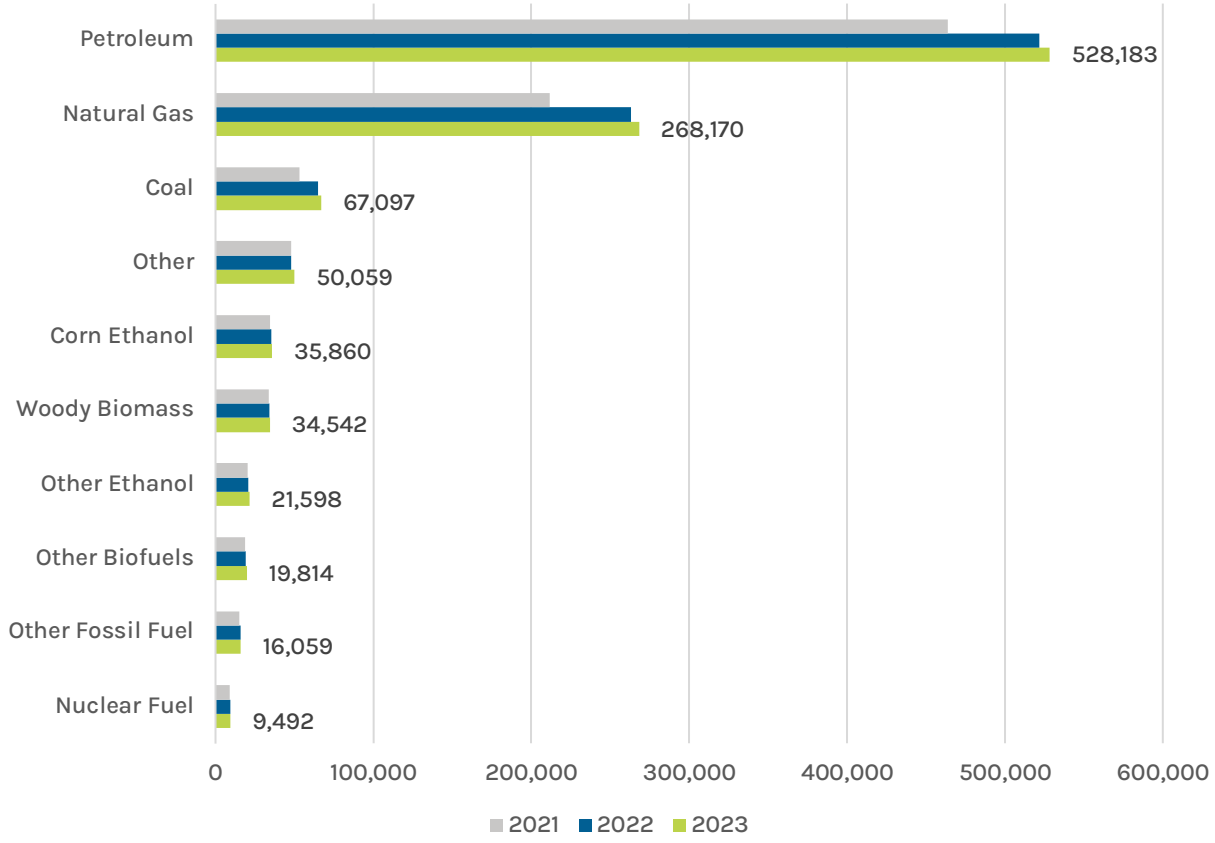
[58] Appendix J contains definitions of each technology.

- The percentage of workers in fuels represented by a union or covered under a project labor or collective bargaining agreement (7%) was lower than the overall energy workforce average (11%), but in line with the national private sector average (7%).
- The fuels workforce was disproportionately male, with an average (74%) just above the overall energy workforce average (73%) and higher than the national workforce average (53%).
- The proportion of non-White workers in the fuels workforce (24%) was lower than the overall energy workforce average (26%) and in line with the overall national workforce average (24%). Both Asian (6%) and Hispanic or Latino (15%) workers were underrepresented in the fuels workforce relative to the energy workforce and the U.S. workforce overall.
- The proportion of Black or African American workers in the fuels workforce (9%) was the same as the energy workforce average (9%), which was also the case for American Indian or Alaska Native workers (2%) and Native Hawaiian or other Pacific Islander workers (1%).
- Veterans were more represented in the fuels workforce (10%) than in the overall energy workforce (9%) and the national workforce overall (5%).
- The proportion of formerly incarcerated individuals in the fuels workforce (2%) was higher than the overall energy workforce average (1%) and similar to the national workforce average (2%).
- The proportion of workers requesting accommodation for a disability in the fuels workforce (2%) was the same as the overall energy workforce average (2%), and lower than the U.S. workforce as a whole (5%).

EMPLOYMENT BY TECHNOLOGY, INDUSTRY, AND OCCUPATION

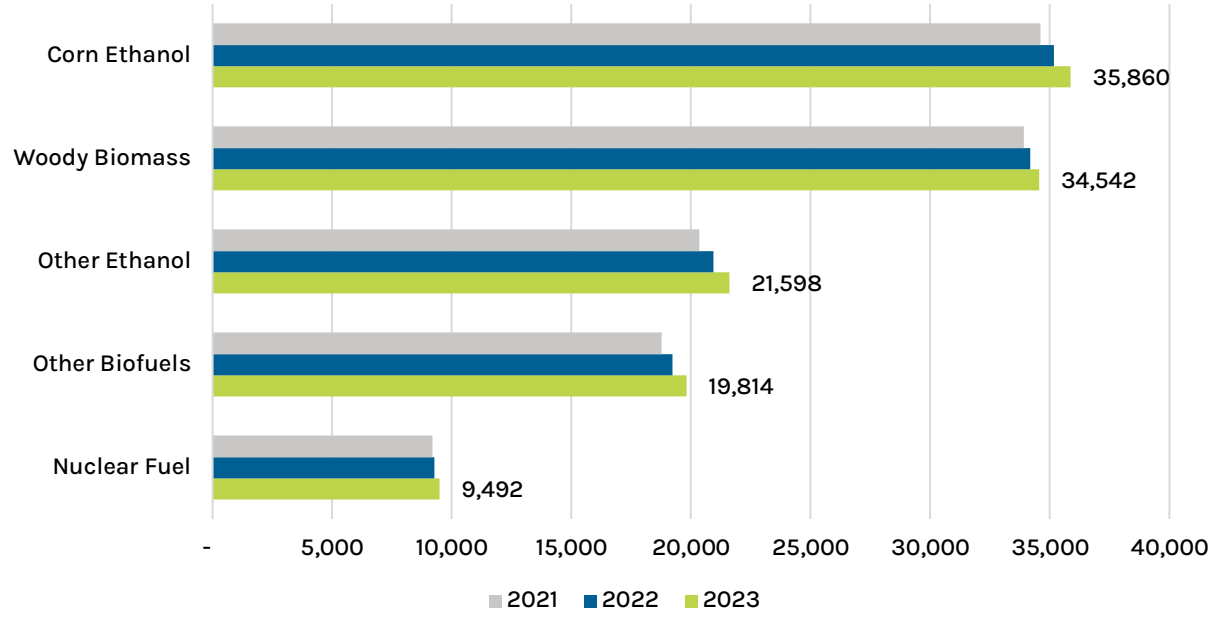
In 2023, fuels employed 1,050,874 workers, representing an increase of 1.8% from 2022 (Figure 58). Petroleum and natural gas employers primarily drove this growth, with petroleum increasing by 6,481 workers (1.2%) and natural gas increasing by 5,283 workers (2.0%).

Figure 58. Fuels Employment by Technology, 2021-2023



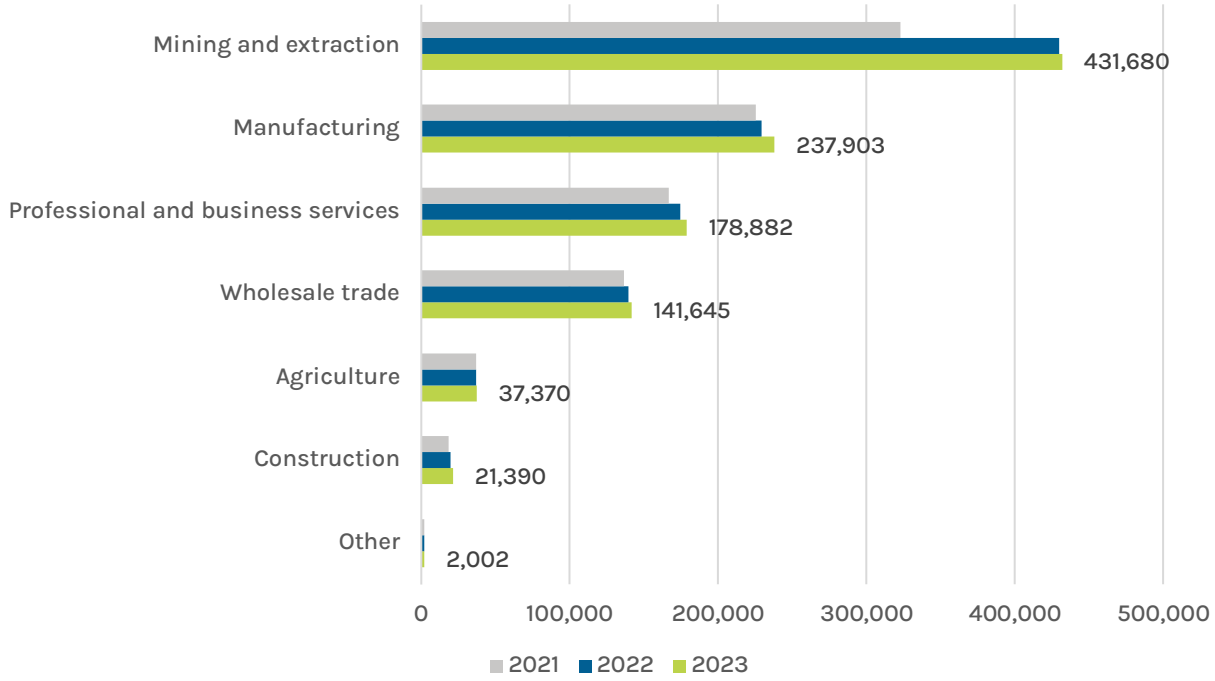
Employment in clean energy fuels — nuclear and those from bio stock — grew from 118,729 in 2022 to 121,306 in 2023, an increase of 2.2%, faster than the 1.7% growth experienced from 2021 to 2022. (Figure 59). All clean energy fuels underwent job growth between 2022 and 2023.

Figure 59. Clean Energy Fuel Technologies Employment, 2021-2023



The largest number of fuels employees were in the mining and extraction industry,[59] with 431,680 workers (Figure 60). Mining and extraction experienced relatively flat growth, adding 1,765 jobs between 2022 and 2023 (0.4%). This comes after a year (2021 to 2022) in which mining and extraction added 107,029 jobs which translated to 33.1% growth — a rate of growth that was partially due to the increased U.S. exports of petroleum and wet gas that stemmed from the conflict in Ukraine.[60] Construction experienced the largest percentage of growth in fuels employment levels, at 9.7%, adding 1,894 jobs. All industries within fuels experienced growth from 2022 to 2023.

Figure 60. Fuels Employment by Industry, 2021-2023



Fuels employees were concentrated across a number of industries within different fuel technology areas (Table 17). The mining and extraction industry represented the largest share of employment. Several technologies, including renewable diesel fuels, offshore natural gas, and nuclear fuels had the highest concentration of workers in the professional and business services industry.

[59] Includes mining and extraction of petroleum, natural gas, and coal as well as support activities for mining and extraction (NAICS 21).
[60] United States Energy & Employment Report 2023

Table 17. Concentration of Fuels Employment by Technology and Industry[61]

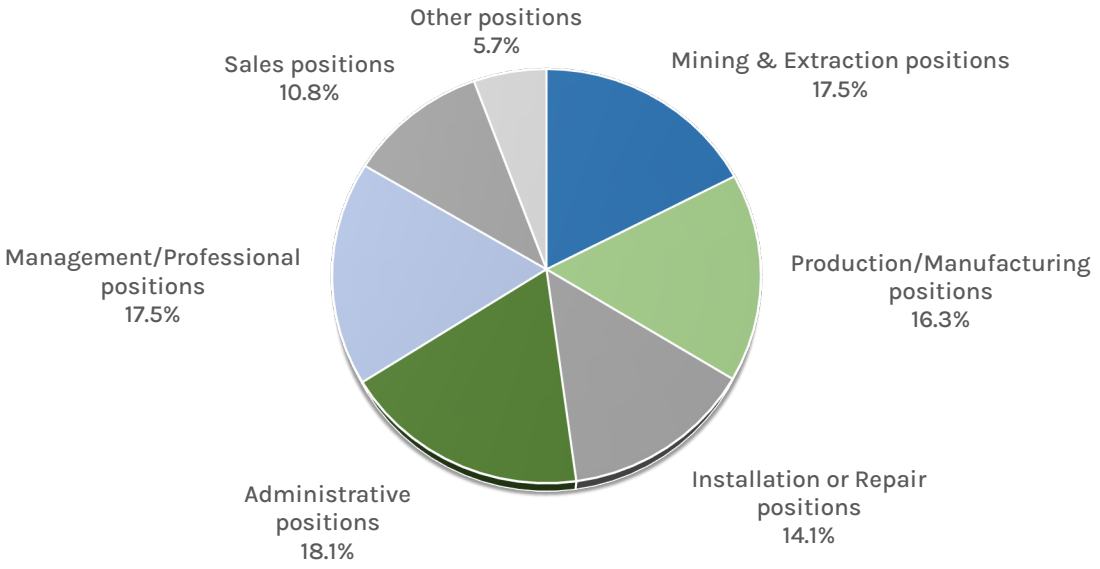
	Agriculture	Mining and Extraction	Construction	Manufacturing	Wholesale Trade	Professional and Business Services	"Other Services"
Coal	0%	**71%**	0%	15%	2%	12%	0%
Onshore Petroleum	0%	**44%**	5%	24%	14%	14%	0%
Offshore Petroleum	0%	39%	0%	**47%**	2%	11%	1%
Onshore Natural Gas	0%	**62%**	0%	16%	12%	10%	0%
Offshore Natural Gas	0%	15%	0%	24%	1%	**60%**	0%
"Other Fossil Fuel"	0%	0%	0%	18%	**47%**	34%	1%
Corn Ethanol	**46%**	0%	0%	26%	19%	8%	0%
"Other Ethanol/Non-Woody Biomass"	13%	0%	0%	12%	27%	**47%**	0%
Woody Biomass/Cellulosic Biofuel	**52%**	0%	0%	13%	3%	31%	0%
Renewable Diesel Fuels	0%	0%	0%	7%	2%	**91%**	0%
Biodiesel Fuels	0%	0%	0%	9%	7%	**84%**	0%
Waste Fuels	0%	0%	0%	3%	2%	**95%**	0%
"Other Biofuels"	0%	0%	0%	3%	22%	**75%**	0%
Nuclear Fuel	0%	5%	0%	31%	10%	**55%**	0%
"Other Fuels"	0%	0%	0%	29%	**52%**	19%	0%

Workers with the same occupation can work in different industries. For example, the manufacturing industry includes many production/manufacturing occupations, but wholesale trade and other industries also employ people in these occupations. For this reason, different trends show up if parsing the data by industry or by occupation. Therefore, it can be useful to show energy employment data and trends by both industry and occupation.

[61] Highlighted values indicated the industry for which the largest share of technology (row) employment lies. For definitions of fuels technologies, please refer to Appendix K.

In terms of distribution of jobs by occupation across all industries, the largest occupational category of workers within fuels was administrative positions (18.1%), followed by management and professional occupations (17.5%) and mining and extraction positions (17.5%) (Figure 61). The concentration of employment within occupational categories remains similar to the previous year.

Figure 61. Fuels Employment by Occupation

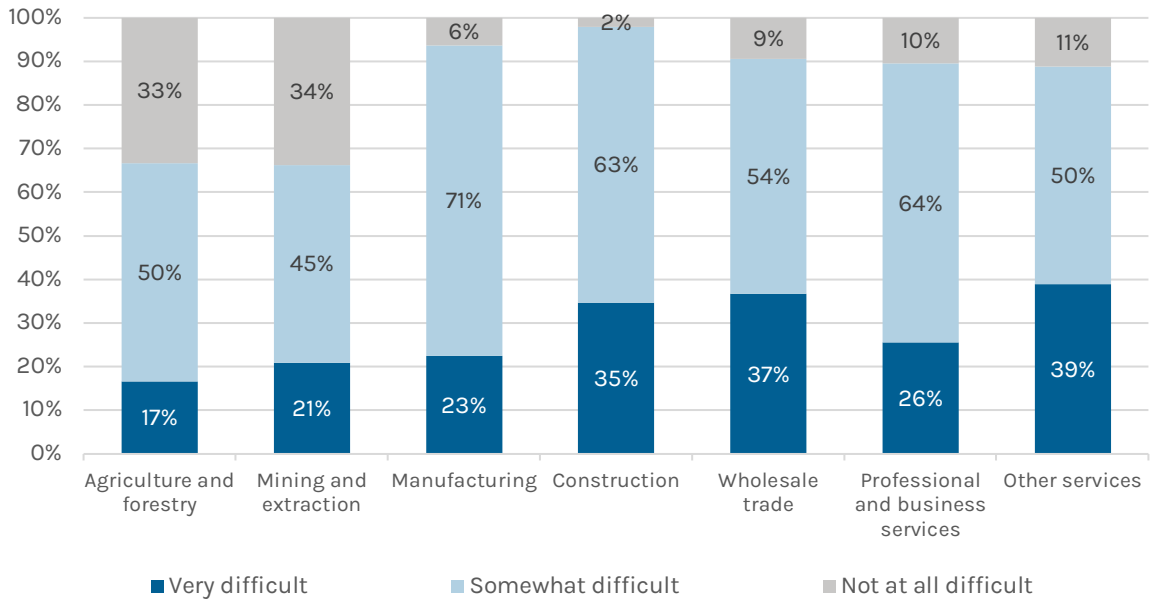


Employer Perspective on Workforce Issues

Current Hiring Difficulty

Among industries within fuels, 98% of construction employers reported at least some difficulty hiring workers (Figure 62). Nearly two in five businesses in other services (39%) that had hired workers from 2022 to 2023 reported that finding qualified workers was "very difficult." Mining and extraction employers reported the least problems with hiring: 34% of respondents indicated that it was "not at all difficult" to find and hire qualified workers. This was in contrast to construction employers, where only 2% of employers that had actively looked to hire workers in 2023 found hiring "not at all difficult."

Figure 62. Fuels Employers' Perceived Hiring Difficulty by Industry



As illustrated in Table 18, insufficient non-technical skills (work ethic, dependability, critical thinking) was the most cited reason for hiring difficulty by employers in mining and extraction, manufacturing, and construction. For professional and business services and other services employers, lack of experience, training, or technical skills topped the list of reasons for hiring difficulty. For all other sectors, lack of experience, training, or technical skills did not reach any higher than the third most common reason for hiring difficulty, which is in stark contrast to other segments of the energy economy, such as construction in EPG and EE, which consistently ranked experience, qualifications, and industry specific knowledge as the top reasons for difficulty.

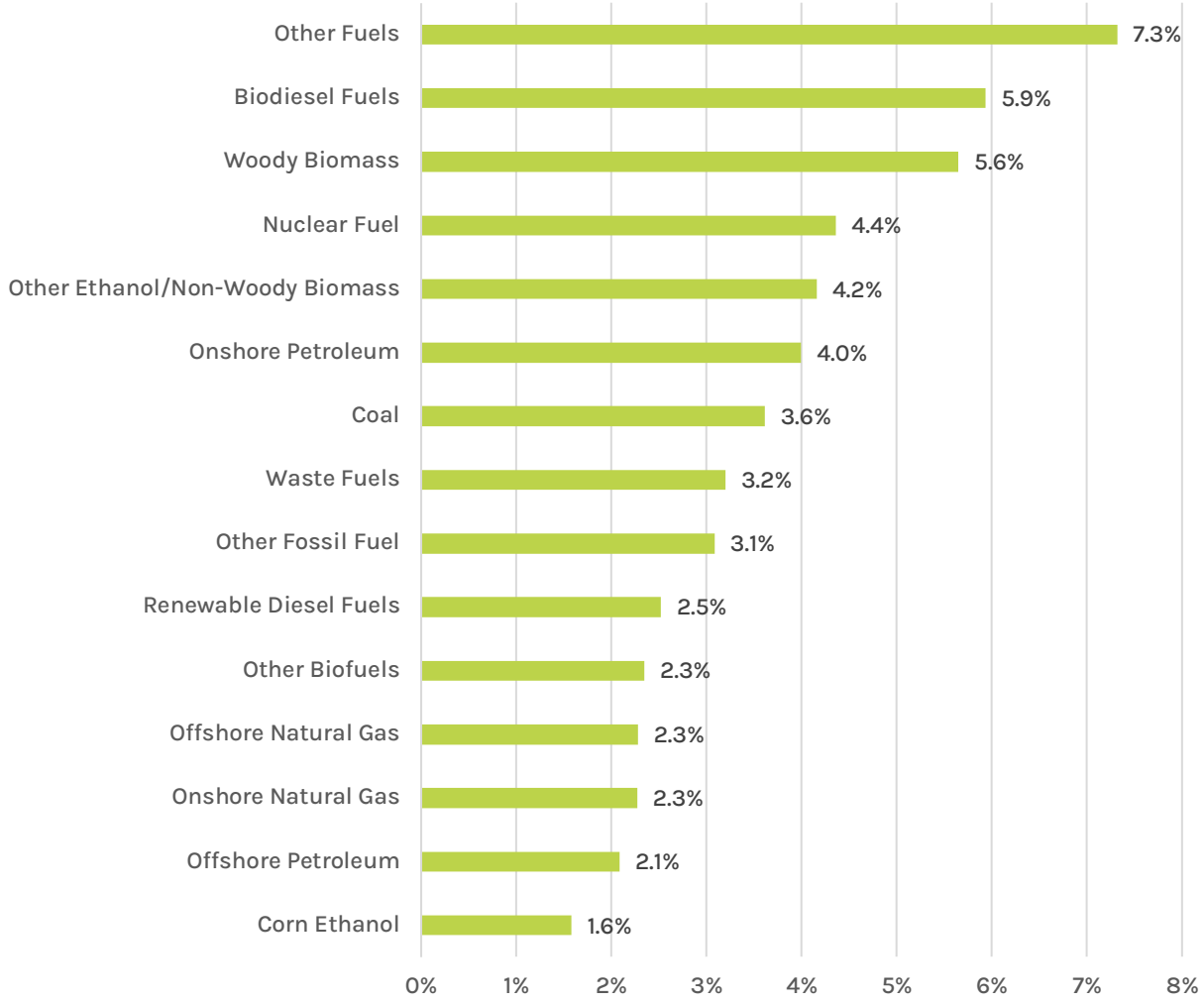
Table 18. Fuels Employers' Reasons for Hiring Difficulty

Industry	Most Common Reason	Second Most Common Reason	Third Most Common Reason
Agriculture & Forestry	Competition/small applicant pool (50%)	Insufficient qualifications (certifications or education) (50%)	Lack of experience, training, or technical skills (50%)
Mining & Extraction	Insufficient non-technical skills (work ethic, dependability, critical thinking) (33%)	Difficulty finding industry-specific knowledge, skills, and interest (33%)	Cannot provide competitive wages (22%)
Manufacturing	Insufficient non-technical skills (work ethic, dependability, critical thinking) (38%)	Location (38%)	Difficulty finding industry-specific knowledge, skills, and interest (31%)
Construction	Insufficient non-technical skills (work ethic, dependability, critical thinking) (41%)	Insufficient qualifications (certifications or education) (35%)	Lack of experience, training, or technical skills (35%)
Wholesale Trade, Distribution, and Transport	Insufficient qualifications (certifications or education) (56%)	Competition/small applicant pool (31%)	Lack of experience, training, or technical skills (25%)
Professional and Business Services	Lack of experience, training, or technical skills (42%)	Cannot provide competitive wages (32%)	Competition/small applicant pool (29%)
Other Services	Lack of experience, training, or technical skills (33%)	Difficulty finding industry-specific knowledge, skills, and interest (24%)	Insufficient non-technical skills (work ethic, dependability, critical thinking) (24%)

Employment Change by Technology and Industry

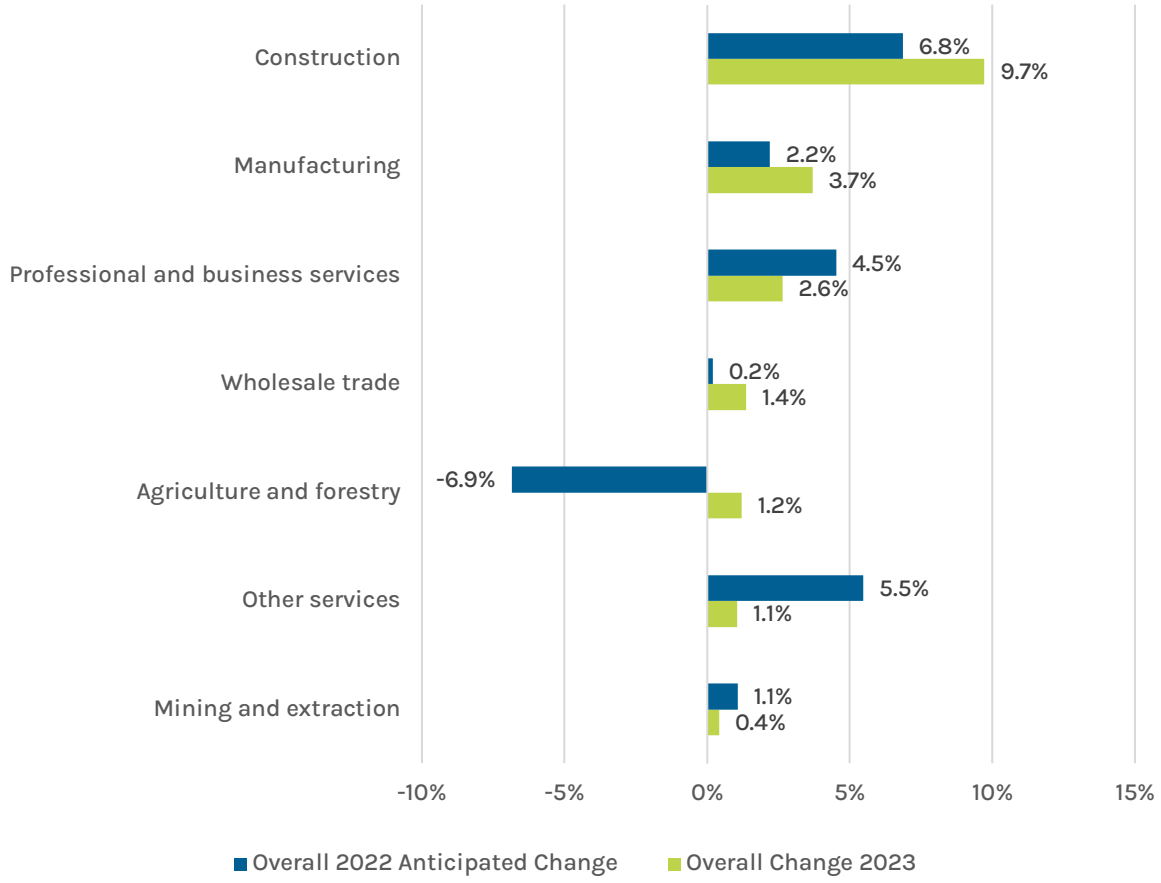
While the previous section highlighted employers' current hiring difficulty across industries, this section focuses on anticipated employment change by technology and industry. This section also compares actual employment change over the last year to anticipated employment change previously forecasted in 2022. All fuels technologies employers anticipate growth through 2024 (Figure 63), ranging from 1.6% in corn ethanol to 7.3% in "other fuels."

Figure 63. Fuels Employers' Anticipated Employment Changes by Technology, 2023-2024



Employers in six out of the seven industries within fuels anticipated job growth from 2022 to 2023 (Figure 64). Agriculture and forestry employers did not anticipate the growth that occurred from 2022 to 2023, expecting to lose workers when the industry experienced actual growth of 1.2%. Construction, manufacturing, wholesale trade, and agriculture and forestry experienced higher growth than anticipated.

Figure 64. Fuels Actual Employment Change 2022-2023 vs. Anticipated Employment Change 2022



Fuels Workforce Demographics

The workforce participation of female workers was slightly lower in fuels (25%) than in the overall energy workforce (26%) and was much lower when compared to the national workforce average (47%). Males made up 74% of the fuels workforce, slightly above the 73% energy workforce average and far exceeding the share of male workers in the overall U.S. workforce (53%). Fuels employers reported fewer than 1% of their employees as gender nonbinary[62] (Table 19).

The proportion of Hispanic or Latino workers in the fuels workforce (15%) was below the national workforce average (19%) and the energy workforce average (18%).

The proportion of non-White workers in the fuels workforce was 24%, which was lower than the energy workforce average of 26% and on par with the national workforce average of 24%. The proportion of Black or African American workers in the fuels workforce (9%) was the same as the overall energy workforce average (9%), but lower than the proportion of Black or African American workers employed economy-wide (13%).

Veterans had higher representation in the fuels workforce (10%) than in the overall energy workforce (9%) and the national workforce (5%). The proportion of formerly incarcerated individuals in the fuels workforce (2%) was higher than the energy workforce average (1%) but matched the U.S. workforce average of 2%. Individuals requesting accommodations for disabilities in the fuels workforce (2%) were employed at a similar rate when compared to the energy workforce as a whole (2%), but lower than the overall national workforce average (5%).

The fuels workforce was composed of a higher share of workers under the age of 30 (31%) than the overall energy workforce (29%) and had a higher share of workers aged 55 or older (20%) compared to the overall energy workforce (18%).

Workers represented by a union or covered under a project labor or collective bargaining agreement were similarly represented in the fuels workforce (7%) and the national private sector workforce (7%) but at a lower level than that of the overall energy workforce (11%).

[62] As with all demographic data in this report, there is a potential for reporting errors and biases. For gender specifically, it is important to note that the U.S. Census only collects data on "sex" and not "gender;" so reporting on gender nonbinary employment should be interpreted with caution.

Table 19. Fuels Workforce Demographics and Characteristics

	Number of Workers	Fuels Average	Energy Workforce Average	National Workforce Average
Male	781,710	74%	73%	53%
Female	266,432	25%	26%	47%
Gender Nonbinary	2,733	<1%	<1%	n/a[63]
Hispanic or Latino	153,370	15%	18%	19%
Not Hispanic or Latino	897,505	85%	82%	81%
American Indian or Alaska Native	19,527	2%	2%	1%
Asian	59,709	6%	7%	7%
Black or African American	96,817	9%	9%	13%
Native Hawaiian or Other Pacific Islander	11,532	1%	1%	<1%
White	803,254	76%	74%	76%
Two or More Races	48,278	5%	5%	3%
Unknown Race	11,757	1%	2%	n/a
Veterans	109,020	10%	9%	5%
18 to 29	324,355	31%	29%	22%
30 to 54	519,495	49%	52%	53%
55 and Over	207,024	20%	18%	23%
Disability	17,852	2%	2%	5%
Formerly Incarcerated	16,524	2%	1%	2%
Represented by Unions, Collective Bargaining Agreements, and/or Project Labor Agreements	77,839	7%[64]	11%	7%

National sources: BLS (2023a, 2023b, 2023c, 2023d), Jobs EQ (2023), Prison Policy (2018)

[63] While the USEER asks workers whether they identify as male, female, and nonbinary, no data from the Bureau of Labor Statistics or U.S. Census exist for the number of nonbinary workers within the national workforce

[64] Unionization rates vary by state.

Petroleum Fuels

Petroleum fuels businesses employed 528,183 workers in 2023, up 6,481 from the 521,702 employed in 2022 (1.2%). The majority of petroleum fuels workers in the United States — 440,433 — worked in onshore petroleum fuel, while the remaining 87,750 worked in offshore petroleum fuel.

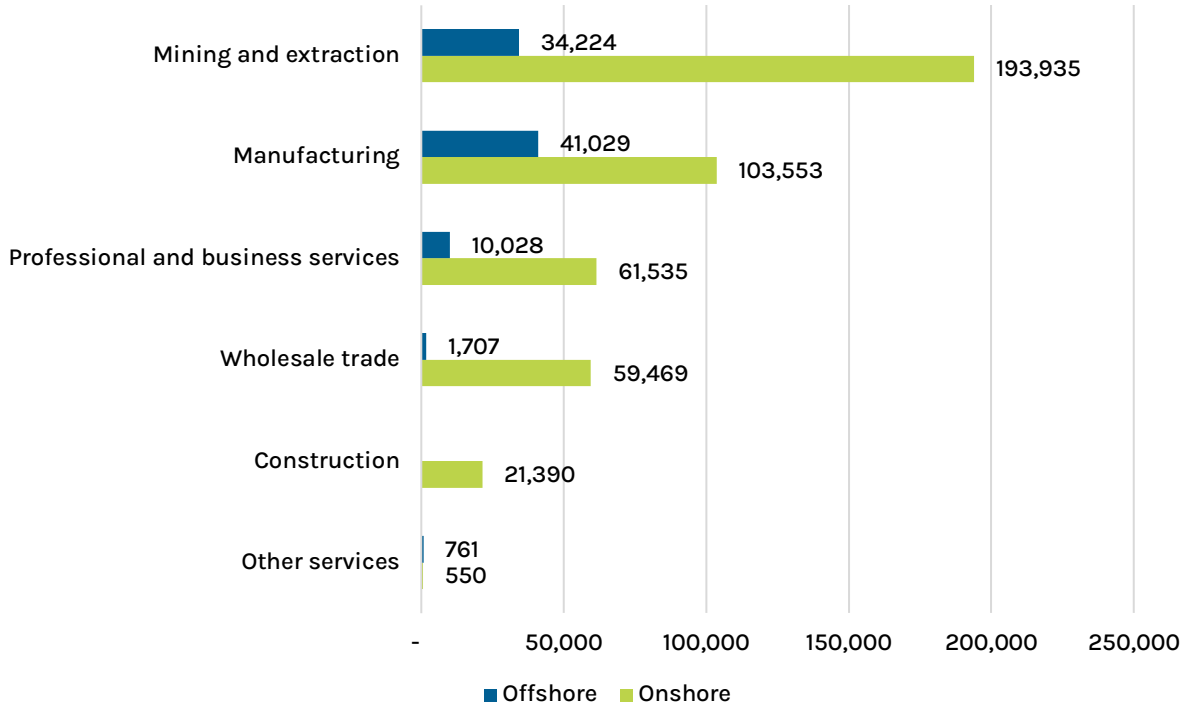
Trends and Key Takeaways

- The largest job gains in petroleum fuels were in the manufacturing industry, with 3,659 added jobs (2.6%) from 2022 to 2023. This was followed by construction, with 1,894 added jobs (9.7%); professional and business services, with 460 added jobs (0.6%); wholesale trade, with 293 added jobs (0.5%); and mining and extraction, with 166 added jobs (0.1%). The number of other services jobs in petroleum fuels remained relatively static since 2022.
- All industries within onshore petroleum anticipate growth in 2024. Similarly, all industries in offshore petroleum anticipate growth in the next year, ranging from 1.1% in other services to 10.2% in wholesale trade.
- The percentage of workers represented by a union or covered under a project labor or collective bargaining agreement in the petroleum fuels workforce (7%) was lower than the energy workforce average (11%) but in line with the national private sector average (7%).
- Female workers in the petroleum fuels workforce (24%) were less represented than in the overall energy workforce (26%) and the overall national workforce (47%).
- Hispanic or Latino workers in the petroleum fuels workforce (16%) were less represented than in the overall energy workforce (18%) and the overall national workforce (19%).
- The percentage of non-white workers in the petroleum fuels workforce (24%) was lower than the energy workforce average (26%) but similar to the economy-wide average (24%).
- Black or African American workers were more represented in the petroleum fuels workforce (10%) than in the overall energy workforce (9%) but less represented when compared to the national workforce average (13%).
- The proportion of veterans in the petroleum fuels workforce (10%) was higher than the overall energy workforce average (9%) and double the national workforce average (5%).
- Individuals requesting accommodations were less represented in the petroleum fuels workforce (1%) than in the overall energy workforce (2%) and the overall national workforce (5%).
- The proportion of formerly incarcerated individuals working in petroleum fuels (2%) was higher than the energy workforce average (1%) and similar to the national workforce average (2%).

Employment by Industry

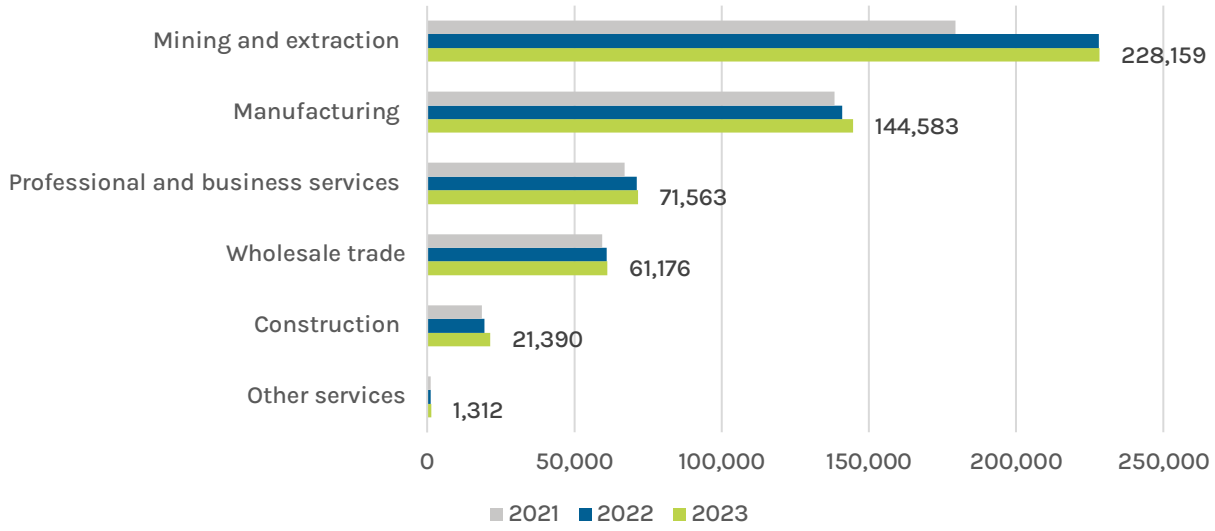
Figure 65 shows employment for onshore and offshore petroleum by industry in 2023. Onshore petroleum businesses employed 440,433 workers, while offshore businesses employed 87,750 workers. Onshore petroleum represented 83.4% of all petroleum fuels employment.

Figure 65. Onshore and Offshore Petroleum Fuels Employment by Industry



The largest number of petroleum fuels employees was in the mining and extraction industry, with 228,159 workers (Figure 66). Businesses in the manufacturing industry added the most jobs between 2022 and 2023, increasing by 3,659 workers or 2.6%. Construction businesses in petroleum fuels grew the fastest, with 9.7% growth or 1,894 additional workers.

Figure 66. Petroleum Fuels Employment by Industry, 2021-2023



Employer Perspective on Workforce Issues

Current Hiring Difficulty

Among respondents employing onshore petroleum fuels workers, construction businesses reported the greatest difficulty finding qualified employees (Figure 67). Similarly, among respondents hiring offshore petroleum fuels workers, construction businesses reported the greatest difficulty finding qualified employees, with a third (33%) of construction businesses identifying hiring as "very difficult" (Figure 68).

Figure 67. Onshore Petroleum Fuels Employers' Perceived Hiring Difficulty

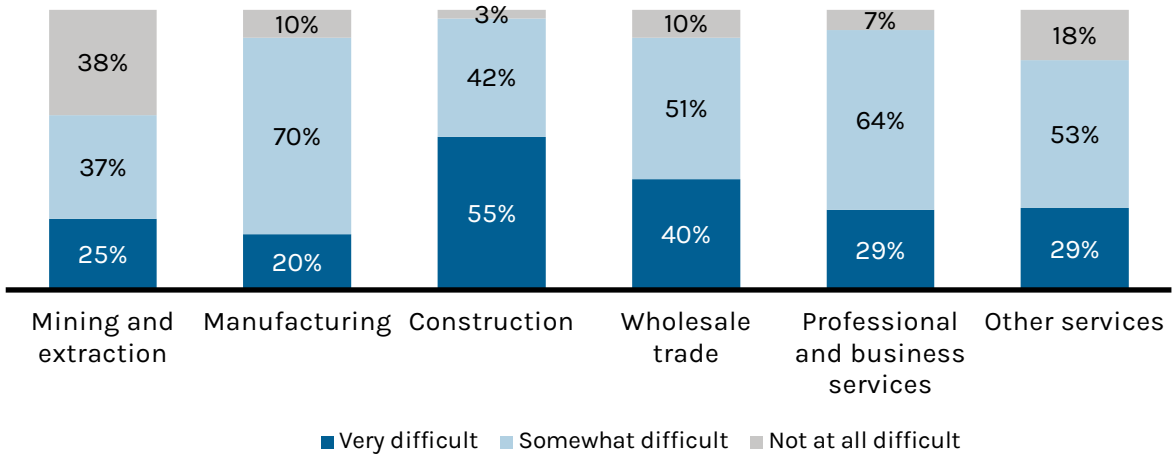
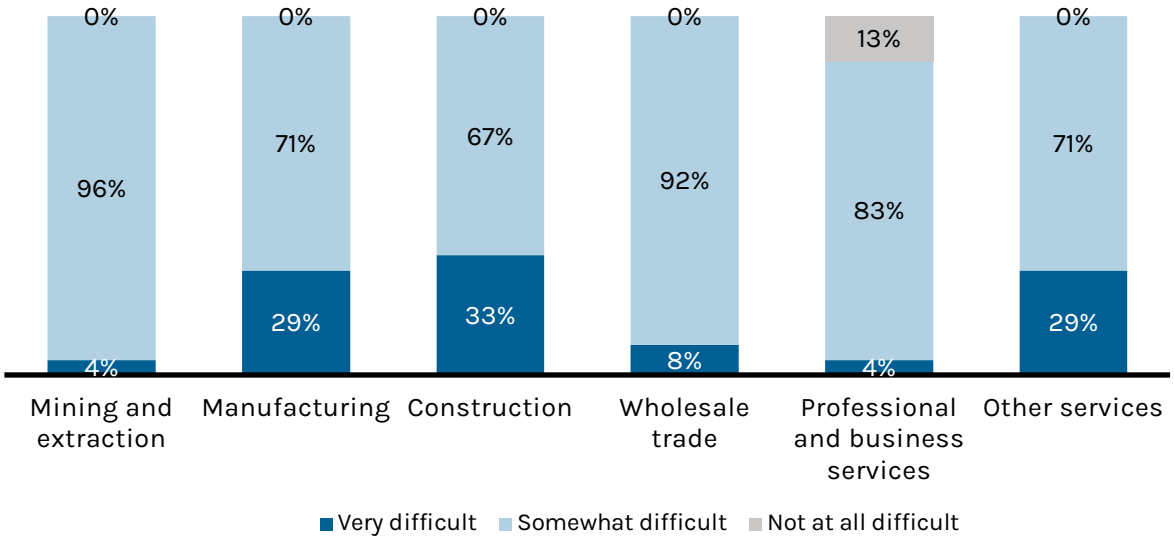


Figure 68. Offshore Petroleum Fuels Employers' Perceived Hiring Difficulty

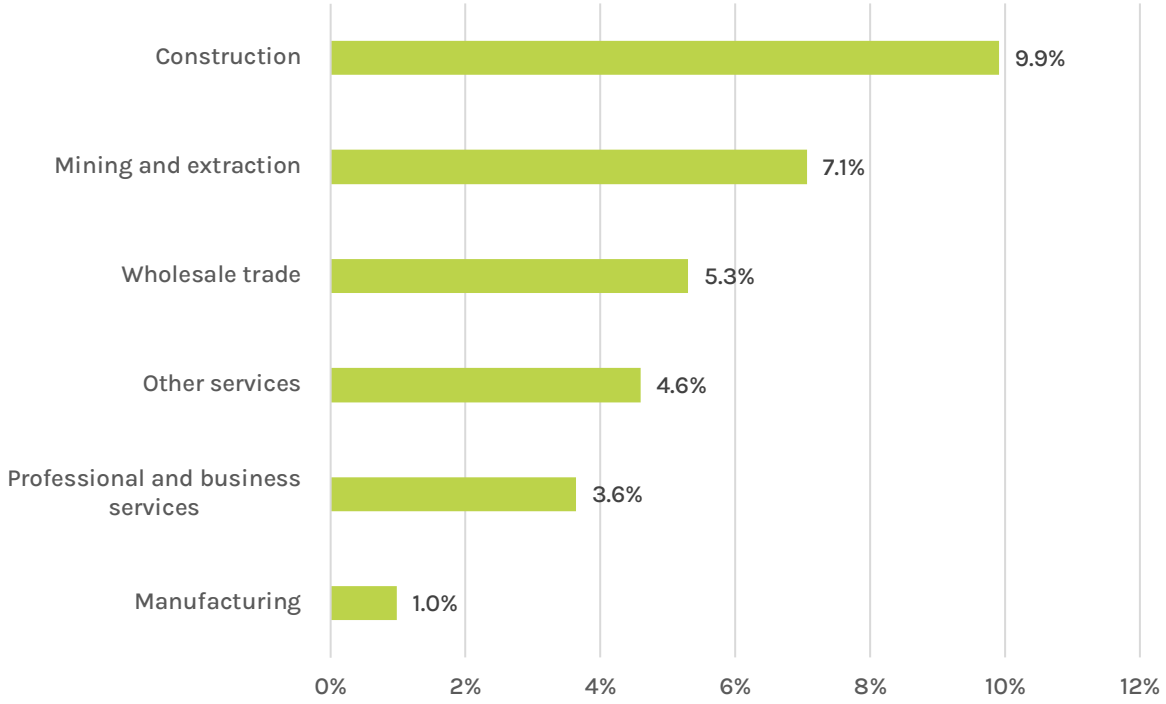


Employment Change by Industry

The previous section highlighted petroleum fuels employers' current hiring difficulty across industries, whereas this section focuses on anticipated employment change by industry. This section also compares actual employment change over the last year to anticipated employment change in 2022.

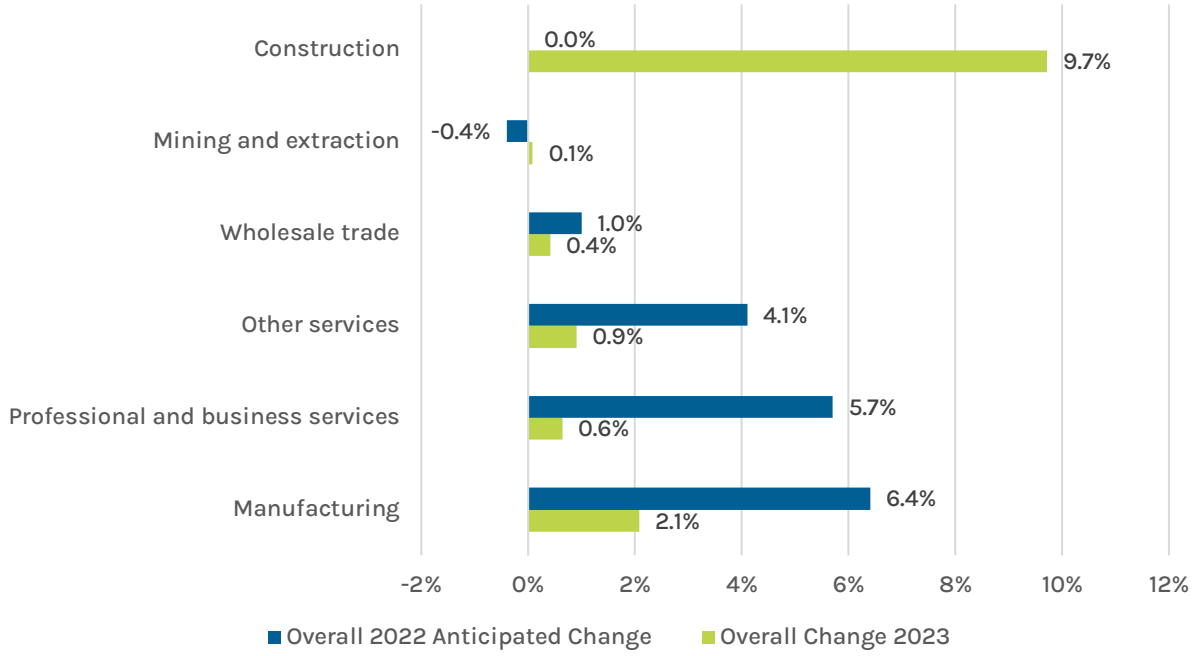
Onshore and offshore petroleum businesses reported differing expectations for job growth through 2024. Among onshore petroleum fuels employers, all industries anticipate positive job growth (Figure 69).

Figure 69. Onshore Petroleum Fuels Employers' Anticipated Employment Change by Industry, 2023-2024



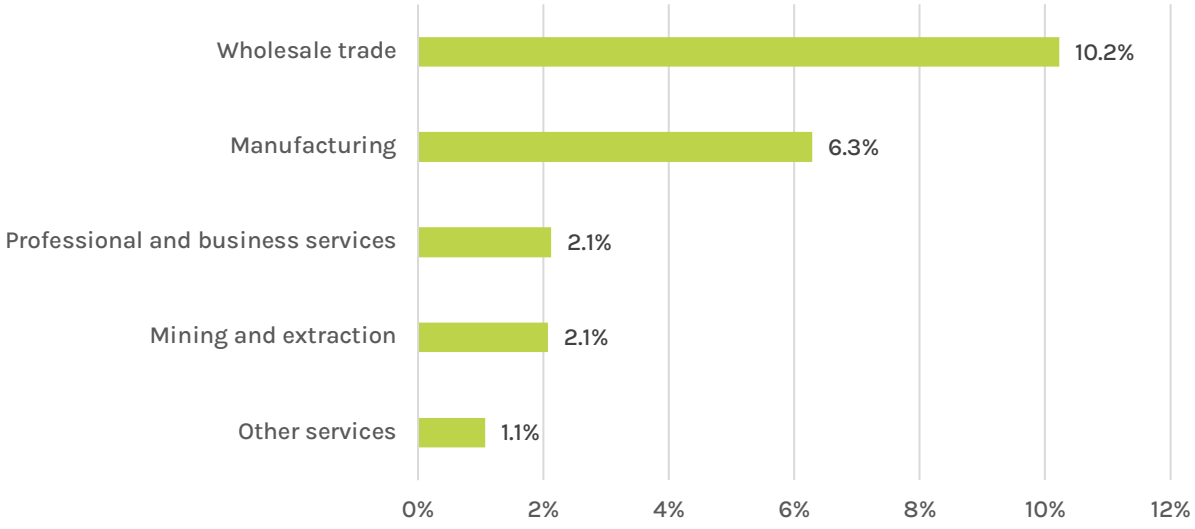
Mining and extraction and construction businesses were the only two industries within onshore petroleum fuels that had anticipated either no growth or a decline in employment from 2022 to 2023. In fact, all industries registered job growth from 2022 to 2023, ranging from 0.1% in mining and extraction to 9.7% in construction (Figure 70).

Figure 70. Onshore Petroleum Fuels Actual Employment Change 2022-2023 vs. Anticipated Employment Change 2022



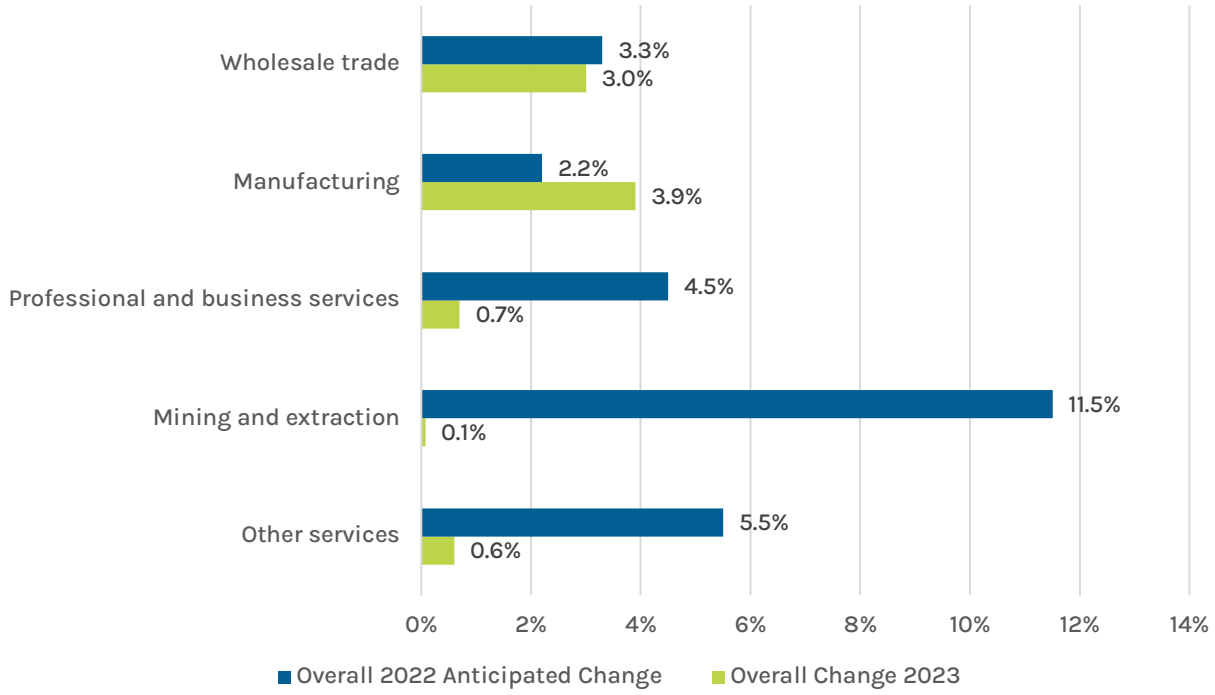
Offshore petroleum fuels employers across all industries expect growth in 2024, with wholesale trade businesses the most optimistic, anticipating 10.2% growth (Figure 71).

Figure 71. Offshore Petroleum Fuels Employers' Anticipated Employment Changes by Industry, 2023-2024



Businesses from all industries involved with offshore petroleum fuels anticipated job growth from 2022 to 2023, and only manufacturing registered greater growth than expected (Figure 72). All other industries experienced lower job growth than predicted.

Figure 72. Offshore Petroleum Fuels Actual Employment Change 2022-2023 vs. Anticipated Employment Change 2022



Petroleum Fuels Workforce Demographics

Males constituted 76% of the petroleum fuels workforce, as compared to 73% for the energy workforce overall and 53% for the national workforce overall (Table 20).

The proportion of Hispanic or Latino workers in the petroleum fuels sector (16%) was lower than the energy workforce average (18%) and the national workforce average (19%). The proportion of non-white workers in the petroleum fuels workforce (24%) was lower than the energy workforce average (26%) but similar to the overall U.S. workforce average (24%). The petroleum fuels workforce also employed a lower share of Asian workers (6%) as compared to the overall energy workforce (7%), and a lower share of workers of two or more races (4%) compared to the overall energy workforce (5%).

Black or African American workers were more represented in the petroleum fuels workforce (10%) than in the overall energy workforce (9%) but less represented when compared to the economy-wide average (13%). The proportion of American Indian or Alaska Native workers in the petroleum fuels workforce (2%) was the same as the energy workforce average (2%).

The proportion of veteran workers in the petroleum fuels workforce (10%) was higher than the energy workforce average (9%) and double the share of veterans in the U.S. workforce as a whole (5%).

The proportion of workers aged 55 or older in the petroleum fuels workforce (19%) was higher than the energy workforce average (18%). Workers under the age of 30 in the petroleum fuels workforce (31%) were more highly represented than in the overall energy workforce (29%).

The proportion of formerly incarcerated workers in the petroleum fuels workforce (2%) was double the energy workforce average (1%) and similar to the national workforce average (2%). The concentration of workers represented by a union or covered under a project labor or collective bargaining agreement in the petroleum fuels workforce (7%) was lower than the energy workforce average (11%) but on par with the national private sector average (7%).

Table 20. Petroleum Fuels Workforce Demographics and Characteristics

	Number of Workers	Petroleum Fuels Average	Energy Workforce Average	National Workforce Average
Male	401,810	76%	73%	53%
Female	125,902	24%	26%	47%
Gender Nonbinary	471	<1%	<1%	n/a
Hispanic or Latino	82,405	16%	18%	19%
Not Hispanic or Latino	445,778	84%	82%	81%
American Indian or Alaska Native	10,206	2%	2%	1%
Asian	30,971	6%	7%	7%
Black or African American	54,614	10%	9%	13%
Native Hawaiian or Other Pacific Islander	5,286	1%	1%	<1%
White	399,876	76%	74%	76%
Two or More Races	23,126	4%	5%	3%
Unknown Race	4,104	<1%	2%	n/a
Veterans	52,134	10%	9%	5%
18 to 29	165,461	31%	29%	22%
30 to 54	263,928	50%	52%	53%
55 and Over	98,794	19%	18%	23%
Disability	5,614	1%	2%	5%
Formerly Incarcerated	8,055	2%	1%	2%
Represented by Unions, Collective Bargaining Agreements, and/or Project Labor Agreements	35,922	7%[65]	11%	7%

National sources: BLS (2023a, 2023b, 2023c, 2023d), Jobs EQ (2023), Prison Policy (2018)

[65] Unionization rates vary by state.

Natural Gas

Natural gas fuels employed 268,170 workers in 2023, up 5,283 from the 262,886 employed in 2022 (2%). Most natural gas workers in the United States — 245,999 — worked in onshore natural gas, while the remaining 22,171 worked in offshore natural gas.

Trends and Key Takeaways

- The largest natural gas fuels job gains were in the manufacturing industry[66], with 3,046 new jobs (7.3%), followed by professional and business services, with 1,989 added jobs (5.5%), and wholesale trade, with 207 added jobs (0.7%). Employment in mining and extraction and other services within natural gas fuels remained relatively flat from 2022 to 2023.
- In natural gas fuels, the male workforce share (75%) was higher than the energy workforce average (73%) and much higher than the national workforce average (53%).
- Hispanic or Latino workers were less represented in the natural gas fuels workforce (15%) than in the overall energy workforce (18%) and the overall national workforce (19%).
- Natural gas fuels employers had a lower percentage of non-white workers (25%) than the energy workforce average (26%) but higher than the U.S. workforce average (24%). This is largely attributable to a lower proportion of Asian workers in the natural gas fuels workforce (5%) compared to the energy workforce average (7%) and a lower proportion of Native Hawaiian or other Pacific Islander workers in the natural gas fuels workforce (<1%) compared to the energy workforce average (1%).
- The proportion of Black or African American workers in the natural gas fuels workforce (10%) was higher than the energy workforce average (9%) but lower than the national workforce average (13%). Workers of two or more races were more highly represented in the natural gas fuels workforce (7%) than in the overall energy workforce (5%).
- The proportion of veteran workers in the natural gas fuels workforce (9%) was equivalent to the energy workforce average (9%), and nearly double the national workforce average (5%).
- The percentage of workers represented by a union or covered under a project labor or collective bargaining agreement in the natural gas fuels workforce (7%) was lower than the energy workforce average (11%) and similar to the national private sector average (7%).
- The proportion of individuals requesting accommodations for disabilities in the natural gas fuels workforce (2%) was the same as the energy workforce average (2%) and less than half the national workforce average (5%).

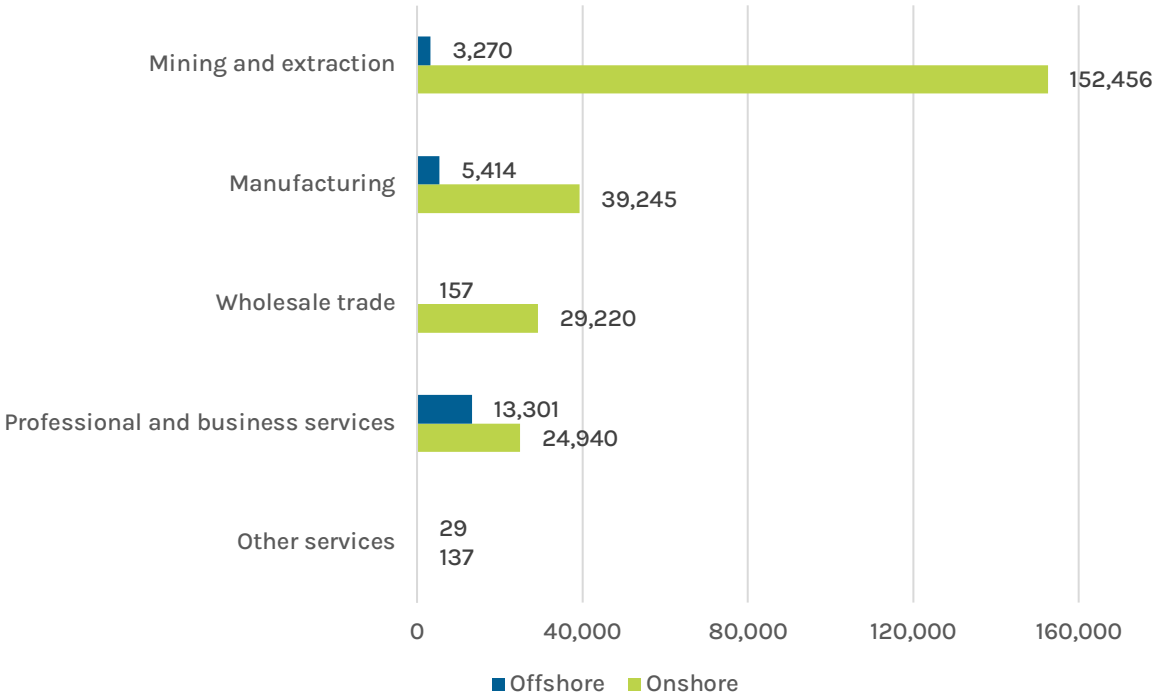
[66] Includes natural gas processing plants, mining and extraction machinery manufacturing, and other product manufacturing for natural gas fuels business.

- The percentage of formerly incarcerated workers in the natural gas fuels workforce (2%) was higher than the energy workforce average (1%) and the same as the overall U.S. workforce average (2%).

Employment by Industry

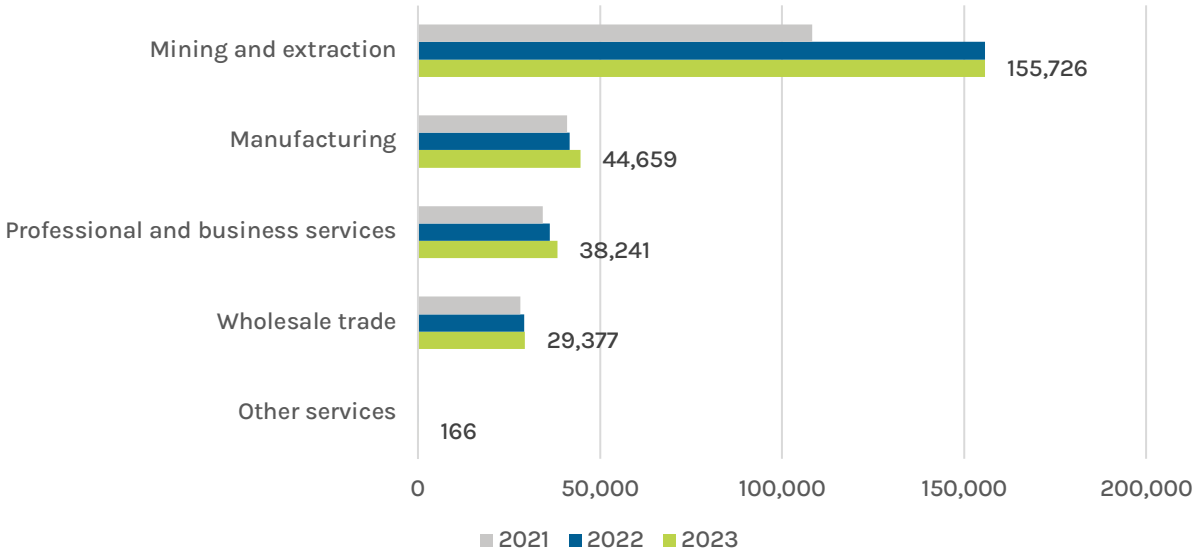
The 2024 USEER splits natural gas fuels into onshore and offshore categories. Figure 73 displays employment between the two categories by industry. Onshore natural gas fuels businesses employed a total of 245,999 workers in 2023, while offshore natural gas fuels businesses employed 22,171 workers. Onshore natural gas fuels represented 91.7% of all natural gas fuels employment.

Figure 73. Onshore and Offshore Natural Gas Fuels Employment by Industry



The largest number of natural gas fuels workers were in the mining and extraction industry, which had 155,726 workers, representing 58.1% of the total technology employment (Figure 74). Mining and extraction employment in natural gas fuels remained flat year-over-year.

Figure 74. Natural Gas Fuels Employment by Industry, 2021-2023

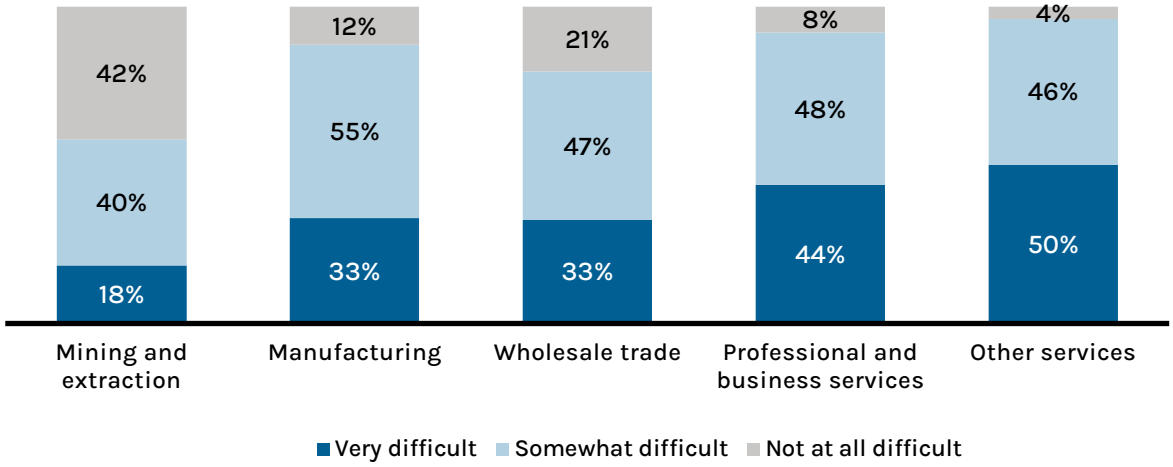


Employer Perspective on Workforce Issues

Current Hiring Difficulty

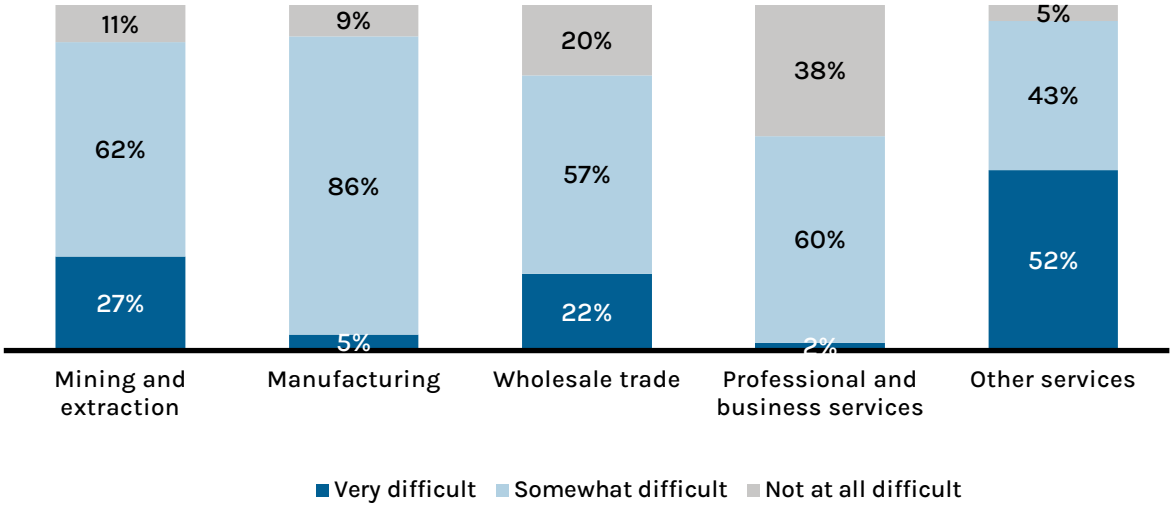
Within onshore natural gas fuels, other services and professional and business services employers reported the highest hiring difficulty, with more than nine-in-ten respondents for each indicating at least some difficulty (Figure 75Figure 75). Other services had the highest percentage of employers indicating that it was “very difficult” to hire for onshore natural gas fuels (50%).

Figure 75. Onshore Natural Gas Fuels Employers’ Perceived Hiring Difficulty



In offshore natural gas fuels, other services and manufacturing employers had the highest reported hiring difficulty, with 95% and 91% of respondents indicating at least some difficulty, respectively (Figure 76). Other services had the highest proportion of employers indicating that it was “very difficult” to hire for offshore natural gas fuels (52%).

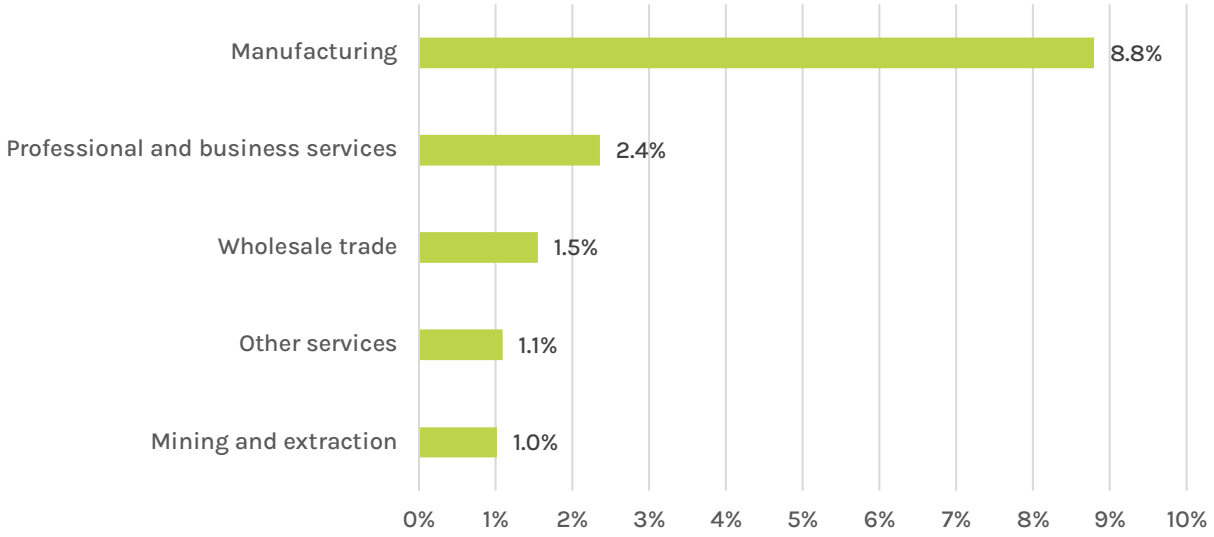
Figure 76. Offshore Natural Gas Fuels Employers’ Perceived Hiring Difficulty



Employment Change by Industry

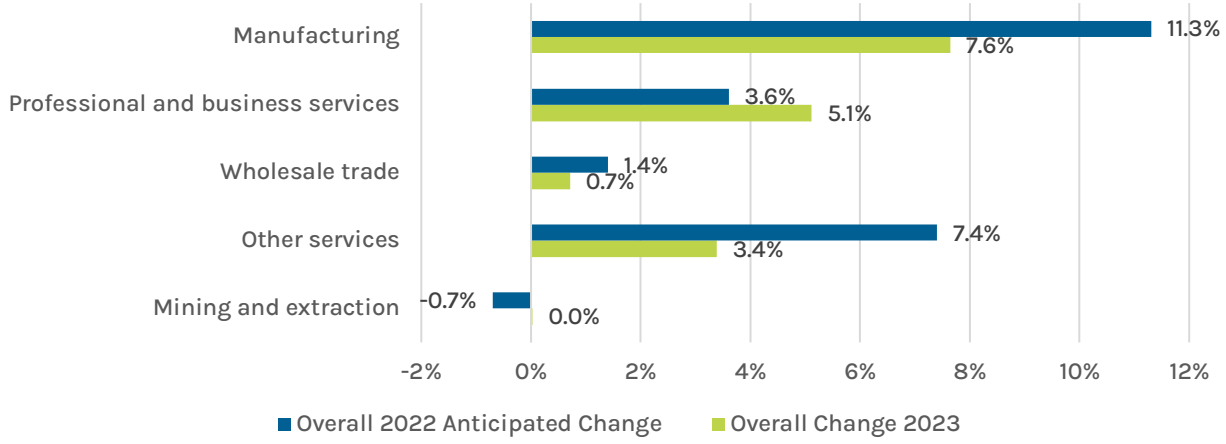
The previous section highlighted natural gas fuels employers' current hiring difficulty across industries, whereas this section focuses on anticipated employment change by industry. This section also compares actual employment change over the last year to anticipated employment change in 2022. Onshore natural gas growth expectations through 2024 range from 1.0% for mining and extraction employers to 8.8% for manufacturing businesses (Figure 77).

Figure 77. Onshore Natural Gas Fuels Employers' Anticipated Employment Change, 2023-2024



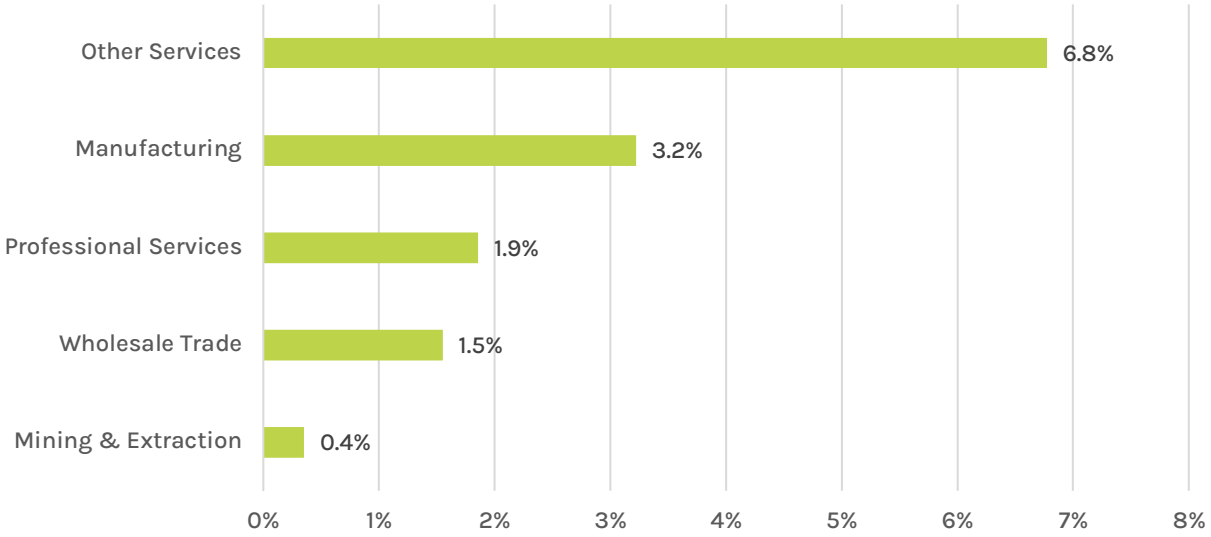
Mining and extraction employers were the only industry within onshore natural gas to anticipate a decline in employment from 2022 to 2023. Manufacturing (7.6%), professional and business services, (5.1%), other services (3.4%), and wholesale trade (0.7%) underwent job growth, while mining and extraction remained flat (0%) year-over-year (Figure 78).

Figure 78. Onshore Natural Gas Fuels Actual Employment Change 2022-2023 vs. Anticipated Employment Change 2022



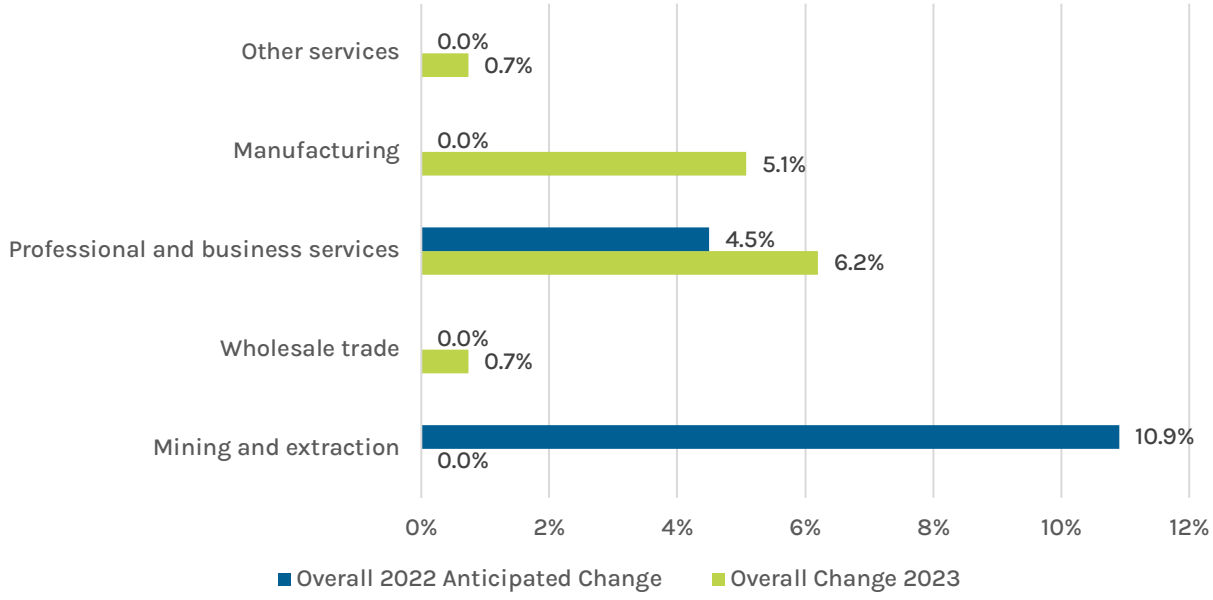
Offshore natural gas employers anticipate job growth ranging from 0.4% in mining and extraction to 6.8% in other services through 2024 (Figure 79).

Figure 79. Offshore Natural Gas Fuels Employers' Anticipated Employment Changes, 2023-2024



Businesses in two out of five industries within offshore natural gas had anticipated job growth from 2022 to 2023, according to last year's USEER, while wholesale trade, other services, and manufacturing businesses did not expect a change in employment. Mining and extraction within offshore natural gas fuels did not add jobs at the rate anticipated in 2022 (Figure 80).

Figure 80. Offshore Natural Gas Fuels Actual Employment Change 2022-2023 vs. Anticipated Employment Change 2022



Natural Gas Fuels Workforce Demographics

Women constituted 25% of the natural gas fuels workforce, lower than the energy workforce average (26%) and the national workforce average (47%) (Table 21).

The proportion of the natural gas fuels workforce made up of Hispanic or Latino workers (15%) was lower than the energy workforce average (18%) and the U.S. economy-wide average (19%). The share of non-white workers in the natural gas fuels workforce (25%) was slightly lower than the energy workforce average (26%) but higher than the national workforce average (24%).

The concentration of veterans in the natural gas fuels workforce (9%) was the same as the energy workforce average (9%) and nearly double the U.S. workforce average (5%). The share of formerly incarcerated individuals in the natural gas fuels workforce (2%) was higher than the energy workforce average (1%) but similar to the national workforce overall (2%). The proportion of workers requesting accommodations for disabilities in the natural gas fuels workforce (2%) was the same as the energy workforce average (2%) and less than half the proportion in the national workforce overall (5%).

The percentage of workers under the age of 30 in the natural gas fuels workforce (32%) was higher than the proportion across the overall energy workforce (29%). Workers between the ages of 30 and 54 were less represented in the natural gas fuels workforce (48%) than the overall energy workforce (52%). The percentage of workers aged 55 or older in the natural gas fuels workforce (20%) was larger than the energy workforce average (18%).

The concentration of workers represented by a union or covered under a project labor or collective bargaining agreement in the natural gas fuels workforce (7%) was lower than the energy workforce as a whole (11%) but in line with the national private sector average (7%).

Table 21. Natural Gas Fuels Workforce Demographics and Characteristics

	Number of Workers	Petroleum Fuels Average	Energy Workforce Average	National Workforce Average
Male	201,267	75%	73%	53%
Female	66,599	25%	26%	47%
Gender Nonbinary	304	<1%	<1%	n/a
Hispanic or Latino	39,831	15%	18%	19%
Not Hispanic or Latino	228,338	85%	82%	81%
American Indian or Alaska Native	4,689	2%	2%	1%
Asian	14,244	5%	7%	7%
Black or African American	26,495	10%	9%	13%
Native Hawaiian or Other Pacific Islander	2,340	<1%	1%	<1%
White	199,791	75%	74%	76%
Two or More Races	18,651	7%	5%	3%
Unknown Race	1,960	<1%	2%	n/a
Veterans	23,805	9%	9%	5%
18 to 29	84,574	32%	29%	22%
30 to 54	129,633	48%	52%	53%
55 and Over	53,963	20%	18%	23%
Disability	5,500	2%	2%	5%
Formerly Incarcerated	5,270	2%	1%	2%
Represented by Unions, Collective Bargaining Agreements, and/or Project Labor Agreements	19,649	7%[67]	11%	7%

National sources: BLS (2023a, 2023b, 2023c, 2023d), Jobs EQ (2023), Prison Policy (2018)

[67] Unionization rates vary by state.

Coal Fuels

Coal fuels employed 67,097 workers in 2023, up 2,239 from the 64,858 employed in 2022 (3.5%).

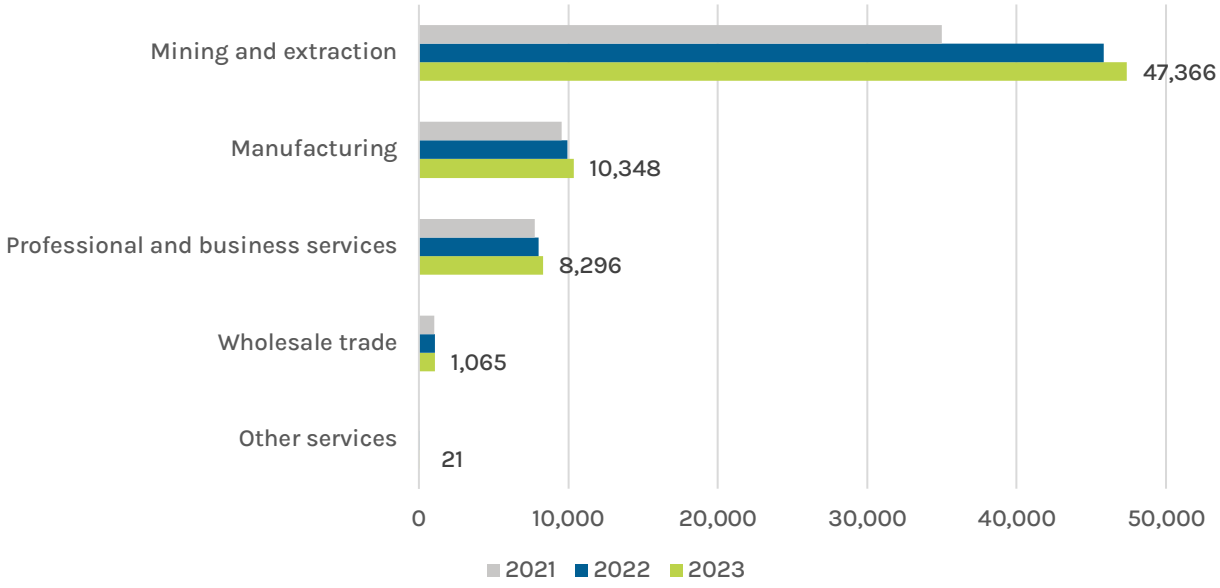
Trends and Key Takeaways

- The largest job gains in coal fuels were in the mining and extraction industry, with 1,553 added jobs (3.4%), followed by manufacturing, with 399 added jobs (4.0%), and professional and business services, with 278 added jobs (3.5%). Wholesale trade and other services employment remained flat year-over-year.
- Businesses within four of the five industries that make up coal fuels anticipate job growth through 2024. Employer estimates range from 2% job growth in other services to 9.3% growth in mining and extraction. Wholesale trade employers within coal fuels do not anticipate job growth through 2024.
- The coal fuels workforce was disproportionately male, with greater male representation (74%) than the overall energy workforce (73%) and the national workforce overall (53%).
- Hispanic or Latino workers were less represented in the coal fuels workforce (14%) than in the overall energy workforce (18%) and the U.S. workforce overall (19%).
- The share of non-white workers in the coal fuels workforce (20%) was lower than the overall energy workforce average (26%) and the national workforce average (24%). This is attributable to a lower-than-average proportion of Asian workers in the coal fuels workforce (6%) compared to the overall energy workforce average (7%), a lower-average-proportion of Black or African American workers in the coal fuels workforce (6%) compared to the overall energy workforce average (9%), and a lower proportion of workers of two or more races in the coal fuels workforce (3%) compared to the overall energy workforce average (5%).
- The proportion of veteran workers in the coal fuels workforce (12%) was higher than the energy workforce average (9%) and more than two times the national workforce average (5%).
- The percentage of workers in the coal fuels workforce represented by a union or covered under a project labor or collective bargaining agreement (11%) was similar to the energy workforce average (11%) and higher than the national private sector average (7%).
- The proportion of individuals requesting accommodations in the coal fuels workforce (2%) was the same as the energy workforce average (2%) and lower than the national workforce average (5%).
- The percentage of formerly incarcerated individuals in the coal fuels workforce (1%) was the same as the energy workforce average (1%) and lower than the national workforce average of 2%.

Employment by Industry

The largest number of coal fuels employees worked at businesses in the mining and extraction industry (47,366 workers) (Figure 81). Mining and extraction businesses also accounted for the most job gains, increasing by 1,553 workers from 2022 to 2023.

Figure 81. Coal Fuels Employment by Industry, 2021-2023

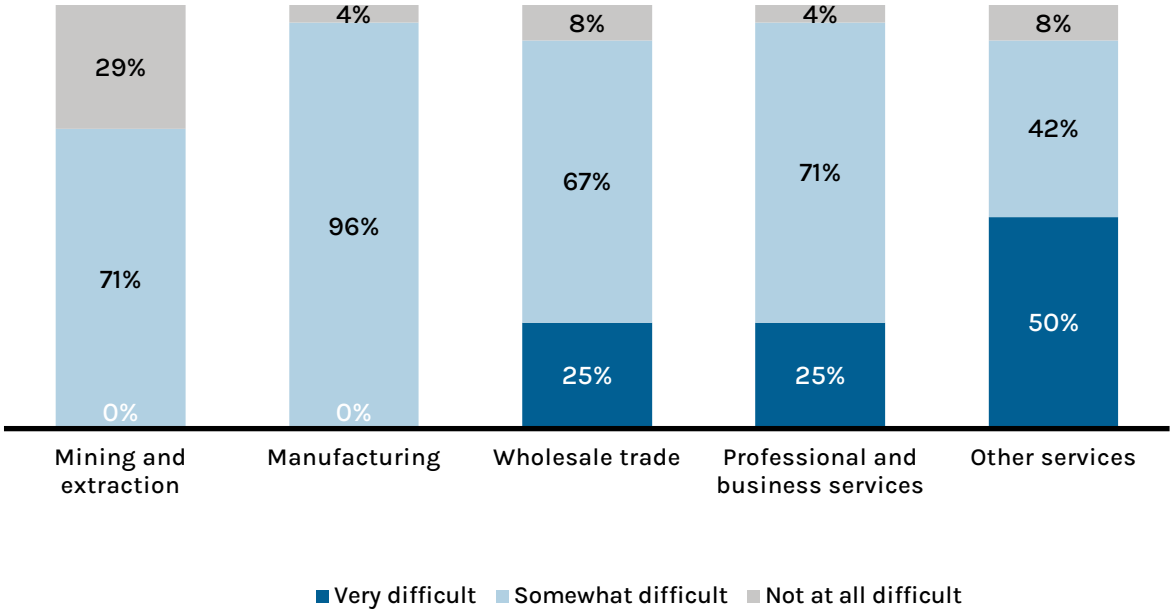


Employer Perspective on Workforce Issues

Current Hiring Difficulty

Within coal fuels industries, professional and business services, manufacturing, wholesale trade, and other services employers had the greatest difficulty hiring workers (Figure 82Figure 82). More than nine-in-ten employers in each of these four industries reported finding qualified workers as at least "somewhat difficult." Mining and extraction businesses in coal fuels reported the least difficulty hiring, with 29% stating that it was "not at all difficult" to find qualified workers.

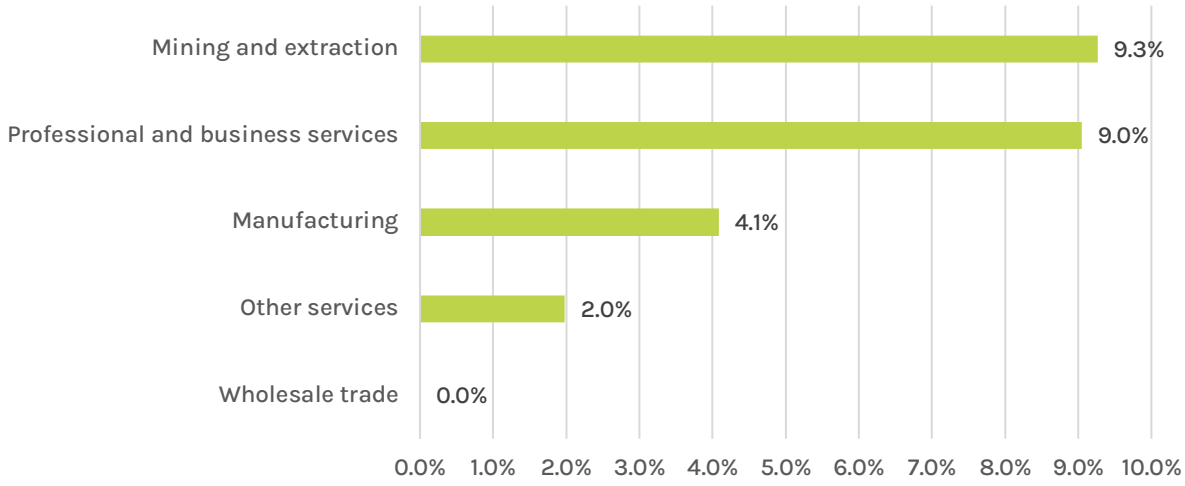
Figure 82. Coal Fuels Employers' Perceived Hiring Difficulty



Employment Change by Industry

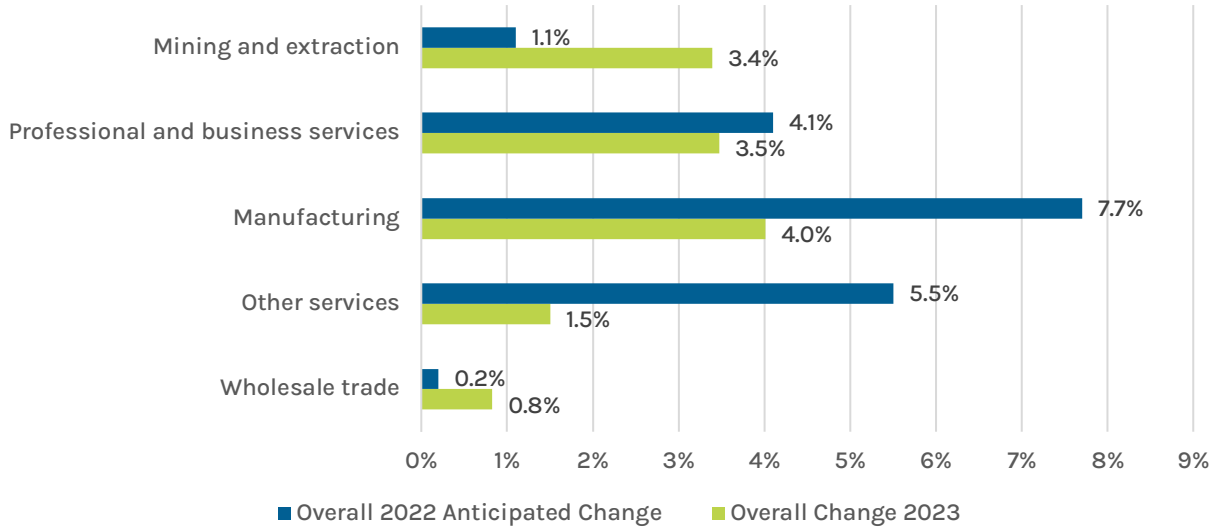
The previous section highlighted coal fuels employers' current hiring difficulty across industries, whereas this section focuses on anticipated employment change by industry. This section also compares actual employment change over the last year to anticipated employment change in 2022. As illustrated in Figure 83, employers across most industries in coal fuels anticipate job growth through 2024. Growth estimates range from 2.0% in other services to 9.3% in mining and extraction.

Figure 83. Coal Fuels Employers' Anticipated Employment Change, 2023-2024



While mining and extraction businesses in coal fuels anticipated meager growth from 2022 to 2023, jobs grew by 3.4% over the period, more than three times the expected growth (Figure 84).

Figure 84. Coal Fuels Actual Employment Change 2022-2023 vs. Anticipated Employment Change 2022



Coal Fuels Workforce Demographics

Coal fuels demographics are largely unchanged from the prior year. Males made up 74% of the coal fuels workforce, as compared to 73% of the overall energy workforce and 53% of the economy-wide workforce (Table 22). The proportion of the coal fuels workforce made up of Hispanic or Latino workers (14%) was lower than the energy workforce average (18%) and the national workforce average (19%).

Non-white workers in coal fuels (20%) were less represented compared to the energy workforce average (26%) and the national workforce average (24%). The proportion of Black or African American workers in coal fuels (6%) was lower than both the energy workforce average (9%) and the economy-wide average (13%).

The concentration of veterans in the coal fuels workforce (12%) was higher than the energy workforce average (9%) and more than double the U.S. workforce average (5%). The proportion of formerly incarcerated individuals in the coal fuels workforce (1%) was the same as the energy workforce average (1%) but lower than the national workforce average (2%). Individuals requesting accommodations for disabilities were less represented in the coal fuels workforce (2%) than the overall U.S. workforce (5%).

The coal fuels workforce had a higher share of workers under the age of 30 (31%) than the overall energy workforce (29%). The coal fuels workforce also had a higher share of workers aged 55 or older (24%) than the overall energy workforce average (18%).

The concentration of workers in the coal fuels workforce represented by a union or covered under a project labor or collective bargaining agreement (11%) was similar to the energy workforce average (11%) but higher than the national private sector average (7%).

Table 22. Coal Fuels Workforce Demographics and Characteristics

	Number of Workers	Coal Fuels Average	Energy Workforce Average	National Workforce Average
Male	49,342	74%	73%	53%
Female	17,455	26%	26%	47%
Gender Nonbinary	299	<1%	<1%	n/a
Hispanic or Latino	9,498	14%	18%	19%
Not Hispanic or Latino	57,599	86%	82%	81%
American Indian or Alaska Native	2,071	3%	2%	1%
Asian	3,828	6%	7%	7%
Black or African American	4,197	6%	9%	13%
Native Hawaiian or Other Pacific Islander	1,297	2%	1%	<1%
White	53,365	80%	74%	76%
Two or More Races	1,718	3%	5%	3%
Unknown Race	621	<1%	2%	n/a
Veterans	7,990	12%	9%	5%
18 to 29	20,761	31%	29%	22%
30 to 54	30,289	45%	52%	53%
55 and Over	16,047	24%	18%	23%
Disability	1,437	2%	2%	5%
Formerly Incarcerated	1,005	1%	1%	2%
Represented by Unions, Collective Bargaining Agreements, and/or Project Labor Agreements	7,652	11%[68]	11%	7%

National sources: BLS (2023a, 2023b, 2023c, 2023d), Jobs EQ (2023), Prison Policy (2018)

[68] Unionization rates vary by state.

Corn Ethanol

Corn ethanol businesses in the United States employed 35,860 workers in 2023, up 708 from the 35,152 employed in 2022 (2.0%).

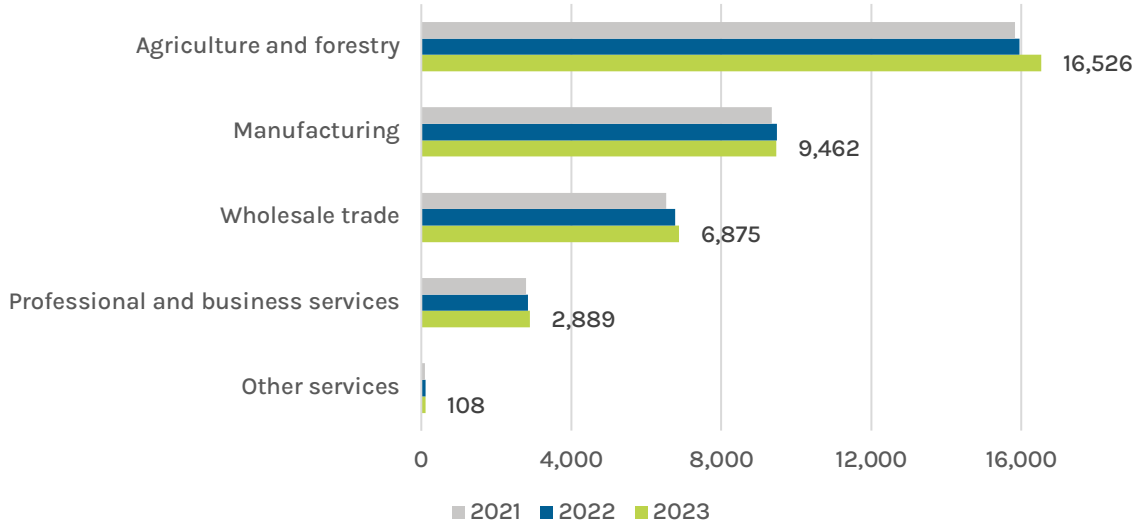
Trends and Key Takeaways

- The largest corn ethanol fuels job gains were in the agriculture and forestry industry, which added 575 new jobs (3.6%), followed by wholesale trade, with 108 added jobs (1.6%), and professional and business services, with 43 added jobs (1.5%). Other services and manufacturing employment was relatively flat from 2022 to 2023.
- Corn ethanol fuels employers in professional and business services, manufacturing, and wholesale trade anticipate job growth in 2024, with expectations ranging from 0.8% to 3.5%. Agriculture and forestry businesses and other services businesses anticipate no job growth for the second year in a row.
- The corn ethanol fuels workforce had a higher share of female workers (31%) than the energy workforce overall (26%), but a lower share than the overall national workforce (47%).
- Hispanic or Latino workers were less represented in the corn ethanol fuels workforce (12%) than in the overall energy workforce (18%) and the national workforce (19%).
- The proportion of non-white workers in the corn ethanol fuels workforce (21%) was lower than the energy workforce average (26%) and the overall U.S. workforce average (24%). There is a lower-than-average proportion of Asian workers in the corn ethanol fuels workforce (6%) compared to the overall energy workforce (7%), as well as a lower proportion of American Indian or Alaska Native workers in the corn ethanol fuels workforce (1%) compared to the overall energy workforce (2%). There is also a lower-than-average proportion of Black or African American workers in the corn ethanol fuels workforce (6%) compared to the overall energy workforce (9%), and a lower-than-average proportion of workers of two or more races in the corn ethanol fuels workforce (3%) than the overall energy workforce (5%).
- Veterans made up 16% of the corn ethanol fuels workforce, a higher concentration than the 9% energy workforce average and more than triple the share in the national workforce overall (5%).
- The percentage of workers represented by a union or covered under a project labor or collective bargaining agreement in the corn ethanol fuels workforce (7%) was lower than the energy workforce average (11%) but on par with the national private sector average (7%).
- Individuals requesting accommodations for disabilities in the corn ethanol fuels workforce (4%) were twice as represented as they were in the overall energy workforce (2%).
- The percentage of formerly incarcerated individuals in the corn ethanol fuels workforce (<1%) was lower than the energy workforce average (1%).

Employment by Industry

The largest number of corn ethanol fuel jobs were in the agriculture and forestry industry, with 16,526 workers (Figure 85). This was up 575 from 2022 (3.6%), the largest job gains of any industry sector in corn ethanol fuels. Wholesale trade businesses contributed 108 new jobs, representing 1.6% growth.

Figure 85. Corn Ethanol Fuels Employment by Industry, 2021-2023

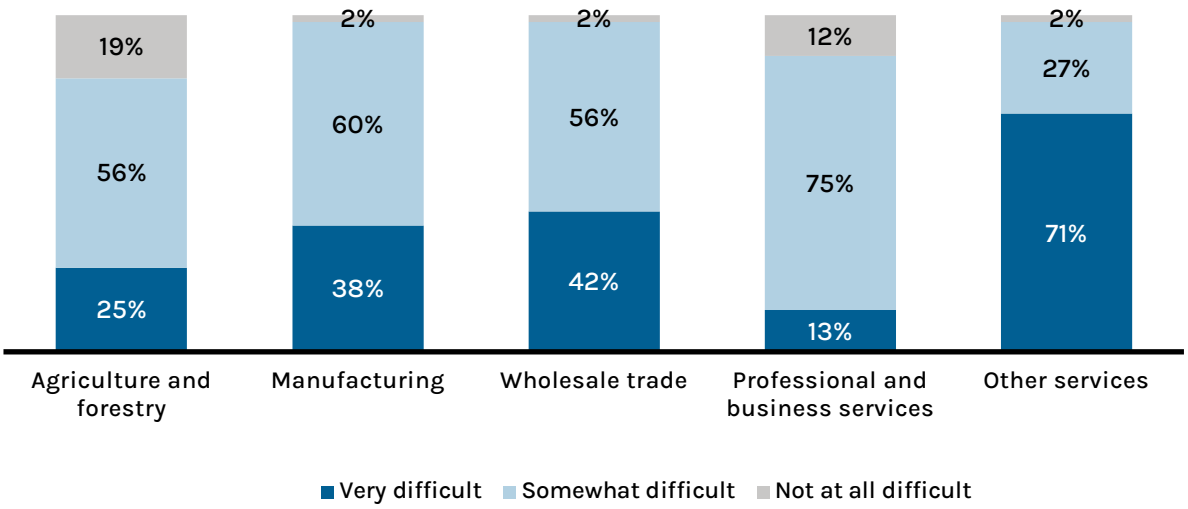


Employer Perspective on Workforce Issues

Current Hiring Difficulty

Within corn ethanol fuels industries, employers across all industries had high overall difficulty hiring workers (Figure 86). Seventy-one percent of other services businesses within corn ethanol fuels reported that finding qualified candidates was “very difficult.”

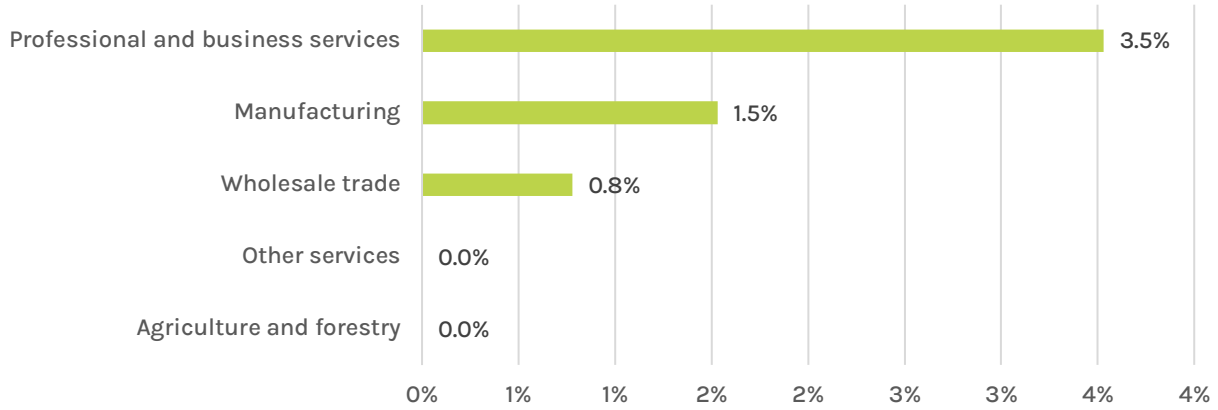
Figure 86. Corn Ethanol Fuels Employers’ Perceived Hiring Difficulty



Employment Change by Industry

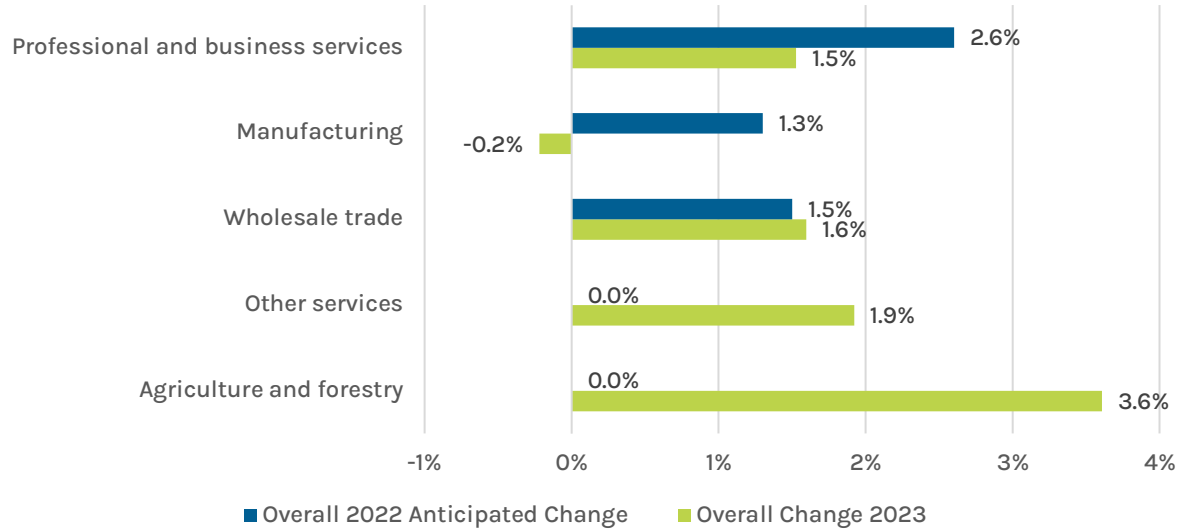
The previous section highlighted employers' current hiring difficulty across industries, while this section focuses on anticipated employment change by industry. This section also compares actual employment change over the last year to anticipated employment change in 2022. As displayed in Figure 87, businesses from three industries anticipated growth from 2022 to 2023: professional and business services (3.5%), manufacturing (1.5%), and wholesale trade (0.8%). Other services and agriculture and forestry businesses did not anticipate any change in employment through 2024.

Figure 87. Corn Ethanol Fuels Employers' Anticipated Employment Change, 2023-2024



Professional and business services (2.6%), wholesale trade (1.5%), and manufacturing (1.3%) businesses anticipated growth from 2022 to 2023. Businesses within each industry category in corn ethanol fuels underwent growth from 2023 to 2024, except for manufacturing, where employment remained relatively flat (-0.2%) (Figure 88).

Figure 88. Corn Ethanol Actual Employment Change 2022-2023 vs. Anticipated Employment Change 2022



Corn Ethanol Fuels Workforce Demographics

The share of females in the corn ethanol fuels workforce (31%) was higher than the energy workforce average (26%), but lower than the U.S. workforce average (47%) (Table 23).

The proportion of the corn ethanol fuels workforce made up of Hispanic or Latino workers (12%) was lower than the energy workforce average (18%) and the national workforce average (19%). The proportion of non-white workers in the corn ethanol fuels workforce (21%) was lower than the energy workforce average (26%) and the overall national workforce average (24%). This is attributable to a lower-than-average proportion of Asian workers in the corn ethanol fuels workforce (6%) as compared to the overall energy workforce (7%), a lower-than-average proportion of American Indian or Alaska Native workers in the corn ethanol fuels workforce (1%) compared to the overall energy workforce (2%), a lower-than-average proportion of Black or African American workers in the corn ethanol fuels workforce (6%) compared to the overall energy workforce (9%), and a lower-than-average proportion of workers of two or more races in the corn ethanol fuels workforce (3%) compared to the overall energy workforce (5%).

The representation of veterans in the corn ethanol fuels workforce (16%) was higher than the energy workforce average (9%) and the U.S. workforce average (5%). Workers requesting accommodations for disabilities in the corn ethanol fuels workforce (4%) were more represented than in the overall energy workforce (2%). Formerly incarcerated individuals in the corn ethanol fuels workforce (<1%) were less represented than in the energy workforce (1%) and the national workforce (2%).

The share of workers aged 55 or older in the corn ethanol fuels workforce (23%) was higher than the energy workforce average (18%), while the share of workers under the age of 30 in the corn ethanol fuels workforce (28%) was lower than the overall energy workforce average (29%).

The proportion of workers represented by a union or covered under a project labor or collective bargaining agreement in the corn ethanol fuels workforce (7%) was lower than the energy workforce average (11%) but similar to the national private sector average (7%).

Table 23. Corn Ethanol Fuels Workforce Demographics and Characteristics

	Number of Workers	Corn Ethanol Average	Energy Workforce Average	National Workforce Average
Male	24,404	68%	73%	53%
Female	11,230	31%	26%	47%
Gender Nonbinary	227	<1%	<1%	n/a
Hispanic or Latino	4,211	12%	18%	19%
Not Hispanic or Latino	31,649	88%	82%	81%
American Indian or Alaska Native	464	1%	2%	1%
Asian	2,227	6%	7%	7%
Black or African American, Not Indigenous	2,318	6%	9%	13%
Native Hawaiian or Other Pacific Islander	660	2%	1%	<1%
White	28,424	79%	74%	76%
Two or More Races	901	3%	5%	3%
Unknown Race	866	2%	2%	n/a
Veterans	5,675	16%	9%	5%
18 to 29	10,122	28%	29%	22%
30 to 54	17,366	48%	52%	53%
55 and Over	8,372	23%	18%	23%
Disability	1,389	4%	2%	5%
Formerly Incarcerated	194	<1%	1%	2%
Represented by Unions, Collective Bargaining Agreements, and/or Project Labor Agreements	2,354	7%[69]	11%	7%

National sources: BLS (2023a, 2023b, 2023c, 2023d), Jobs EQ (2023), Prison Policy (2018)

[69] Unionization rates vary by state.

Woody Biomass and Cellulosic Biofuels

Woody biomass and cellulosic biofuels employed 34,542 workers in 2023, an increase of 378 from the 34,164 employed in 2022 (1.1%).

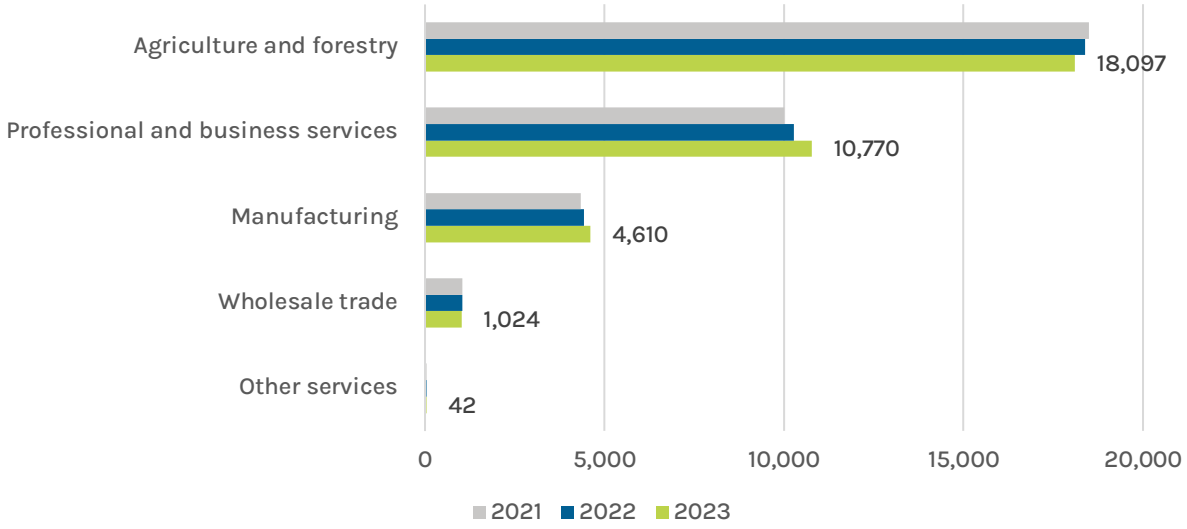
Trends and Key Takeaways

- The largest job gains in woody biomass and cellulosic biofuels were in the professional and business services industry, with 501 new jobs (4.9%), followed by manufacturing, with 177 added jobs (4.0%). Agriculture and forestry experienced a decline of 283 jobs (-1.5%). Other services and wholesale trade employment remained relatively static year-over-year.
- Most employers within woody biomass and cellulosic biofuels expect job growth through 2024, ranging from 4.1% in manufacturing to 8.7% in other services. Agriculture and forestry and wholesale trade businesses expect employment to stay level through 2024.
- The percentage of workers in woody biomass and cellulosic biofuels represented by a union or covered under a project labor or collective bargaining agreement (7%) was lower than the overall energy workforce (11%) and on par with the national private sector average (7%).
- The woody biomass and cellulosic biofuels workforce had a lower share of females than the overall energy workforce, with a contingent of 30% female workers compared to 26% in the overall energy workforce, and 47% in the national workforce overall.
- The proportion of non-white workers in the woody biomass and cellulosic biofuels workforce (18%) was lower than the energy workforce average (26%) and the national workforce average (24%). This is attributable to the lower-than-average representation of most minority races within the woody biomass and cellulosic biofuels workforce.
- Hispanic or Latino workers were less represented in the woody biomass and cellulosic biofuels workforce (11%) than in the overall energy workforce (18%) and the overall national workforce (19%). Similarly, Black and African American workers were less represented in the woody biomass and cellulosic biofuels workforce (5%) than in the overall energy workforce (9%) and the national workforce (13%).
- The woody biomass and cellulosic biofuels workforce had a higher proportion of veterans (15%) compared to the energy workforce average (9%) and the national workforce average (5%).
- The woody biomass and cellulosic biofuels workforce had a higher rate of individuals requesting accommodations for disabilities (3%) than the overall energy workforce (2%).

Employment by Industry

The largest number of woody biomass and cellulosic biofuels employees was in the agriculture and forestry industry, with 18,097 workers (Figure 89). The agriculture and forestry industry lost 283 jobs from 2022 to 2023 (-1.5%). The industry sector with the largest gains was professional and business services, with 501 added jobs (4.9%), followed by manufacturing, with 177 added jobs (4.0%).

Figure 89. Woody Biomass and Cellulosic Biofuels Employment by Industry, 2021-2023

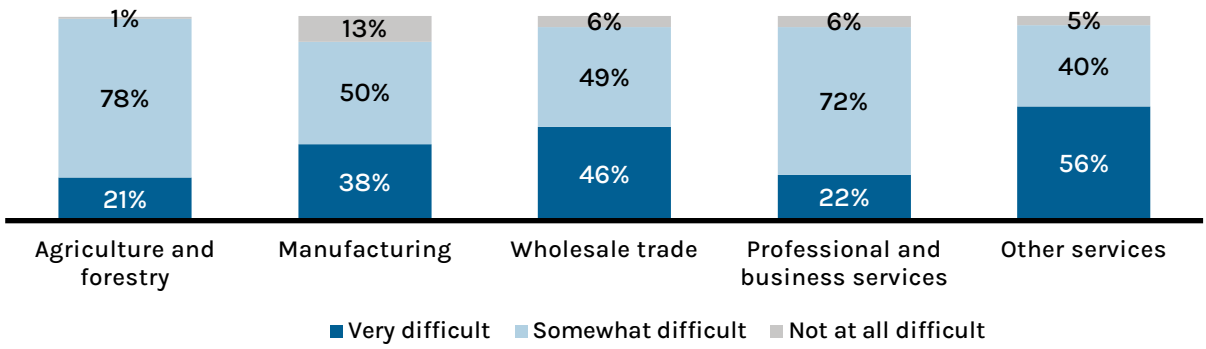


Employer Perspective on Workforce Issues

Current Hiring Difficulty

Within woody biomass and cellulosic biofuels, the agriculture and forestry industry had the greatest difficulty hiring workers, with 99% of employers claiming some level of difficulty. More than half of other services employers (56%) indicated that they found it "very difficult" to find and hire qualified workers (Figure 90).

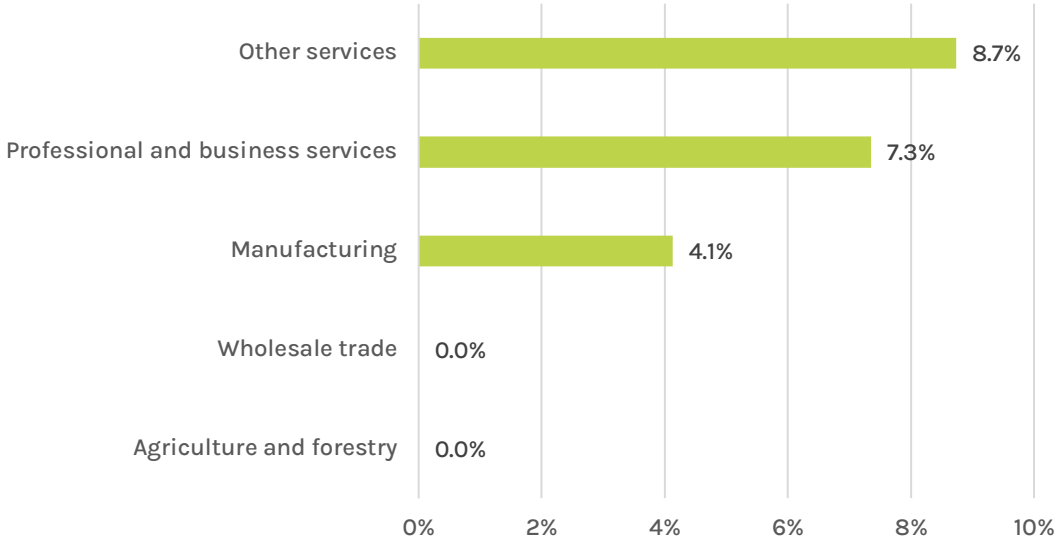
Figure 90. Woody Biomass and Cellulosic Biofuels Employers' Perceived Hiring Difficulty



Employment Change by Industry

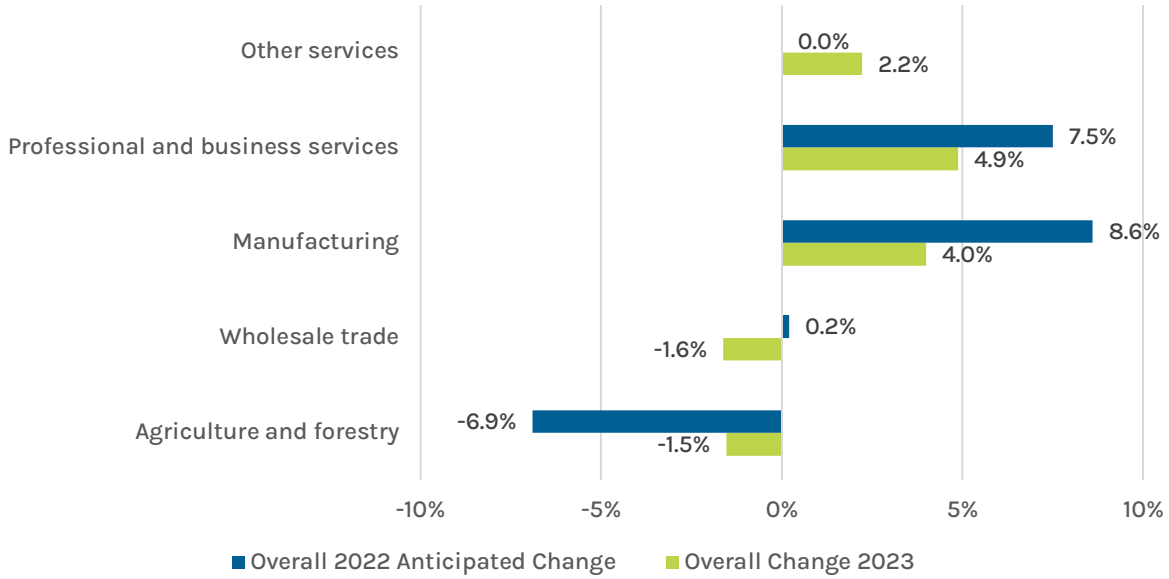
The previous section highlighted employers' current hiring difficulty across industries, whereas this section focuses on anticipated employment change by industry. This section also compares actual employment change over the last year to anticipated employment change in 2022. As displayed in Figure 91, employers in other services (8.7%), professional and business services (7.3%), and manufacturing (4.1%) expect job growth through 2024.

Figure 91. Woody Biomass and Cellulosic Biofuels Employers' Anticipated Changes in Employment, 2023-2024



From 2022 to 2023, employment in the agriculture and forestry industry declined less than a fourth as quickly as predicted by employers in the previous year (Figure 92).

Figure 92. Woody Biomass and Cellulosic Biofuels Actual Employment Change 2022-2023 vs. Anticipated Employment Change 2022



Woody Biomass and Cellulosic Biofuels Workforce Demographics

The woody biomass and cellulosic biofuels workforce had a larger share of females than the energy workforce overall: female employees made up 30% of the woody biomass and cellulosic biofuels workforce, as compared to 26% of the energy workforce overall and 47% of the U.S. workforce overall (Table 24).

The proportion of Hispanic or Latino workers in the woody biomass and cellulosic biofuels workforce (11%) was lower than the overall energy workforce average (18%) and the national workforce average (19%).

The proportion of non-white workers in the woody biomass and cellulosic biofuels workforce (18%) was lower than the energy workforce average (26%) and the national workforce average (24%), which is attributable to lower-than-average representation of all minority races in the woody biomass and cellulosic biofuels workforce.

The representation of veterans in the woody biomass and cellulosic biofuels workforce (15%) was higher than the energy workforce average (9%) and triple the representation in the U.S. workforce overall (5%). Individuals requesting accommodations for disabilities in the woody biomass and cellulosic biofuels workforce (3%) were represented at a higher rate than in the energy workforce overall (2%).

The share of those represented by a union or covered under a project labor or collective bargaining agreement in the woody biomass and cellulosic biofuels workforce (7%) was lower

than the energy workforce average (11%) and similar to the national private sector average (7%). The proportion of formerly incarcerated workers in the woody biomass and cellulosic biofuels workforce (3%) was greater than the overall energy workforce average (1%) and the national workforce average (2%). The proportion of workers under the age of 30 in the woody biomass and cellulosic biofuels workforce (30%) was slightly higher than the energy workforce average (29%). Workers aged 55 or older in the woody biomass and cellulosic biofuels workforce (22%) were more represented than in the overall energy workforce (18%).

Table 24. Woody Biomass and Cellulosic Biofuels Workforce Demographics and Characteristics

	Number of Workers	Woody Biomass Average	Energy Workforce Average	National Workforce Average
Male	23,636	68%	73%	53%
Female	10,531	30%	26%	47%
Gender Nonbinary	376	1%	<1%	n/a
Hispanic or Latino	3,810	11%	18%	19%
Not Hispanic or Latino	30,732	89%	82%	81%
American Indian or Alaska Native	450	1%	2%	1%
Asian	1,806	5%	7%	7%
Black or African American	1,646	5%	9%	13%
Native Hawaiian or Other Pacific Islander	345	1%	1%	<1%
White	28,333	82%	74%	76%
Two or More Races	1,046	3%	5%	3%
Unknown Race	923	3%	2%	n/a
Veterans	5,126	15%	9%	5%
18 to 29	10,268	30%	29%	22%
30 to 54	16,816	49%	52%	53%
55 and Over	7,459	22%	18%	23%
Disability	1,195	3%	2%	5%
Formerly Incarcerated	947	3%	1%	2%
Represented by Unions, Collective Bargaining Agreements, and/or Project Labor Agreements	2,499	7%[70]	11%	7%

National sources: BLS (2023a, 2023b, 2023c, 2023d), Jobs EQ (2023), Prison Policy (2018)

[70] Unionization rates vary by state.

Other Biofuels

"Other biofuels" industries include any fuel made from biomass that is not classified elsewhere in the USEER, such as non-woody biomass, renewable diesel fuels, biodiesel fuels, waste fuels, and ethanol not produced from corn.[71] Businesses in "other biofuels" employed 41,412 workers in 2023, an increase of 1,264 from the 40,148 employed in 2022 (3.1%).

Trends and Key Takeaways

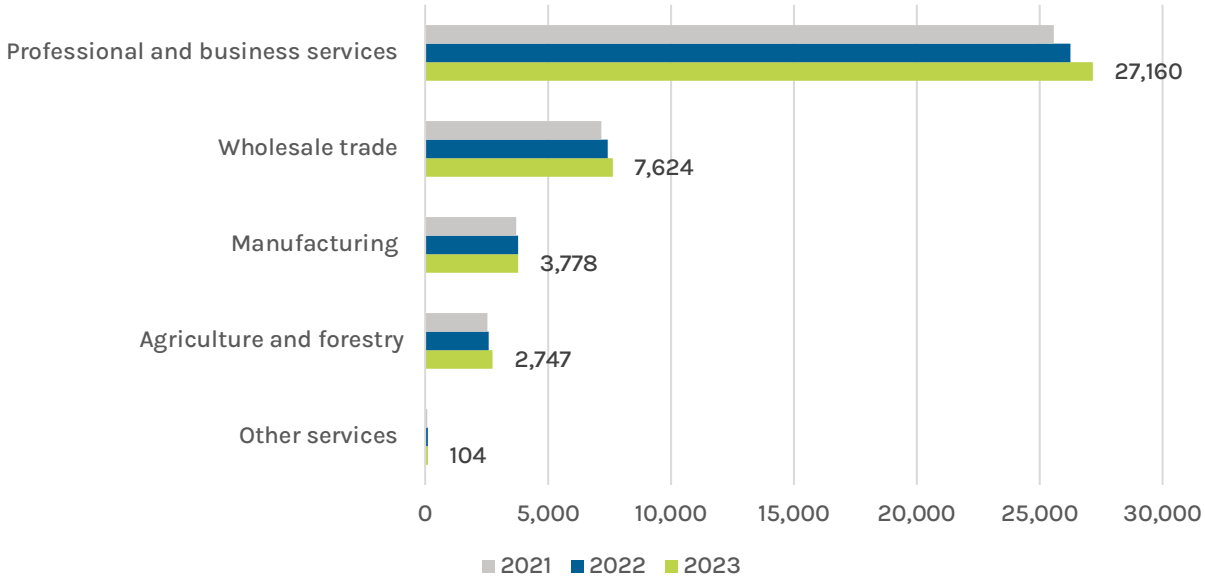
- The largest job gains were in the professional and business services industry, with 912 new jobs (3.5%), followed by wholesale trade, with 190 added jobs (2.6%), and agriculture and forestry, with 156 added jobs (6.0%). Employment in manufacturing and other services businesses within "other biofuels" remained relatively unchanged from 2022 to 2023.
- The majority of businesses within "other biofuels" expect growth in 2024, ranging from 1.4% in manufacturing to 7.2% in wholesale trade.
- The percentage of workers in "other biofuels" represented by a union or covered under a project labor or collective bargaining agreement (5%) was lower than the energy workforce average (11%) and the national private sector average (7%).
- Within the "other biofuels" workforce, a third of workers identified as female (33%) compared to 26% in the energy workforce overall and 47% for the national workforce overall.
- The share of non-white workers in the "other biofuels" workforce (25%) was slightly lower than the energy workforce average (26%) and higher than the national workforce average (24%).
- Black or African American workers were just as represented in the "other biofuels" workforce (9%) as in the overall energy workforce (9%) but were underrepresented relative to the overall U.S. workforce (13%).
- Veterans were more represented in the "other biofuels" workforce (11%) compared to the energy workforce average (9%).
- Individuals requesting accommodations for disabilities in the "other biofuels" workforce (4%) were twice as represented as in the overall energy workforce (2%) but were slightly less represented than in the overall national workforce (5%).

[71] Definitions of fuels technologies can be found in Appendix K.

Employment by Industry

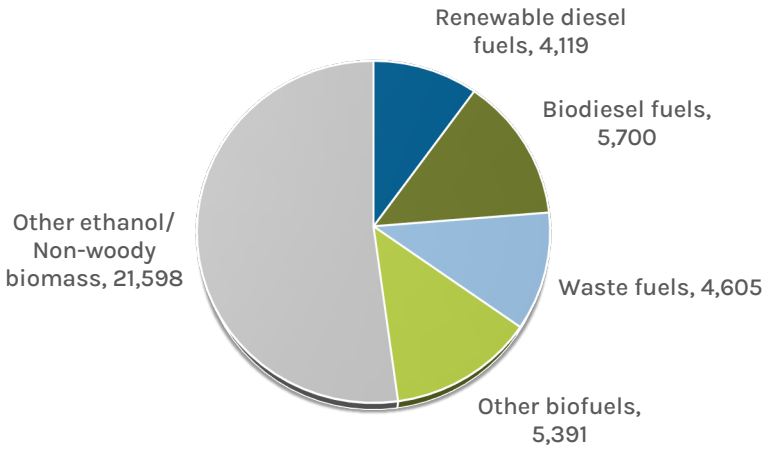
The largest number of "other biofuels" employees was in the professional and business services industry, with 27,160 workers (Figure 93). Professional and business services businesses added the most jobs from 2022 to 2023 (912 jobs, or 3.5%), followed by wholesale trade businesses (190 jobs, or 2.6%).

Figure 93. "Other Biofuels" Employment by Industry, 2021-2023



The 2024 USEER splits "other biofuels" into several components: other ethanol/non-woody biomass, renewable diesel fuels, biodiesel fuels, waste fuels, and other biofuels. Figure 94 illustrates how employment in these technologies was distributed. The largest component was other ethanol/non-woody biomass, with 21,598 workers, followed by biodiesel fuels, with 5,700 workers.

Figure 94. "Other Biofuels" Employment by Component Fuels Technology

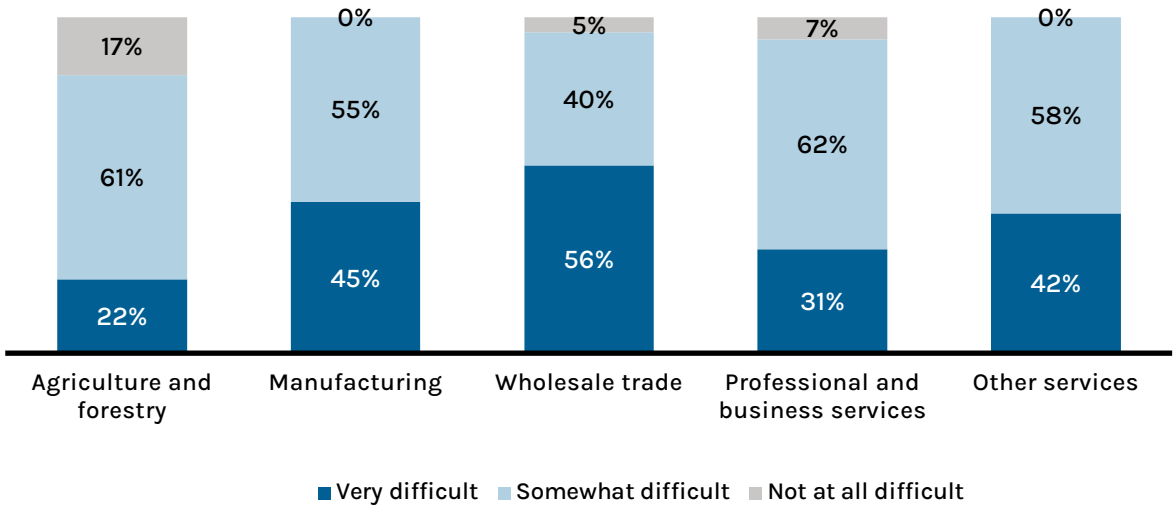


Employers Perspective on Workforce Issues

Current Hiring Difficulty

Businesses within all "other biofuels" industries had difficulty finding qualified workers, with at least four-in-five employers reporting it was at least "somewhat difficult" to hire (Figure 95).

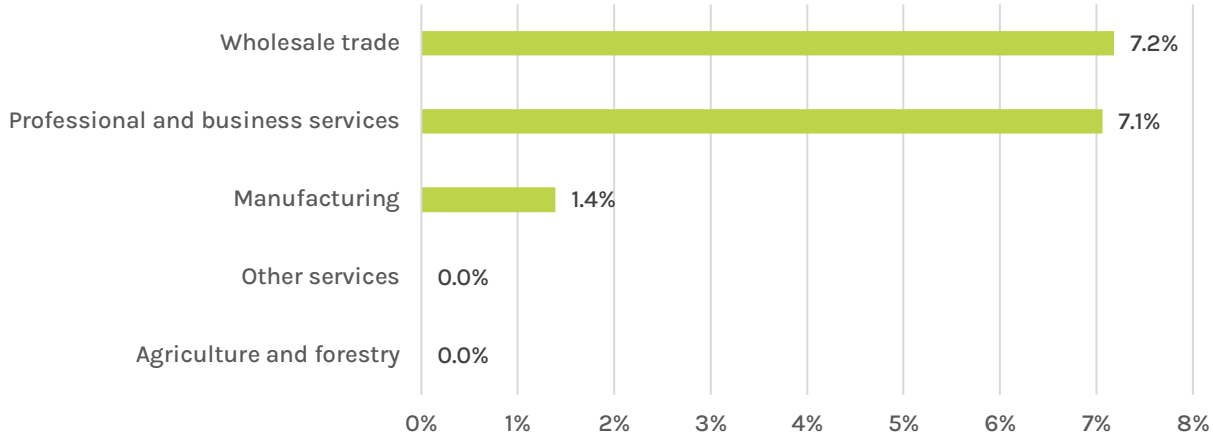
Figure 95. "Other Biofuels" Employers' Perceived Hiring Difficulty



Employment Change by Industry

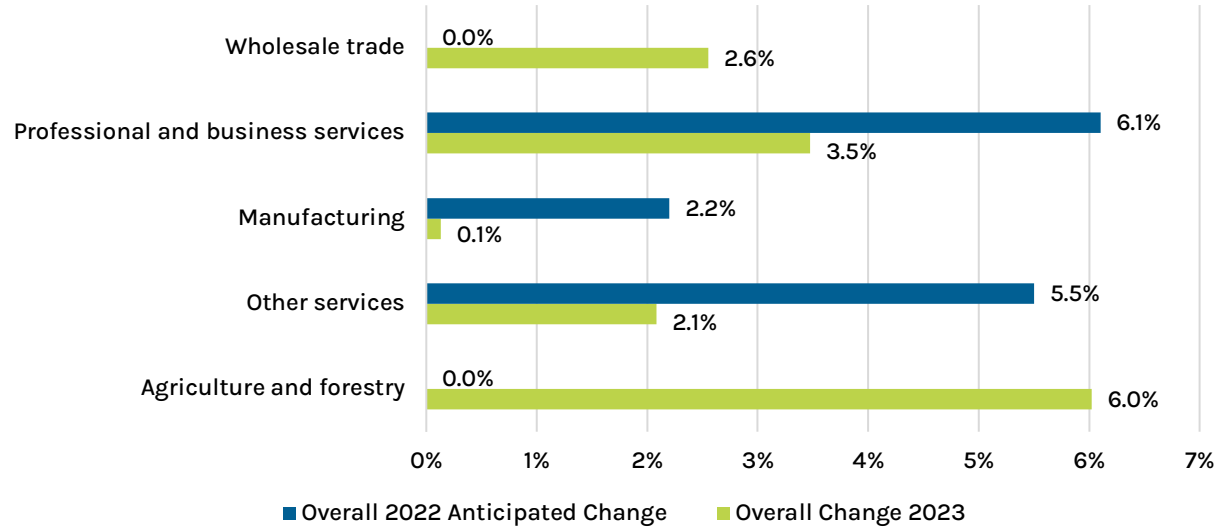
The previous section highlighted "other biofuels" employers' current hiring difficulty across industries, whereas this section focuses on anticipated employment change by industry. This section also compares actual employment change over the last year to anticipated employment change in 2022. Three industries within "other biofuels" expect job growth through 2024, ranging from 1.4% in manufacturing to 7.2% in wholesale trade (Figure 96). Businesses in other services and agriculture and forestry anticipate no change in employment.

Figure 96. "Other Biofuels" Employers' Anticipated Employment Change, 2023-2024



Agriculture and forestry and wholesale trade industries within "other biofuels" grew in employment from 2022 to 2023 despite employers predicting that employment levels would stay the same (Figure 97).

Figure 97. "Other Biofuels" Actual Employment Change 2022-2023 vs. Anticipated Employment Change 2022



"Other Biofuels" Workforce Demographics

Female employees constituted a larger share of the "other biofuels" workforce (33%) compared to the energy workforce overall (26%) but a smaller share than the U.S. workforce overall (47%) (Table 25).

The proportion of the "other biofuels" workforce made up of Hispanic or Latino workers (13%) was lower than the energy workforce average (18%) and the overall national workforce average (19%).

The proportion of non-white workers in "other biofuels" (25%) was lower than the energy workforce average (26%) and higher than the national workforce average (24%).

The concentration of veterans in the "other biofuels" workforce (11%) was higher than the energy workforce average (9%) and more than double the national workforce average (5%). The proportion of formerly incarcerated workers in the "other biofuels" workforce (1%) was the same as the energy workforce average (1%) but lower than the proportion economy-wide (2%). The proportion of workers requesting accommodations for disabilities in the "other biofuels" workforce (4%) was twice as high as the energy workforce average (2%) and just below the national workforce average (5%).

The "other biofuels" workforce was younger than the overall energy workforce, with a larger share of workers under the age of 30 (31%) compared to the overall energy workforce (29%) and a larger share of workers between 30 and 54 years old (54%) compared to the overall energy workforce (52%). Workers aged 55 and older were less represented in the "other biofuels" workforce (15%) than in the overall energy workforce (18%).

The share of workers represented by a union or covered under a project labor or collective bargaining agreement in the "other biofuels" workforce (5%) was lower than the energy workforce average (11%) and the national private sector average (7%).

Table 25. "Other Biofuels" Workforce Demographics and Characteristics

	Number of Workers	"Other Biofuels" Average	Energy Workforce Average	National Workforce Average
Male	27,122	65%	73%	53%
Female	13,812	33%	26%	47%
Gender Nonbinary	478	1%	<1%	n/a
Hispanic or Latino	5,241	13%	18%	19%
Not Hispanic or Latino	36,171	87%	82%	81%
American Indian or Alaska Native	778	2%	2%	1%
Asian	2,875	7%	7%	7%
Black or African American	3,797	9%	9%	13%
Native Hawaiian or Other Pacific Islander	817	2%	1%	<1%
White	30,989	75%	74%	76%
Two or More Races	1,074	3%	5%	3%
Unknown Race	1,082	3%	2%	n/a
Veterans	4,527	11%	9%	5%
18 to 29	12,747	31%	29%	22%
30 to 54	22,560	54%	52%	53%
55 and Over	6,105	15%	18%	23%
Disability	1,699	4%	2%	5%
Formerly Incarcerated	551	1%	1%	2%
Represented by Unions, Collective Bargaining Agreements, and/or Project Labor Agreements	2,024	5%[72]	11%	7%

National sources: BLS (2023a, 2023b, 2023c, 2023d), Jobs EQ (2023), Prison Policy (2018)

[72] Unionization rates vary by state.

Nuclear Fuels

Nuclear fuels employed 9,492 workers in 2023, up slightly from the 9,264 employed in 2022; this represented a 2.5% growth rate.

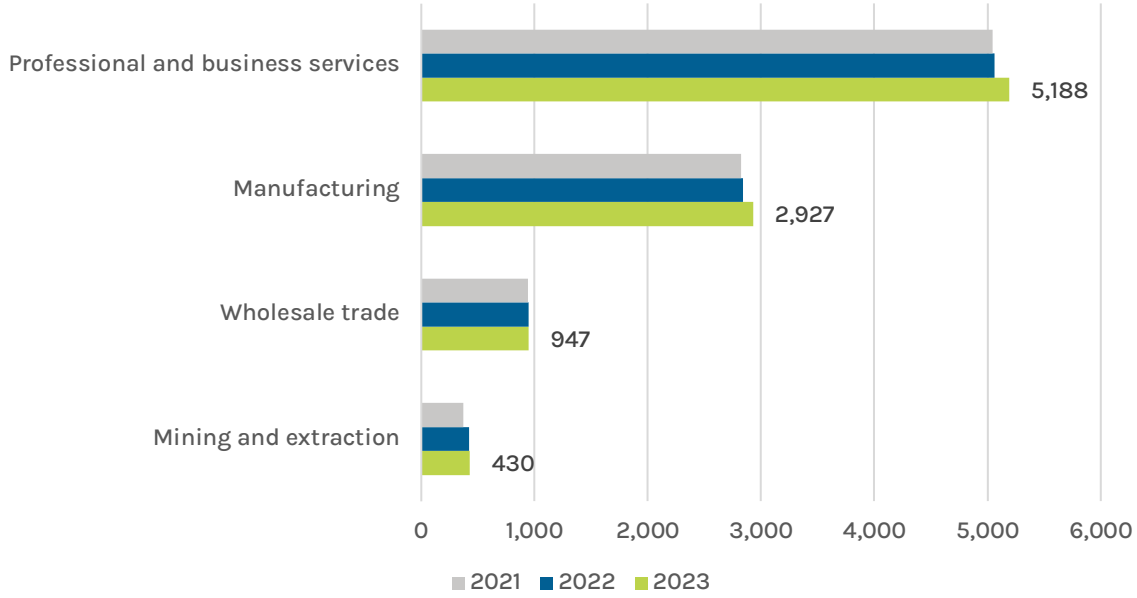
Trends and Key Takeaways

- The professional and business services industry within nuclear fuels experienced the greatest job gains, with 128 new jobs (a 2.5% growth rate), followed by manufacturing, with 89 added jobs (3.1%). Mining and extraction and wholesale trade employment remained relatively flat year-over-year.
- Employers in each industry within nuclear fuels anticipate job growth in 2024, ranging from 1.5% in wholesale trade to 11.2% in professional and business services.
- The percentage of workers represented by a union or covered under a project labor or collective bargaining agreement in the nuclear fuels workforce (17%) was higher than the energy workforce average (11%) and the national private sector average (7%).
- The proportion of female workers in the nuclear fuels workforce (29%) was higher than the energy workforce average (26%) but lower than the U.S. workforce average (47%).
- Hispanic and Latino workers in the nuclear fuels workforce (15%) were less concentrated compared to the energy workforce (18%) and the overall national workforce (19%).
- The percent of non-white workers in the nuclear fuels workforce (32%) was higher than the energy workforce average (26%) and the national workforce average (24%).

Employment by Industry

The largest number of nuclear fuels employees was in the professional and business services industry (5,188 workers). The professional and business services industry in nuclear fuels also underwent the greatest increase in jobs in 2023, growing by 128 workers or an increase of 2.5% (Figure 98).

Figure 98. Nuclear Fuels Employment by Industry, 2021-2023

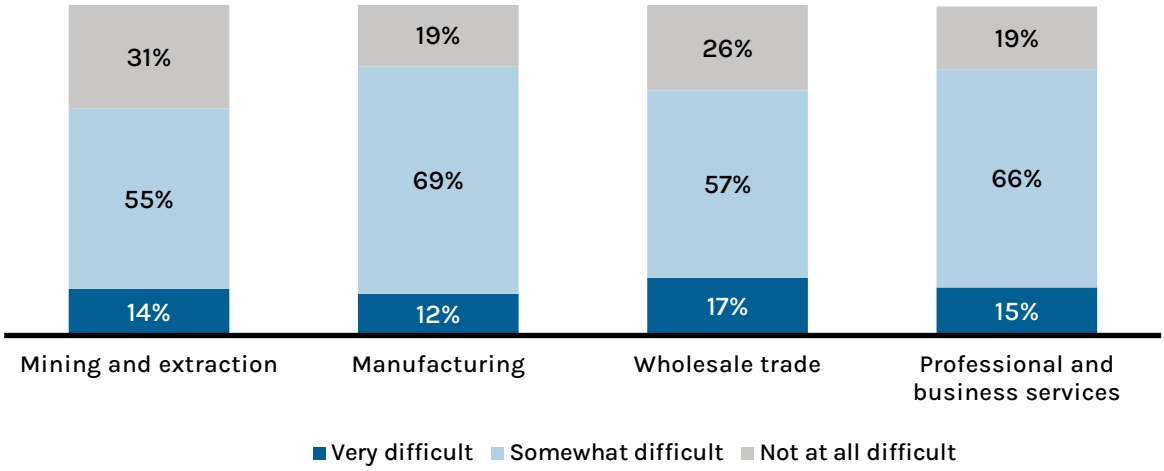


Employer Perspective on Workforce Issues

Current Hiring Difficulty

Within nuclear fuels, businesses in professional and business services had the greatest difficulty hiring workers. Eighty-one percent of these employers reported at least some difficulty finding qualified workers (Figure 99).

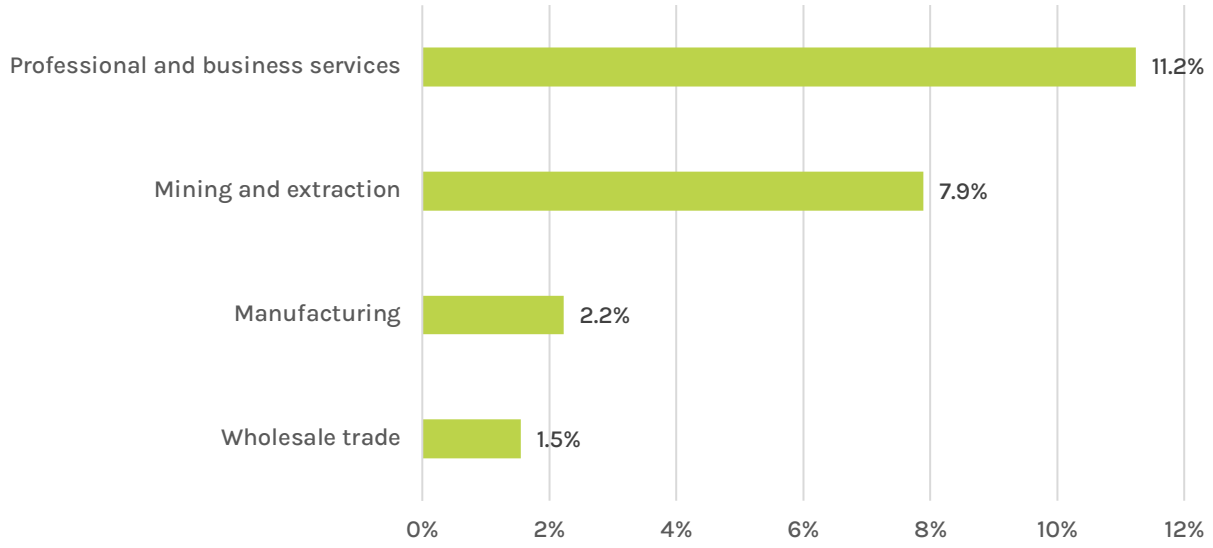
Figure 99. Nuclear Fuels Employers' Perceived Hiring Difficulty



Employment Change by Industry

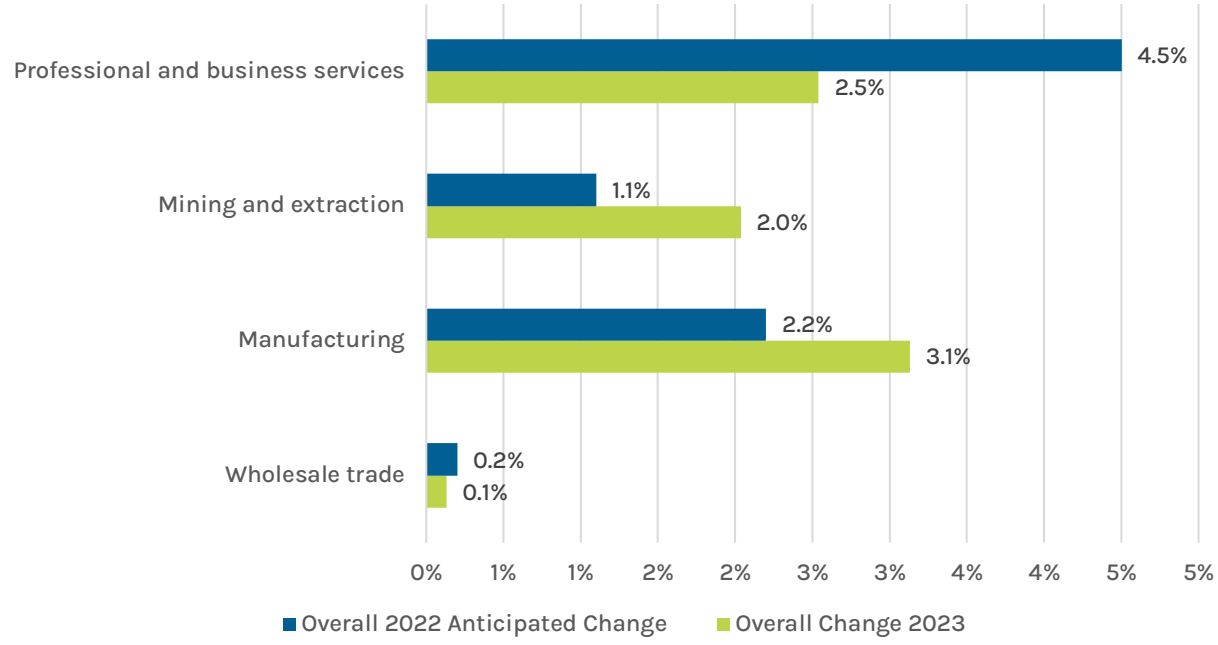
The previous section highlighted nuclear fuels employers' current hiring difficulty across industries, whereas this section focuses on anticipated employment change by industry. This section also compares actual employment change over the last year to anticipated employment change in 2022. Each of the four industries within nuclear fuels anticipates job growth through 2024, ranging from 1.5% in wholesale trade to 11.2% in professional and business services (Figure 100).

Figure 100. Nuclear Fuels Employers' Anticipated Employment Change, 2023-2024



All industries anticipated employment growth from 2022 to 2023, and all industries within nuclear fuels experienced growth between 2022 and 2023, ranging from 0.1% in wholesale trade to 3.1% in manufacturing (Figure 101).

Figure 101. Nuclear Fuels Actual Employment Change 2022-2023 vs. Anticipated Employment Change 2022



Nuclear Fuels Demographics

The share of female workers in the nuclear fuels workforce (29%) was higher than the overall energy workforce average (26%) but lower than the national workforce overall (47%). (Table 26).

The proportion of non-white workers in the nuclear fuels workforce (32%) was higher than the energy workforce average (26%) and the U.S. workforce average (24%). This is attributable to a higher-than-average proportion of workers of two or more races in the nuclear fuels workforce (9%) as compared to the energy workforce overall (5%) and a higher-than-average proportion of Asian workers in the nuclear fuels workforce (9%) compared to the energy workforce overall (7%). The proportion of American Indian or Alaska Native workers in the nuclear fuels workforce (2%) was the same as the overall energy workforce average (2%).

The proportion of the nuclear fuels workforce made up of Hispanic or Latino workers (15%) was lower than the energy workforce average (18%) and the overall national workforce average (19%) The proportion of Black or African American workers in the nuclear fuels workforce (9%) was similar to the overall energy workforce average (9%), but lower than the U.S. workforce average (13%).

The concentration of those represented by a union or covered under a project labor or collective bargaining agreement in the nuclear fuels workforce (17%) was higher than the energy workforce average (11%) but higher than the national private sector average (7%).

The proportion of formerly incarcerated workers in the nuclear fuels workforce (2%) was higher than the energy workforce average (1%) and similar to the national workforce (2%). There were slightly more workers requesting accommodations for disabilities in the nuclear fuels workforce (3%) compared to the energy workforce average (2%). The proportion of workers aged 18 to 29 in the nuclear fuels workforce (31%) was higher than the energy workforce average (29%), and the proportion of those aged 30 to 54 in the nuclear fuels workforce (54%) was slightly higher than the energy workforce average (52%). The percentage of workers aged 55 or older in the nuclear fuels workforce (14%) was lower than the energy workforce average (18%).

Table 26. Nuclear Fuels Workforce Demographics and Characteristics

	Number of Workers	Nuclear Fuels Average	Energy Workforce Average	National Workforce Average
Male	6,706	71%	73%	53%
Female	2,754	29%	26%	47%
Gender Nonbinary	32	<1%	<1%	n/a
Hispanic or Latino	1,461	15%	18%	19%
Not Hispanic or Latino	8,030	85%	82%	81%
American Indian or Alaska Native	198	2%	2%	1%
Asian	871	9%	7%	7%
Black or African American	811	9%	9%	13%
Native Hawaiian or Other Pacific Islander	240	3%	1%	<1%
White	6,482	68%	74%	76%
Two or More Races	834	9%	5%	3%
Unknown Race	55	<1%	2%	n/a
Veterans	916	10%	9%	5%
18 to 29	2,981	31%	29%	22%
30 to 54	5,173	54%	52%	53%
55 and Over	1,338	14%	18%	23%
Disability	240	3%	2%	5%
Formerly Incarcerated	151	2%	1%	2%
Represented by Unions, Collective Bargaining Agreements, and/or Project Labor Agreements	1,625	17%[73]	11%	7%

National sources: BLS (2023a, 2023b, 2023c, 2023d), Jobs EQ (2023), Prison Policy (2018)

[73] Unionization rates vary by state.

Other Fuels[74]

"Other fuels" businesses employed 66,118 workers in 2023, up 2,494 from the 63,624 employed in 2022 (3.9%).

Trends and Key Takeaways

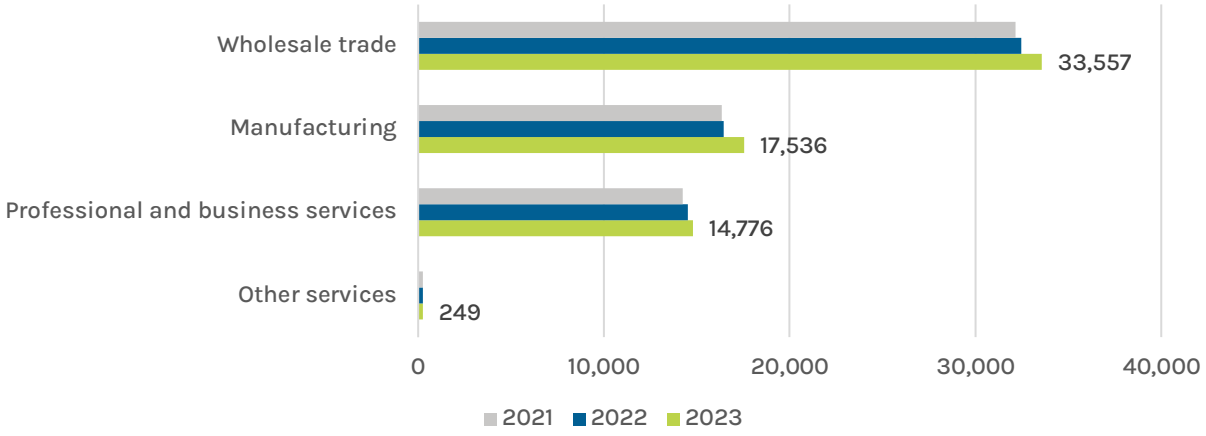
- The largest job gains in "other fuels" were in the wholesale trade industry, with 1,120 new jobs (3.5%), followed by manufacturing, with 1,099 added jobs (6.7%), and professional and business services, with 273 added jobs (1.9%).
- Employers in all industries within "other fuels" expect job growth through 2024, ranging from 2.2% in manufacturing to 10.0% in other services.
- The percentage of workers represented by a union or covered under a project labor or collective bargaining agreement in "other fuels" (9%) was lower than the energy workforce average (11%) but higher than the national private sector average (7%).
- Male workers made up 72% of the "other fuels" workforce, slightly lower than the 73% energy workforce average.
- Hispanic or Latino workers in the "other fuels" workforce (10%) were less concentrated than in the energy workforce overall (18%) and the overall national workforce (19%).
- The proportion of non-white workers in the "other fuels" workforce (15%) was significantly lower than the energy workforce average (26%) and the national workforce average (24%).
- Black or African American workers were underrepresented, making up 4% of the "other fuels" workforce compared to 9% of the overall energy workforce and 13% of the U.S. workforce overall.
- Veterans were more represented in the "other fuels" workforce (13%) compared to the overall energy workforce (9%) and the national workforce (5%).

[74] For definitions of fuels technologies, please see Appendix K.

Employment by Industry

The largest number of "other fuels" workers were in the wholesale trade industry, with 33,557 workers (Figure 102). The wholesale trade industry also experienced the largest job growth (1,120 added jobs or a 3.5% growth rate).

Figure 102. "Other Fuels" Employment by Industry, 2021-2023

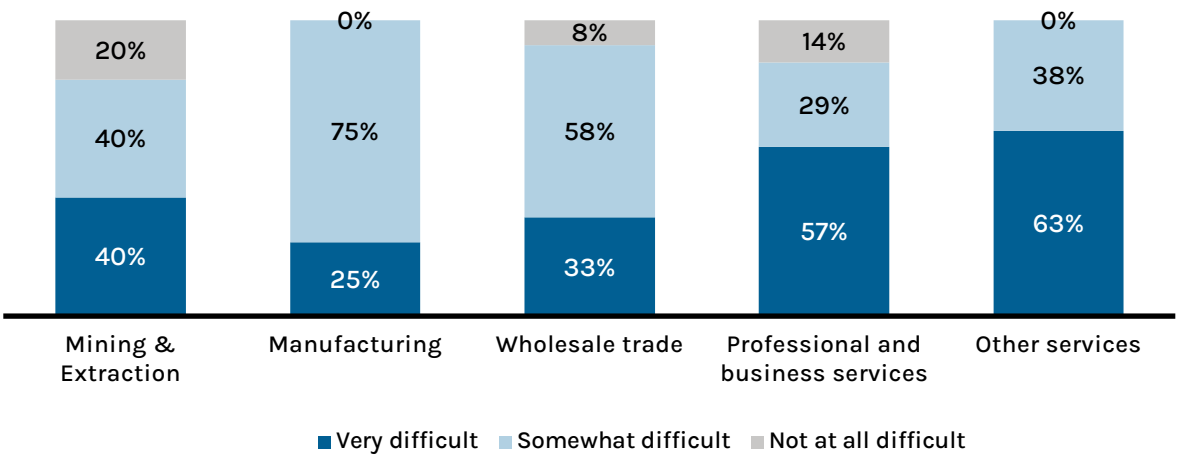


Employer Perspective on Workforce Issues

Current Hiring Difficulty

The other services and manufacturing industries within "other fuels" had the greatest difficulty hiring workers from 2022 to 2023 (Figure 103). Every employer that hired workers in 2023 in other services or manufacturing reported at least some difficulty finding qualified workers.

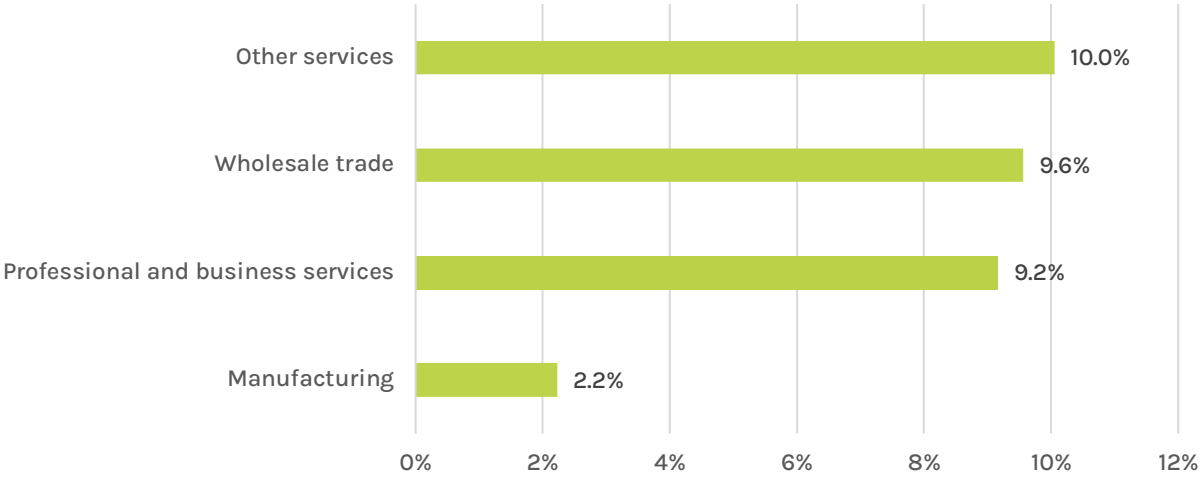
Figure 103. "Other Fuels" Employers' Perceived Hiring Difficulty



Employment Change by Industry

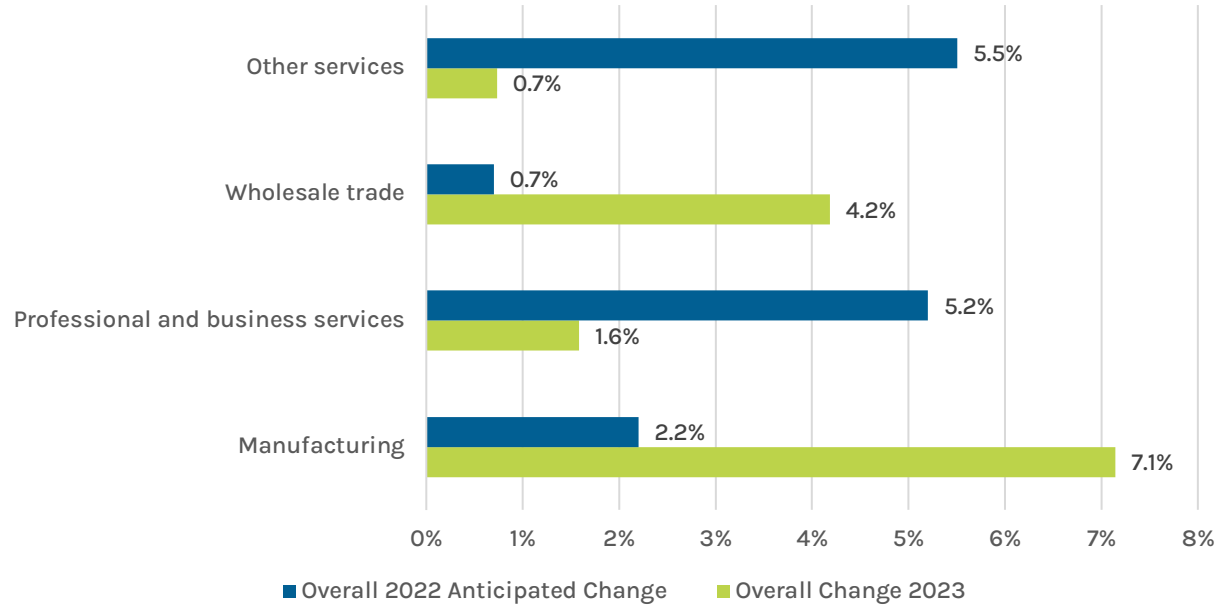
The previous section highlighted employers' current hiring difficulty across industries, whereas this section focuses on anticipated employment change by industry. This section also compares actual employment change over the last year to anticipated employment change in 2022. As illustrated in Figure 104, all industries within "other fuels" are expecting job growth in 2024, ranging from 2.2% in manufacturing to 10.0% in other services.

Figure 104. "Other Fuels" Employers' Anticipated Change in Employment, 2023-2024



Every industry segment in "other fuels" anticipated growth from 2022 to 2023 and every industry experienced growth (Figure 105).

Figure 105. "Other Fuels" Actual Employment Change 2022-2023 vs. Anticipated Employment Change 2022



"Other Fuels" Workforce Demographics

The proportion of male workers in the "other fuels" workforce (72%) was slightly lower than the energy workforce average (73%) and much higher than the national workforce average (53%) (Table 27).

The proportion of the workforce in "other fuels" that was made up of Hispanic or Latino workers (10%) was lower than the energy workforce average (18%) and the U.S. workforce average (19%).

The share of non-white workers in the "other fuels" workforce (15%) was lower than the energy workforce average (26%) and the national workforce average (24%).

The concentration of veterans in the "other fuels" workforce (13%) was higher than in the overall energy workforce (9%) and much higher than in the national workforce overall (5%). The share of workers aged 55 or older in the "other fuels" workforce (23%) was higher than the energy workforce average (18%), while the share of workers aged 18 to 29 in the "other fuels" workforce (26%) was lower than the energy workforce average (29%), and the share of workers aged 30 to 54 (51%) was lower than the energy workforce average (52%).

The share of workers represented by a union or covered under a project labor or collective bargaining agreement in the "other fuels" workforce (9%) was lower than the energy workforce average (11%) but higher than the national private sector average (7%).

Table 27. "Other Fuels" Workforce Demographics and Characteristics

	Number of Workers	"Other Fuels" Average	Energy Workforce Average	National Workforce Average
Male	47,422	72%	73%	53%
Female	18,150	27%	26%	47%
Gender Nonbinary	546	<1%	<1%	n/a
Hispanic or Latino	6,912	10%	18%	19%
Not Hispanic or Latino	59,206	90%	82%	81%
American Indian or Alaska Native	670	1%	2%	1%
Asian	2,882	4%	7%	7%
Black or African American	2,935	4%	9%	13%
Native Hawaiian or Other Pacific Islander	545	<1%	1%	<1%
White	55,989	85%	74%	76%
Two or More Races	923	1%	5%	3%
Unknown Race	2,174	3%	2%	n/a
Veterans	8,847	13%	9%	5%
18 to 29	17,443	26%	29%	22%
30 to 54	33,729	51%	52%	53%
55 and Over	14,946	23%	18%	23%
Disability	779	1%	2%	5%
Formerly Incarcerated	351	<1%	1%	2%
Represented by Unions, Collective Bargaining Agreements, and/or Project Labor Agreements	6,115	9%[75]	11%	7%

National sources: BLS (2023a, 2023b, 2023c, 2023d), Jobs EQ (2023), Prison Policy (2018)

[75] Unionization rates vary by state.

Multi-Sector Technologies

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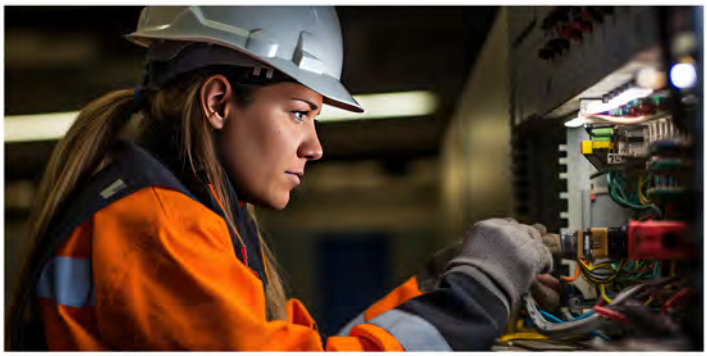
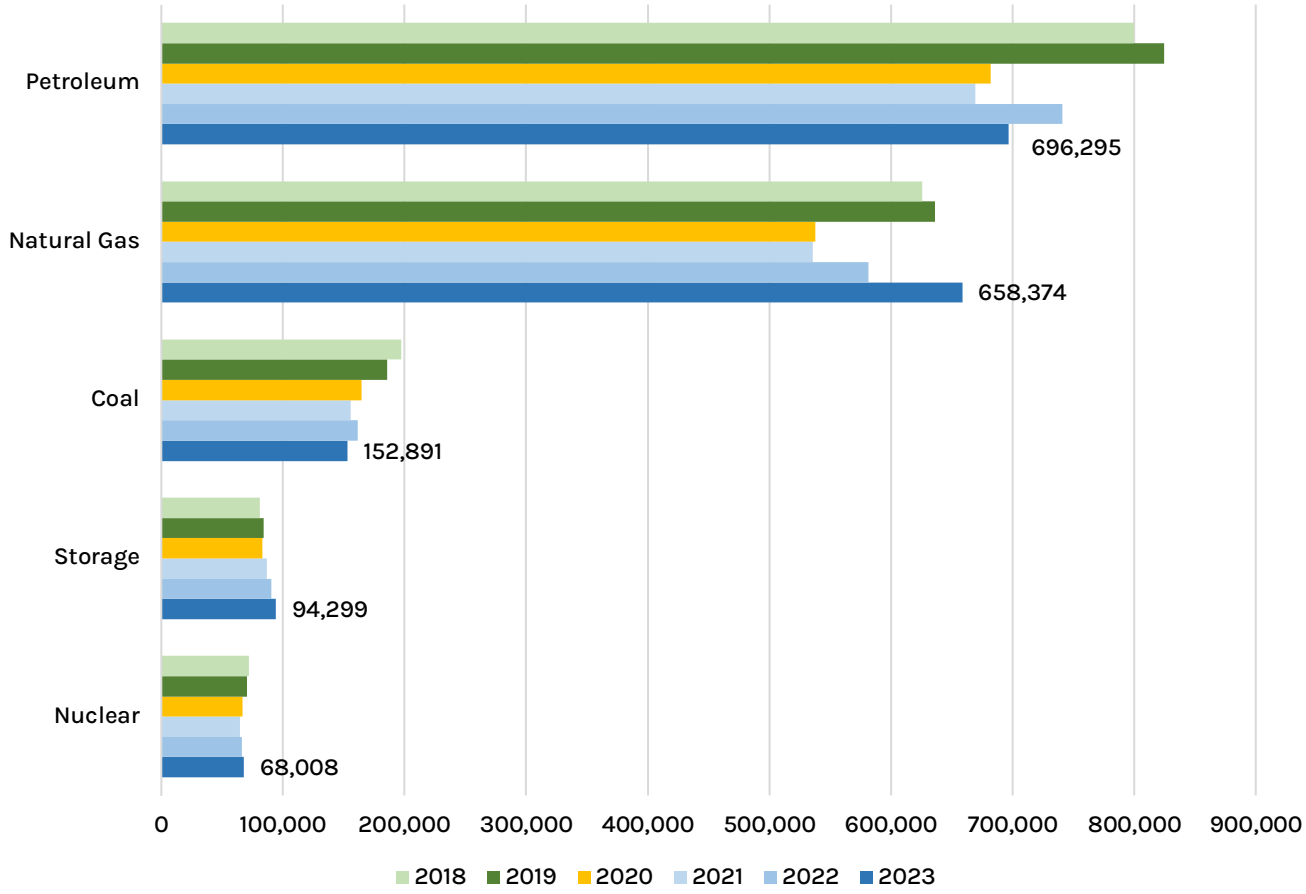


Multi-Sector Technologies

Four sectors — natural gas, coal, oil/petroleum, and nuclear — are present in three sections of this report: Electric Power Generation; Transmission, Distribution, and Storage; and Fuels[76]. These sectors use fuels for electric power generation (EPG) and are also responsible for transmission, such as pipelines that transport natural gas or railroads that move coal. These sectors are also responsible for storing fuel, making storage a cross-cutting technology. This section presents full employment results for each of these four sectors and for storage technologies from across those three report sections. The following chart (Figure 106) highlights employment in multi-sector technologies from 2018 to 2023.

Figure 106. Multi-Sector Technologies Employment, 2018-2023



[76] Fuels are combusted or otherwise spent in the generation of electricity or heat. Employment in fuels includes any work related to fuel extraction, mining and processing. This includes businesses that manufacture machinery that supports oil and gas extraction as well as coal mining. Agriculture and forestry workers who support fuel production with biodiesels, corn ethanol and fuel wood are also included in the employment data for fuels. This category also includes the production of nuclear fuels for power plants.

Natural Gas

In 2023, the natural gas sector employed 658,374 workers across all technologies, with the largest concentration (268,170) in fuels, representing an increase of more than 77,000 workers from 2022 (13.3%). Fuel transmission and distribution had the second-largest number of natural gas workers, at just over 265,000 (Table 28). Fuel transmission and distribution increased by just over 67,000 jobs (33.9%), mostly due to the increase in natural gas pipeline construction in 2023[77]. Together, these two energy categories made up 81% of all natural gas jobs.

Table 28. Natural Gas Employment by Technology and Industry

	Fuels	Conventional Gas Electric Power Generation	Advanced Gas Electric Power Generation	Fuel Transmission and Distribution	Storage	Total
Mining and Extraction	155,726	-	-	-	-	155,726
Utilities	-	18,690	48,049	122,986	-	189,725
Construction	-	10,230	9,543	108,712	537	129,021
Manufacturing	44,659	3,410	2,619	-	272	50,960
Wholesale Trade, Distribution, and Transport (Including Pipeline)	29,377	3,437	5,397	33,556	224	71,992
Professional and Business Services	38,241	8,348	11,607	-	686	58,882
Other Services	166	1,044	845	-	11	2,066
Total	268,170	45,160	78,060	265,254	1,730	658,374

The largest proportion of natural gas jobs were in the utilities industry (29%), concentrated in natural gas EPG and natural gas transmission and distribution. The largest concentration of natural gas workers in any technology industry sector was in mining and extraction within fuels, which totaled 155,726 jobs, or approximately 24% of total natural gas jobs.

[77] A similar decline in jobs can be seen in oil pipeline construction, suggesting that pipeline construction jobs shifted from oil to gas in 2023.

Coal

In 2023, the coal sector employed 152,891 workers across all technologies, with the largest concentration — 67,097 — in fuels. This represents a decrease of 8,498 jobs or growth of -5.3%. This decrease comes after the coal sector increased employment by 3.5% (5,500) jobs from 2021 to 2022. Coal EPG totaled 63,180 jobs, and another 22,613 jobs were in fuel transmission and distribution via rail, truck, and water transport[78] (Table 29).

Table 29. Coal Employment by Technology and Industry

	Fuels	Electric Power Generation	Fuel Transmission and Distribution	Total
Mining and Extraction	47,366	--	-	47,366
Utilities	-	25,692	-	25,692
Construction	-	6,401	-	6,401
Manufacturing	10,348	997	-	11,345
Wholesale Trade, Distribution, and Transport (Including Pipeline)	1,065	5,961	22,613	29,639
Professional and Business Services	8,296	23,274	-	31,570
Other Services	21	857	-	878
Total	67,097	63,180	22,613	152,891

Coal sector employment was most concentrated in three industries: mining and extraction for fuels (31%); professional and business services (21%); and utilities for EPG (17%). All fuel transmission and distribution transport employment was in the wholesale trade, distribution and transport industry as commodity flows, 71% of fuels jobs were in the mining and extraction industry, and 41% of coal EPG jobs were in the utilities industry.

[78] Commodity flows as determined by the Quadrennial Energy Review.

Petroleum

In 2023, the petroleum sector employed 696,295 workers across all technologies, a decrease of more than 44,000 jobs from 2022 (-6%). The decline in employment is mostly due to the shift in pipeline construction jobs from petroleum pipelines to natural gas-dedicated pipelines in 2023.[79] Petroleum employment was most concentrated in fuels, which accounted for 76% of petroleum jobs, up from 70% in 2022 (Table 30).

Table 30. Petroleum Employment by Technology and Industry

	Fuels	Electric Power Generation	Fuel Transmission and Distribution	Storage	Total
Mining and Extraction	228,159	-	-	-	228,159
Utilities	-	449	-	-	449
Construction	21,390	-	40,466	1,194	63,050
Manufacturing	144,583	5,290	-	268	150,141
Wholesale Trade, Distribution, and Transport (Including Pipeline)	61,176	2,106	113,382	32	176,696
Professional and Business Services	71,563	4,364	-	1	75,928
Other Services	1,312	129	-	431	1,871
Total	528,183	12,337	153,848	1,926	696,295

The majority of fuels jobs were in the mining and extraction industry, at 43%. The second-largest number of fuels jobs were in the manufacturing sector (i.e., refining and petroleum products) with 144,583 workers, or 27% of fuels. One-third (33%) of all petroleum jobs (across all technologies) were in mining and extraction.

[79] Pipeline construction for natural gas increased from 46,295 in 2022 to 108,712 in 2023.

Nuclear

In 2023, the nuclear sector employed 68,008 workers across fuels and EPG, an increase of more than 1,800 jobs from 2022 (2.8%). Most nuclear jobs (86%) were in EPG, with just 14% in fuels (Table 31).

Table 31. Nuclear Employment by Technology and Industry

	Fuels	Electric Power Generation	Total
Mining and Extraction	430	-	430
Utilities	-	41,241	41,241
Construction	-	2,150	2,150
Manufacturing	2,927	1,726	4,653
Wholesale Trade, Distribution, and Transport	947	2,499	3,446
Professional and Business Services	5,188	10,819	16,007
Other Services	-	82	82
Total	9,492	58,517	68,008

Seventy percent (70%) of nuclear EPG jobs were in the utilities industry, and EPG jobs in the utilities industry accounted for 61% of all nuclear jobs (across all technologies). Fuels jobs were distributed primarily between manufacturing and professional and business services. Fuels and EPG jobs in the professional and business services industry accounted for 24% of all nuclear jobs.

Storage

Storage technologies fall under the TDS category and employed 94,299 workers in 2023 (Table 32). This represents growth of 4.3% from 2022 to 2023. Of these workers, 80% were in battery storage (93.5% of companies indicated that they worked with lithium batteries) and 10% were in pumped storage hydropower, the second-largest number of jobs in storage.

Table 32. Storage Employment by Technology and Industry

	Pumped Storage Hydropower	Battery	Petroleum	Natural Gas	Other Fuels[80]	Other[81]	Total
Mining and Extraction	-	-	-	-	-	-	-
Utilities	-	-	-	-	-	-	-
Construction	3,546	39,079	1,194	537	1,277	1,317	46,951
Manufacturing	2,486	14,028	268	272	-	1,602	18,656
Wholesale Trade, Distribution, and Transport (Including Pipeline)	1,469	8,521	32	224	-	48	10,293
Professional and Business Services	1,525	12,948	1	686	618	835	16,613
"Other Services"	78	1,126	431	11	53	88	1,787
Total	9,104	75,702	1,926	1,730	1,948	3,889	94,299

The construction industry employed the most workers in storage technologies, representing 50% of all jobs. Manufacturing of storage components was the second-largest industry, employing more than 18,600 workers or one-fifth (20%) of all storage jobs. Battery manufacturing made up 15% of all storage jobs in 2023.

[80] "Other fuels" refers to any gas or liquid fuel storage that is not captured in the categories listed previously or a category that is used when unable to split employment into a single fuel storage category where employees spend most of their time.
[81] "Other" refers to any storage that is not captured in the categories listed previously or a category that is used when unable to split employment into a single category where employees spend most of their time.

Energy Efficiency

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Energy Efficiency

Reducing the energy usage of buildings is an important component of the nation's decarbonization strategy. The Inflation Reduction Act (2022) created and expanded programs aimed at decarbonizing buildings, including providing a number of direct incentives to consumers to install more efficient and less polluting technologies such as the Low Income Home Energy Assistance Program (LIHEAP), the Energy Efficiency Home Improvement Credit, and the High-Efficiency Electric Home Rebate program.[82] In addition, the Bipartisan Infrastructure Law (2021) supports federal investments in research and development, demonstration, and deployment programs to help to achieve carbon-free electricity in the U.S. by 2035 and a net-zero economy by 2050.[83]

For the purposes of this report, energy efficiency (EE) includes the production, wholesale trade, installation, and repair and maintenance of products that increase EE and the provision of services that reduce energy consumption in buildings by the end user. EE also includes design and contracting services that improve buildings' efficiency, such as insulation and lighting upgrades (including improvement in natural lighting), or that otherwise reduce overall energy consumption across homes and businesses. Energy efficiency sector employment categories include: ENERGY STAR® certified appliances, products, and services; traditional heating, ventilation, and cooling (HVAC); advanced and recycled building materials; LED, CFL, and other efficient lighting; renewable heating and cooling; and other EE activities.

Within EE, the ENERGY STAR program is an important component of the USEER survey. ENERGY STAR establishes definitions of efficiency for residential and commercial products. The USEER survey identifies employment involved in the production, construction, installation, and maintenance of these products. For example, jobs in this chapter include contractors who install, maintain, and repair ENERGY STAR certified products, as well as other upstream activities such as wholesale trade and distribution.[84]

Businesses performing EE activities do not have dedicated industry classifications (NAICS codes), so data on the size and scope of EE employment are limited. Employment at EE businesses is therefore embedded within other industry data (e.g., electrical contractors; HVAC and plumbing contractors; appliance manufacturers). Furthermore, businesses may not be wholly engaged in EE work, and therefore workers may spend only a portion of their time supporting EE activities. Direct reporting from employers in the USEER survey is therefore necessary to ensure accurate and useful data on the sector.

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[82] See generally, https://www.energy.gov/scep/home-energy-rebates-programs; https://www.energy.gov/scep/wap/weatherization-assistance-program.

[83] See https://www.energy.gov/gdo/bipartisan-infrastructure-law.

[84] For the purposes of this report, EE does not include activities related to efficient manufacturing and industrial processes, increasing fuel economy of vehicles (efficient vehicles and components that increase fuel economy are included in the Motor Vehicles chapter of this report), or programs embedded with utilities, including combined heat and power (employment at utilities are included in the EPG and TDS chapters of this report, while CHP is included in the EPG chapter of this report).

Utility Energy Efficiency Programs

Many energy utilities and third parties in the U.S. sponsor or manage EE programs for residential, commercial, and industrial properties. However, the USEER EE employment numbers do not include direct employees of the utilities that administer these programs. These employees are included in the numbers for "utilities" employees in either the electric power generation or transmission, distribution, and storage sections of this report. Though the Energy Efficiency section does not capture these employees, the programs include many different incentives and tools that reduce energy consumption and improve EE in meaningful ways.[85]

In 2023, EE employed 2,290,179 workers, an increase of 74,747 jobs or 3.4% from the 2,215,432 employed in 2022. EE employment, along with Fuels employment, are the only two major technology categories that have yet to recover all jobs lost during the COVID-19 pandemic.

TRENDS AND KEY TAKEAWAYS

- EE employment from 2022 to 2023 grew by 74,748 jobs or 3.4%. All technologies related to EE grew from 2022 to 2023.
- Traditional HVAC[86], the largest EE technology employment category, added the most jobs (by total number of jobs but had a smaller than average growth rate) for the third year in a row, at 18,165 (3.2%), followed by other LED, CFL and efficient lighting (8,583 jobs); ENERGY STAR certified appliances (not including HVAC) (7,040 jobs); ENERGY STAR certified insulation (5,509 jobs); advanced building materials/insulation (4,934 jobs); and other high efficiency HVAC that are out of the scope for ENERGY STAR certification (4,754 jobs).
- The largest gains were in the construction industry, with 45,334 added jobs (3.8%), followed by manufacturing (15,893 jobs, 5.3%), professional and business services (11,256 jobs, 2.3%), other services (1,532 jobs, 3.8%), and wholesale trade (733 jobs, 0.4%).
- Employers in all five EE industries anticipate growth in 2024, with four out of five industries expecting growth of at least 8%.
- The percentage of workers in EE represented by a union or covered under a project labor or collective bargaining agreement (13%) was higher than the energy workforce average (11%).
- EE's workforce tended to be disproportionately male, with an average the same as the overall energy workforce average, at 73%. This is much higher than the 53% economy-wide workforce average.

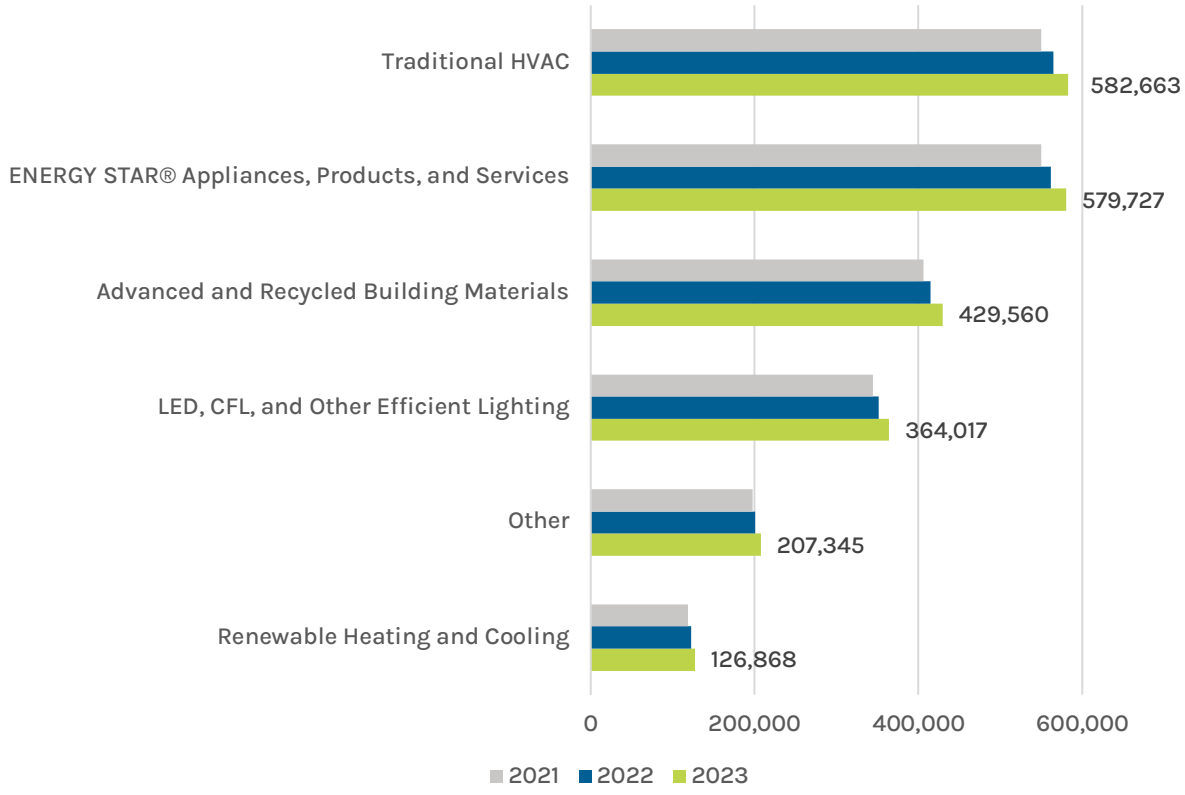
[85] For examples see Energy Efficiency Program Typology and Data Metrics: Enabling Multi-State Analyses Through the Use of Common Terminology | Electricity Markets and Policy Group (lbl.gov).
[86] For definitions of technologies, refer to Appendix J: Energy Technology Definitions.

- EE businesses employed a percentage of Hispanic or Latino workers (18%) that is on par with the overall energy workforce average (18%).
- The percent of White workers in EE was higher than the energy workforce average, 75% compared to 74%. Asian workers in the EE workforce (6%) are less represented than in the overall energy workforce (7%), and workers of two or more races in the EE workforce (3%) are less represented than in the overall energy workforce (5%).
- The proportion of Black or African American workers in the EE workforce (9%) was the same as the overall energy workforce (9%).
- The proportion of veterans working in EE (9%) was also the same as the energy workforce average (9%).
- There were slightly more workers requesting accommodations for a disability in EE (3%) than in the overall energy workforce (2%).
- The percentage of formerly incarcerated workers in EE (2%) was double the overall energy workforce average (1%).

EMPLOYMENT BY TECHNOLOGY, INDUSTRY, AND OCCUPATION

Traditional HVAC and ENERGY STAR-related jobs employ a similar number of workers (582,663 compared to 579,727 respectively) and grew at the same rate from 2022 to 2023 (3.2%; Figure 107).

Figure 107. Energy Efficiency Employment by Technology Group, 2021-2023



There are 12 ENERGY STAR technology areas identified in EE. ENERGY STAR certified HVAC businesses employed 192,617 workers, the most of any ENERGY STAR technology. ENERGY STAR certified LED lighting followed, with 148,799 employees. Figures 108 and 109 below split the ENERGY STAR technologies into two groups, with the five largest technologies (those employing more than 66,000 workers) occupying the top chart and the seven smallest technologies (those employing less than 34,000 workers) occupying the bottom chart.

Figure 108. Energy Efficiency Employment in ENERGY STAR 5 Largest Technologies, 2023

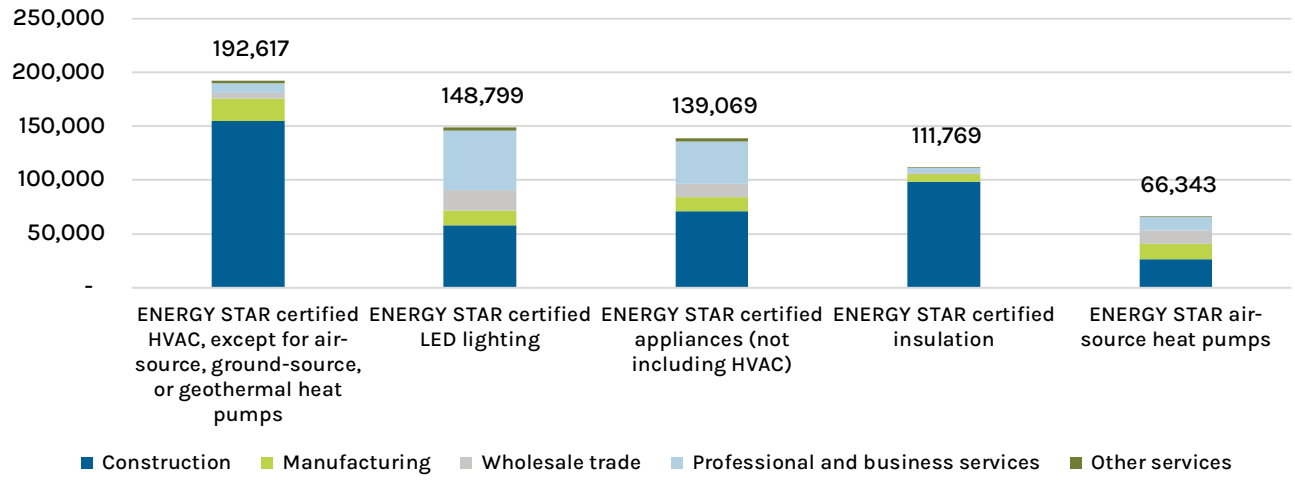
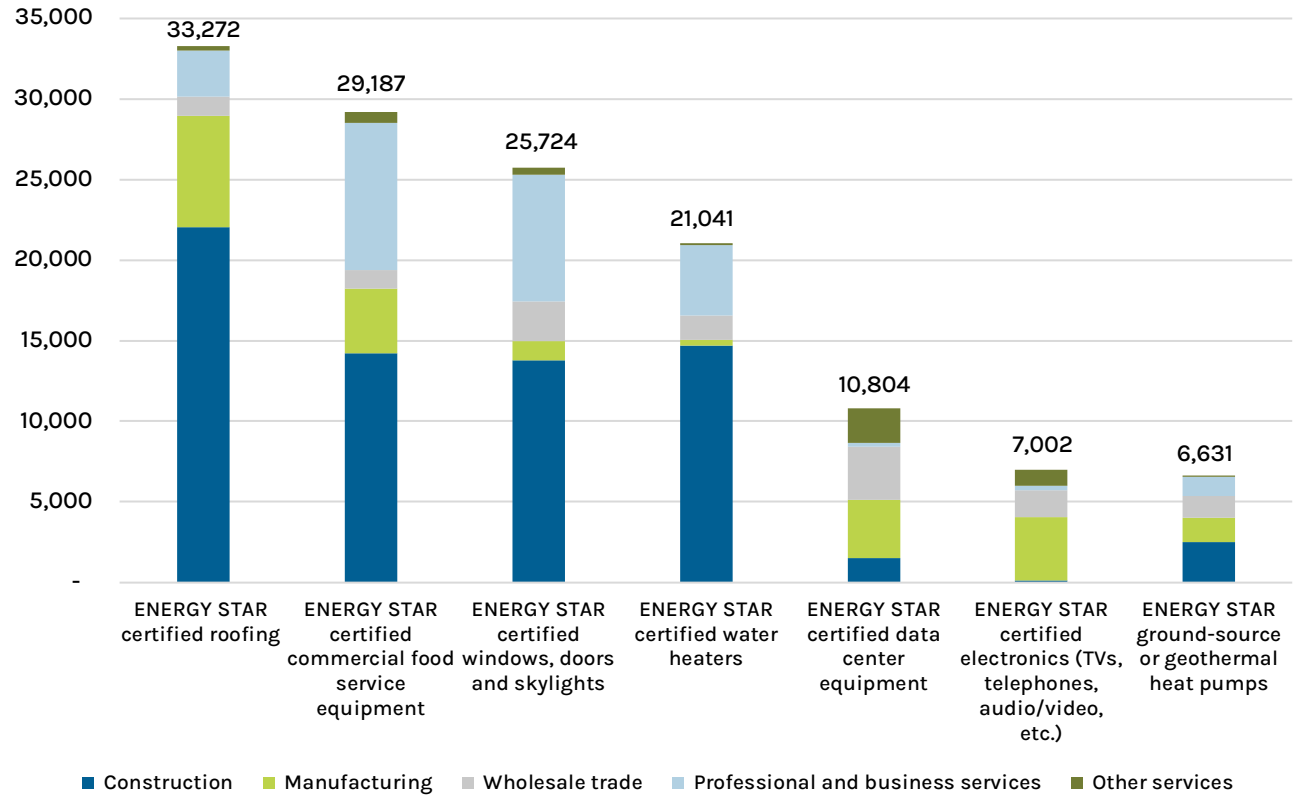
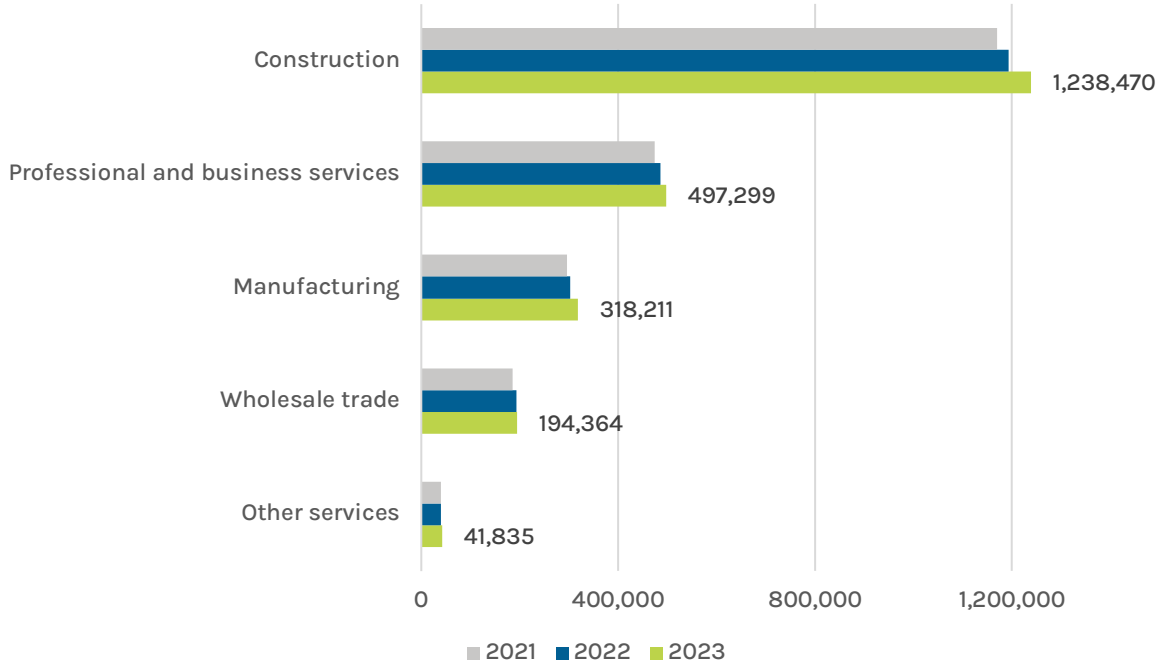


Figure 109. Energy Efficiency Employment in ENERGY STAR 7 Smallest Technologies, 2023



Workers in the construction industry made up the largest segment of EE employment, accounting for 1,238,470 jobs, which was up 45,334 from 2022 (Figure 110). Manufacturing businesses grew by the largest percentage in 2023, at 5.3% (15,893 jobs).

Figure 110. Energy Efficiency Employment by Industry, 2021-2023



The construction industry was also the largest employer for the majority of the EE technologies, except for the four technologies for which manufacturing employment was largest: ENERGY STAR certified electronics (e.g., TVs, telephones, audio/video); ENERGY STAR certified data center equipment; advanced building materials/insulation; and "other" energy efficiency technologies[87] (Table 33).

[87] Includes any energy efficiency technology that is not captured within other categories or a category that is used when unable to split employment into a single energy efficiency category where employees spend "more of their time." For additional technology definitions, please refer to Appendix K.

Table 33. Energy Efficiency Employment by Technology and Industry, 2023[88]

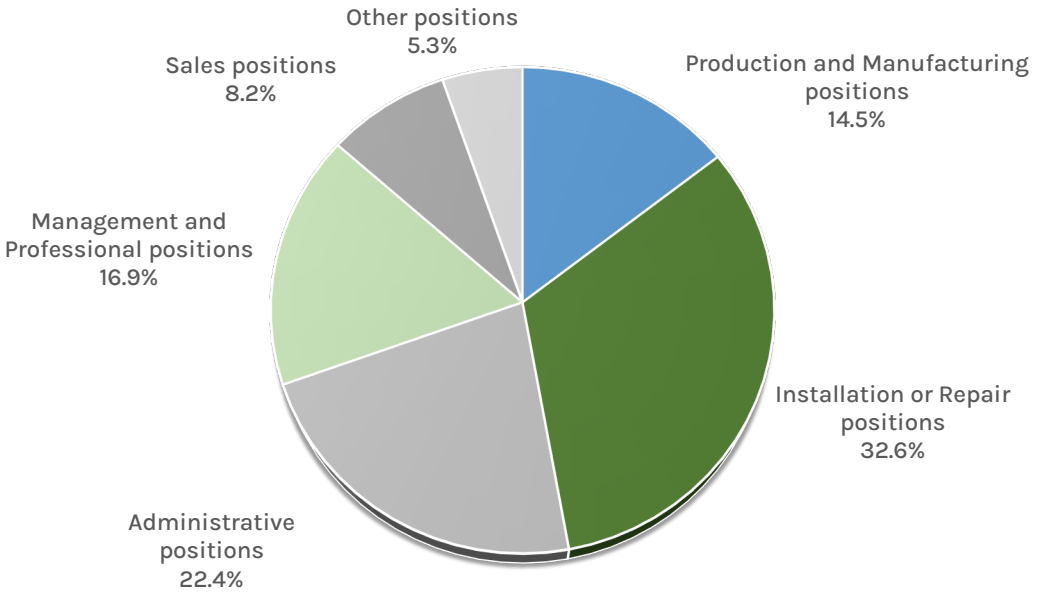
Detailed Technology	Construction	Manufac-turing	Wholesale Trade	Professional and Business Services	Other Services
ENERGY STAR certified appliances (not including HVAC)	**51%**	9%	9%	28%	2%
ENERGY STAR certified HVAC, except for air-source, ground-source, or geothermal heat pumps	**80%**	11%	3%	5%	1%
ENERGY STAR air-source heat pumps	**40%**	21%	19%	19%	1%
ENERGY STAR ground-source or geothermal heat pumps	**38%**	23%	20%	18%	1%
Other high-efficiency HVAC out of scope for ENERGY STAR certification (e.g., indirect evaporative coolers, air-to-water heat pumps, energy recovery systems)	**51%**	24%	6%	18%	1%
Traditional HVAC goods, control systems and services	**54%**	5%	10%	28%	3%
ENERGY STAR certified water heaters	**70%**	2%	7%	21%	0%
ENERGY STAR certified electronics (e.g., TVs, telephones, audio/video)	2%	**56%**	24%	4%	14%
ENERGY STAR certified windows, doors, and skylights	**54%**	5%	10%	31%	2%
ENERGY STAR certified roofing	**66%**	21%	4%	9%	1%
ENERGY STAR certified insulation	**88%**	7%	1%	4%	0%
Air sealing	**53%**	3%	25%	18%	0%
ENERGY STAR certified commercial food service equipment	**49%**	14%	4%	31%	2%
ENERGY STAR certified data center equipment	14%	**33%**	31%	2%	20%
ENERGY STAR certified LED lighting	**39%**	9%	13%	37%	2%
Other LED, CFL and efficient lighting	**52%**	18%	11%	19%	0%
Other renewable heating and cooling (e.g., geothermal, bioenergy, solar heating)	**63%**	7%	7%	23%	1%
Advanced building materials/insulation	24%	**51%**	1%	23%	1%
Recycled building materials	**55%**	15%	4%	23%	4%
Reduced water consumption products and appliances	**63%**	6%	6%	23%	1%
Energy auditing services	**49%**	0%	0%	46%	5%
Other	32%	**41%**	5%	18%	3%
TOTAL	**54%**	14%	8%	22%	2%

[88] Bolded cells indicated the industry with the largest share of employment for each technology (row)

Workers with the same occupation can work in different industries. For example, the construction industry includes many installation or repair occupations, but wholesale trade and other industries also employ people in these occupations. For this reason, different trends show up if parsing the data by industry or occupation. It can be useful to show energy employment data and trends by both.

The largest occupation group within EE was installation or repair positions, which accounted for 32.6% of all EE jobs (Figure 111). This was followed by administrative positions (22.4%), management and professional positions (16.9%), and production and manufacturing positions (14.5%). These proportions are largely unchanged from the previous year.

Figure 111. Energy Efficiency Employment by Occupation



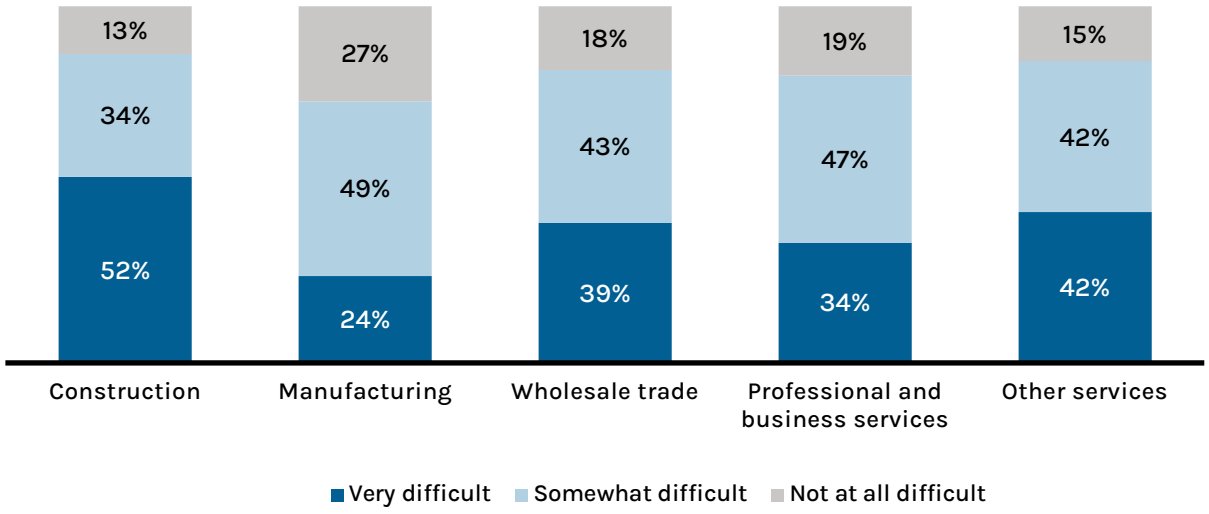
Employer Perspective on Workforce Issues

Current Hiring Difficulty

EE businesses reported hiring challenges, with between 73% and 87% of businesses in each industry sector reporting at least some difficulty finding workers in 2023 (Figure 112). This is slightly down from 2022, when difficulty was experienced by between 84% and 95% of businesses, dependent on industry sector.

Once again, construction businesses reported the highest level of hiring difficulty, with 87% reporting that it was "very difficult" or "somewhat difficult" to hire qualified workers. Construction also had the highest percentage of employers indicating that it was "very difficult" to hire, at 52%. Union construction businesses[89] reported lower levels of hiring difficulty than the average for the construction industry overall, with only 36% of union construction businesses reporting that it was "very difficult" to hire as compared to 53% of non-union construction firms.

Figure 112. Energy Efficiency Employers' Perceived Hiring Difficulty



[89] Defined as businesses with at least 20% of their employees belonging to a union or covered by a project labor or collective bargaining agreement.

All industries reported lack of experience, training, or technical skills as the primary reason that it was difficult to hire (Table 34). Among construction, manufacturing, and wholesale trade businesses, insufficient non-technical skills (work ethic, dependability, critical thinking) was among the top three reasons for hiring difficulty, while insufficient qualifications (certifications or education) was among the top three reasons for hiring difficulty cited by professional and business services and other services businesses within EE.

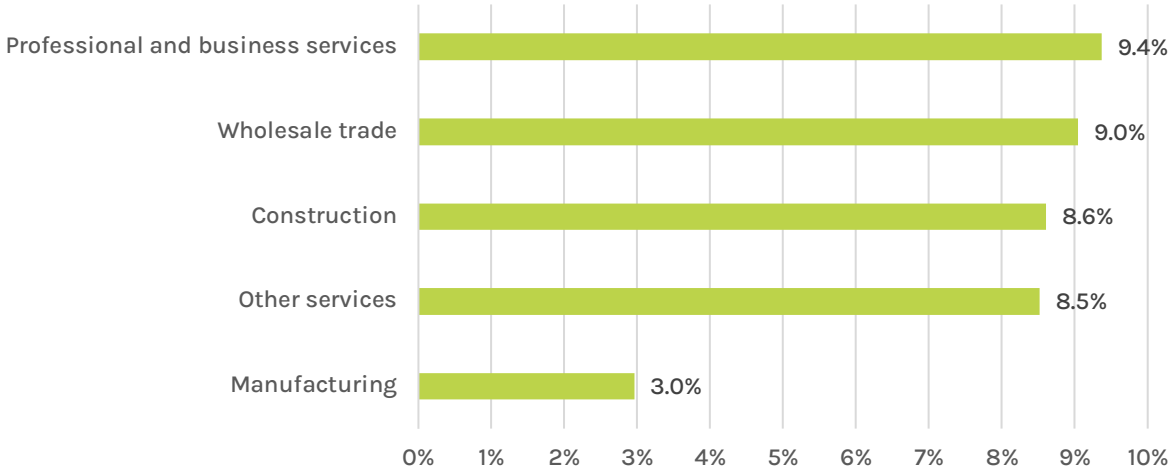
Table 34. Energy Efficiency Employers' Reasons for Hiring Difficulty

Industry	Most Common Reason	Second Most Common Reason	Third Most Common Reason
Construction	Lack of experience, training, or technical skills (37%)	Insufficient non-technical skills (work ethic, dependability, critical thinking) (28%)	Difficulty finding industry-specific knowledge, skills, and interest (27%)
Manufacturing	Lack of experience, training, or technical skills (36%)	Cannot provide competitive wages (29%)	Insufficient non-technical skills (work ethic, dependability, critical thinking) (25%)
Wholesale trade	Lack of experience, training, or technical skills (30%)	Insufficient non-technical skills (work ethic, dependability, critical thinking) (30%)	Difficulty finding industry-specific knowledge, skills, and interest (30%)
Professional and business services	Lack of experience, training, or technical skills (42%)	Cannot provide competitive wages (36%)	Insufficient qualifications (certifications or education) (25%)
Other services	Lack of experience, training, or technical skills (36%)	Difficulty finding industry-specific knowledge, skills, and interest (32%)	Insufficient qualifications (certifications or education) (23%)

Employment Change by Industry

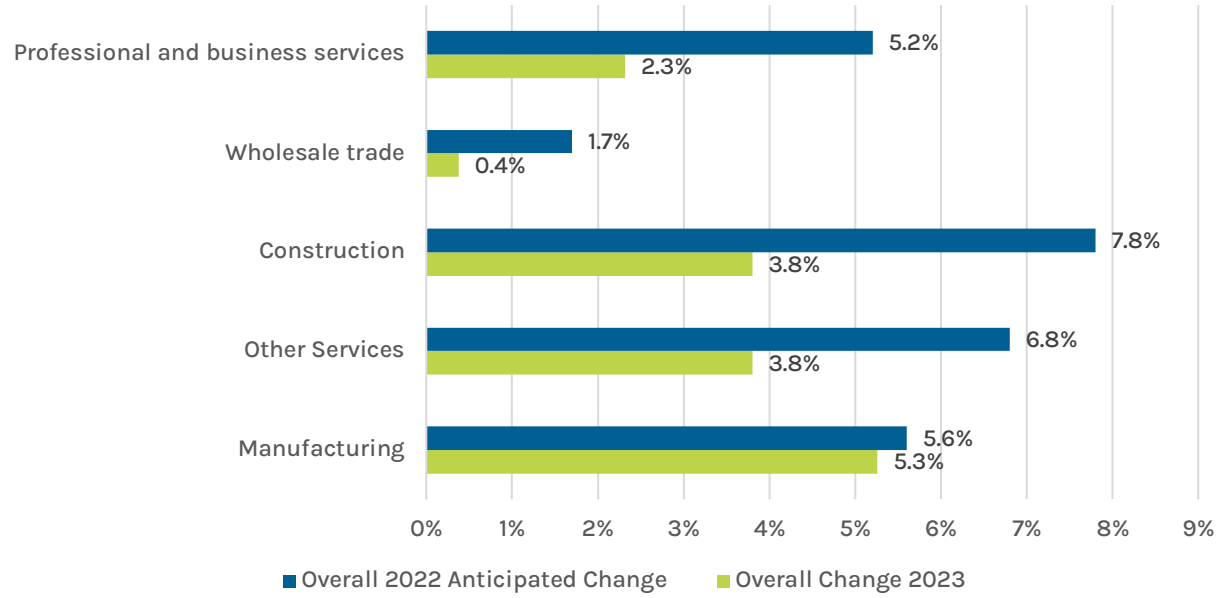
The previous section highlighted EE employers' current hiring difficulty across industries, whereas this section focuses on anticipated employment change by industry. This section also compares anticipated employment change in 2022 to the actual employment change over the last year. Employers in all five EE industries anticipate job growth in 2023, ranging from 3.0% in manufacturing to 9.4% in professional and business services (Figure 113).

Figure 113. Energy Efficiency Anticipated Employment Changes, 2024



Growth among all EE industries in 2023 did not meet employer expectations, although manufacturing was within a percentage point between anticipated and actual growth. (Figure 114).

Figure 114. Energy Efficiency Actual Employment Change 2022-2023 vs. Anticipated Employment Change 2022



Energy Efficiency Demographics

The demographics for the EE workforce are displayed in Table 35, and are largely unchanged from 2022. The EE workforce was disproportionately male (73%), consistent with the overall energy workforce (73%), but significantly higher than the U.S. workforce average (53%).

The proportion of Hispanic or Latino workers in EE (18%) was similar to the overall energy workforce (18%), but lower than the national workforce average (19%).

EE establishments employed a higher percentage of White workers (75%) than the overall energy sector (74%) but a lower percentage than the national workforce average (76%). This is attributable to a lower-than-average proportion of workers of two or more races in the EE workforce (3%) compared to the overall energy workforce (5%), and a lower-than-average proportion of Asian workers in the EE workforce (6%) compared to the overall energy workforce (7%). The proportion of Black or African American workers in EE (9%) was the same as in the overall energy workforce (9%), and the proportion of Native Hawaiian or Pacific Islander workers in EE (1%) was the same as in the overall energy workforce (1%). The representation of Black or African Americans in EE (9%) is considerably lower than the national workforce average (13%), while the representation of Native Hawaiian or Pacific Islanders in EE (1%) is slightly higher when comparing to the U.S. workforce as a whole (<1%). American Indian or Alaska Native workers in EE (3%) were more represented than in the overall energy workforce (2%) and the U.S. workforce as a whole (1%).

The percentage of veterans in the EE workforce (9%) was the same as the energy workforce average (9%), but significantly higher than the national workforce average (5%). Formerly incarcerated workers in EE (2%) are employed at double the rate as the energy industry as a whole (1%), but on par with the U.S. workforce average (2%).[90] Workers requesting accommodations for disabilities in EE (3%) were employed at a higher rate than in the overall energy workforce (2%) but at a lower rate than the national workforce average (5%).

The EE workforce was mostly composed of young and middle-aged workers, with workers under the age of 30 in EE (31%) more represented than in the overall energy workforce (29%), and with workers between the ages of 30 and 54 in EE (55%) more represented than in the overall energy workforce (52%). Workers under the age of 30 in EE (31%) were more represented than the national workforce overall (22%). Workers aged 55 or older in EE (14%) were less represented compared to the energy workforce overall (18%) and the national workforce overall (23%).

The concentration of workers represented by a union or covered under a project labor or collective bargaining agreement in EE (13%) was higher than the energy workforce average (11%) and the national private sector average (7%).

[90] Formerly incarcerated people are employed in waste management services, construction, and food service at higher rates when compared to other major industries. Source: Prison Policy Initiative, 2022. Approximately 54% of employment in EE is in construction.

Table 35. Energy Efficiency Workforce Demographics and Characteristics

	Number of Energy Efficiency Workers	Energy Efficiency Average	Energy Workforce Average	National Workforce Average
Male	1,675,511	73%	73%	53%
Female	601,714	26%	26%	47%
Gender Nonbinary	12,954	<1%	<1%	n/a
Hispanic or Latino	406,000	18%	18%	19%
Not Hispanic or Latino	1,884,179	82%	82%	81%
American Indian or Alaska Native	61,998	3%	2%	1%
Asian	142,340	6%	7%	7%
Black or African American	197,531	9%	9%	13%
Native Hawaiian or Other Pacific Islander	29,678	1%	1%	<1%
White	1,720,709	75%	74%	76%
Two or More Races	79,757	3%	5%	3%
Unknown Race	58,625	3%	2%	n/a
Veterans	206,691	9%	9%	5%
18 to 29	702,338	31%	29%	22%
30 to 54	1,260,173	55%	52%	53%
55 and over	327,668	14%	18%	23%
Disability	69,424	3%	2%	5%
Formerly Incarcerated	35,563	2%	1%	2%
Represented by Unions, Collective Bargaining Agreements, and/or Project Labor Agreements	290,878	13%[91]	11%	7%

National sources: BLS (2023a, 2023b, 2023c, 2023d), Jobs EQ (2023), Prison Policy (2018)

[91] Unionization rates vary by state.

Motor Vehicles & Component Parts

United States Energy & Employment Report 2024 • www.energy.gov/USEER

Motor Vehicles and Component Parts

Transportation is the leading source of greenhouse gas emissions in the United States,[92] and motor vehicles are a major driver of those emissions.[93] Increasing the efficiency of motor vehicles, developing domestic zero-emissions vehicles supply chains, and incentivizing adoption are key components of recent state and federal policies, including the Inflation Reduction Act.[94]

The motor vehicles (MV) and component parts (CP) category includes companies that manufacture and ship new vehicles and parts, design vehicles and parts, and repair motor vehicles. In this section, "MV & CP jobs" and "MV & CP employment" are used to refer to jobs or employment in both motor vehicles *and* component parts.[95]

In 2023, MV & CP businesses employed 2,664,981 workers, a 72,984 (2.8%) increase over 2022.[96] Of these 72,984 new positions, CP contributed 18,882, an increase of 1.7%.

TRENDS AND KEY TAKEAWAYS

- MV & CP jobs grew by 72,984 jobs, or 2.8%, from 2022 to 2023.
- Since 2020, MV & CP businesses have added more than 339,000 jobs, a growth rate of 14.6%.
- Gasoline and diesel vehicle employment, the largest MV & CP technology, added the most jobs of any category, at 39,305 (2.0%).
- Jobs in clean vehicles (BEV, plug-in hybrid, and hydrogen/fuel cell) increased by 24,826 (11.4%). This figure is broken down as follows: battery electric vehicle (BEV) jobs grew the fastest and most, increasing by 12.9% (17,064 jobs); plug-in hybrid vehicle jobs increased by 10.5% (5,743 jobs); and hydrogen/fuel cell vehicle jobs increased by 11.5% (2,019 jobs).
- More than a quarter (26.2%) of battery storage businesses classified in transmission, distribution, and storage (TDS) identified vehicles or other transportation as the application of their battery technology. This is a decrease from 31.5% in 2022.[97]

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[92] Environmental Protection Agency, Inventory of U.S. Greenhouse Gas Emissions and Sinks, available at https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks

[93] Environmental Protection Agency, Fast Facts on Transportation Greenhouse Gas Emissions, available at https://www.epa.gov/greenvehicles/fast-facts-transportation-greenhouse-gas-emissions

[94] See generally, https://afdc.energy.gov/laws/electric-vehicles-for-tax-credit

[95] Does not include traditional transportation jobs such as bus drivers, taxi drivers, etc.

[96] There are 2,552,222 MV workers employed in identifiable technologies such as those in Figure 114 and Figure 115. The difference between this and the 2,664,981 total is due to the flow of commodities that are technology-agnostic.

[97] More businesses in battery storage identified behind the meter (buildings or industrial facilities) (65.2% compared to 63.5%) and consumer devices (18.7% vs. 17.9%) as the application of their battery storage work in 2023 when compared to 2022.

- As with 2022, the largest job gains in 2023 were in the repair and maintenance industry, which added 44,736 new jobs (4.5%).
- Repair and maintenance and manufacturing had the highest percentages of businesses reporting hiring difficulty, with more than nine out of 10 respondents within each of those industries indicating it was "very difficult" or "somewhat difficult" to find employees. More than half of repair and maintenance businesses reported that hiring was "very difficult" (53%).
- Employers in all MV & CP industries anticipate growth through 2024, ranging from 2% for wholesale trade, distribution, and transport to 7.5% for employers in professional and business services.
- The MV & CP workforce was disproportionately made up of male employees, with 74% of workers identifying as male compared to 73% of the overall energy workforce, and 53% in the national workforce overall.
- The percent of non-white workers in the MV & CP workforce (24%) was lower than the overall energy workforce average (26%) but similar to the national workforce average (24%).
- Hispanic or Latino workers were more concentrated in the MV & CP workforce (20%) than in the energy workforce overall (18%) and in the national workforce overall (19%).
- Black or African American workers in the MV & CP workforce (8%) were underrepresented compared to the energy workforce average (9%) and the national workforce average (13%).[98]
- Veterans in the MV & CP workforce (10%) were more highly represented than in the overall energy workforce (9%) and the national workforce (5%).
- Those requesting accommodations for disabilities in the MV & CP workforce (2%) were similarly represented in the overall energy workforce (2%) but less highly represented than in the national workforce (5%).
- The percentage of formerly incarcerated workers in MV & CP (1%) was on par with the overall energy workforce (1%) and lower than that of the national workforce (2%).
- The percentage of workers in MV & CP represented by a union or covered under a project labor or collective bargaining agreement (6%) was lower than the overall energy workforce average (11%) and the national private sector average (7%). Manufacturing and repair and maintenance industries each make up 39% of total MV

[98] Representation varies by industry within MV & CP. For example, motor vehicle and motor vehicle component parts manufacturing employs higher than average numbers of Black or African American workers (18%), whereas repair and maintenance, wholesale trade, and professional and business services is made up of between 4% and 7% Black or African American workers depending on NAICS classification.

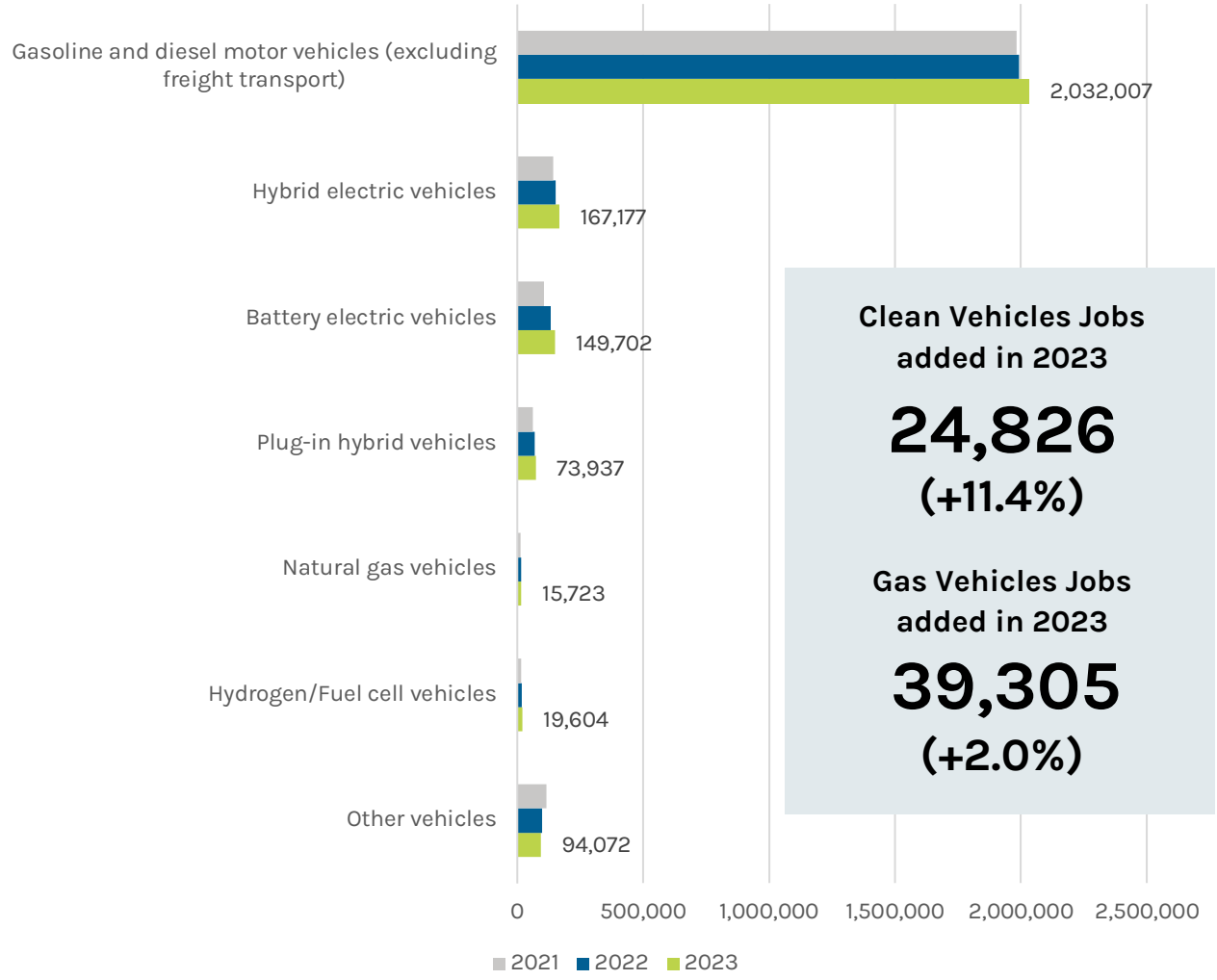
& CP employment. According to the Bureau of Labor Statistics (BLS), the percentage of workers that were represented by unions in manufacturing was 9.1% whereas the percentage in other services (where automotive repair and maintenance is classified) was 3.6%.[99]

[99] Source: https://www.bls.gov/news.release/pdf/union2.pdf, private sector represented by unions, 2023

EMPLOYMENT BY TECHNOLOGY, INDUSTRY, AND OCCUPATION

Overall employment across MV & CP grew in 2023, as did growth in all major technology categories, as the sector saw wholly new investments and shifts in technology at existing businesses. As in previous years, gasoline and diesel vehicles remained the largest MV & CP technology by employment, adding 39,305 jobs (2.0%), although BEV employment grew more than six times faster (12.9%, or 17,064 jobs; Figure 115). All clean vehicle jobs, which include jobs in BEV, plug-in hybrid, and hydrogen/fuel cell vehicles, added 24,826 workers from 2022 to 2023. Employment in "other vehicles" declined by 3,973 workers, or -4.1%.[100]

Figure 115. Motor Vehicles and Component Parts Employment by Technology, 2021-2023



[100] "Other vehicles" includes all employment that cannot be classified into the categories provided and includes employees that work across technologies without a primary sector identified by employers.

Jobs in clean vehicles and component parts technologies grew 11.0% from 2022 to 2023, led by 17,064 new jobs in battery electric vehicles (BEVs) (12.9%), and including plug-in hybrids' 5,743 jobs (8.4%) and fuel cell electric vehicles' (FCEV) 2,019 jobs (11.5%). Jobs for hybrid vehicles also grew, adding 15,953 jobs (10.5%).

Most of the employment across vehicle technology types was in the MV category, which accounted for 1,448,219 workers (Figure 116). Workers focused on the CP segment totaled 1,104,003 in 2023. Close to half of the jobs in gasoline and diesel motor vehicles were in component parts (45.7%), while for alternative fuel vehicles, component parts make up a much smaller percentage of the total jobs (24.7%).

Employment growth in clean vehicles

11.0%

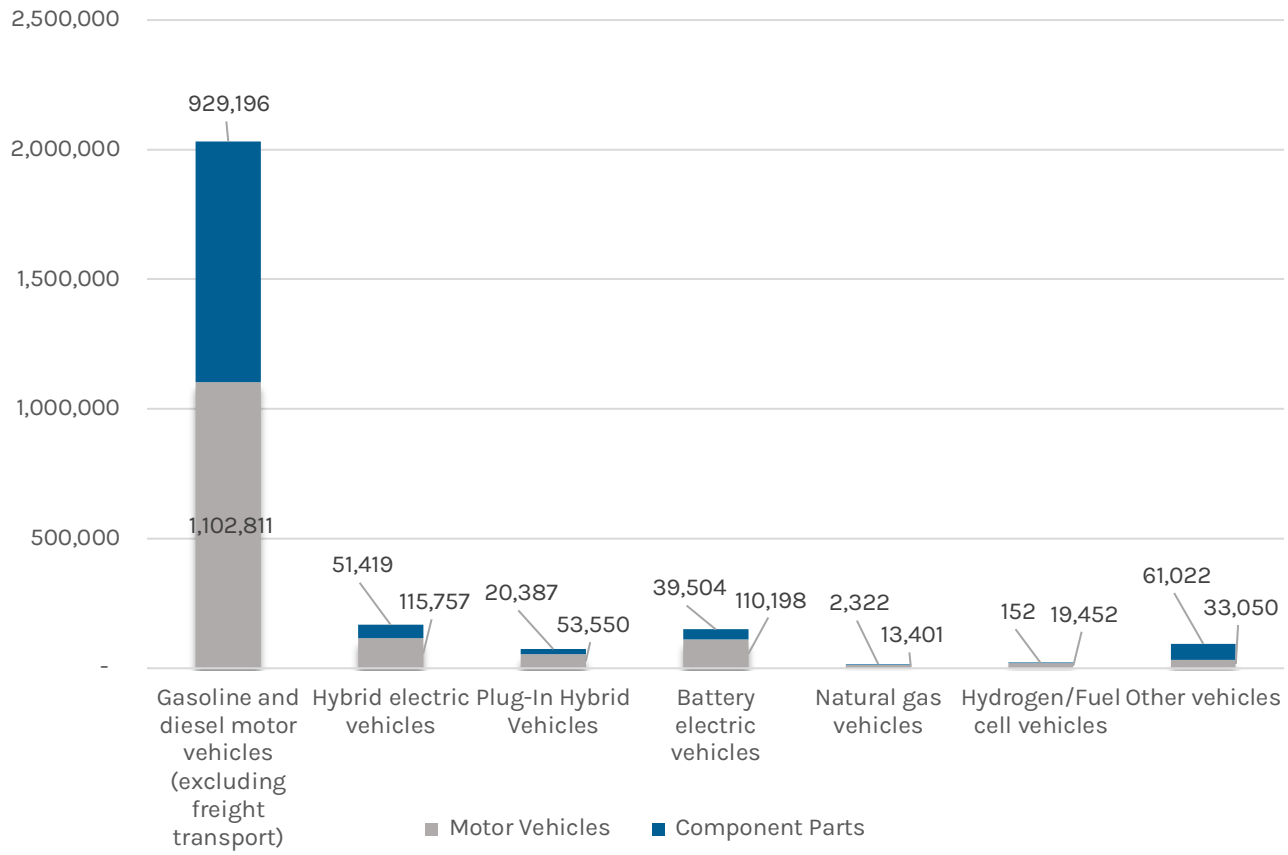
in 2023

Hydrogen/Fuel Cell vehicles +2,019 (11.5%)

Plug-in hybrid vehicles +5,743 (8.4%)

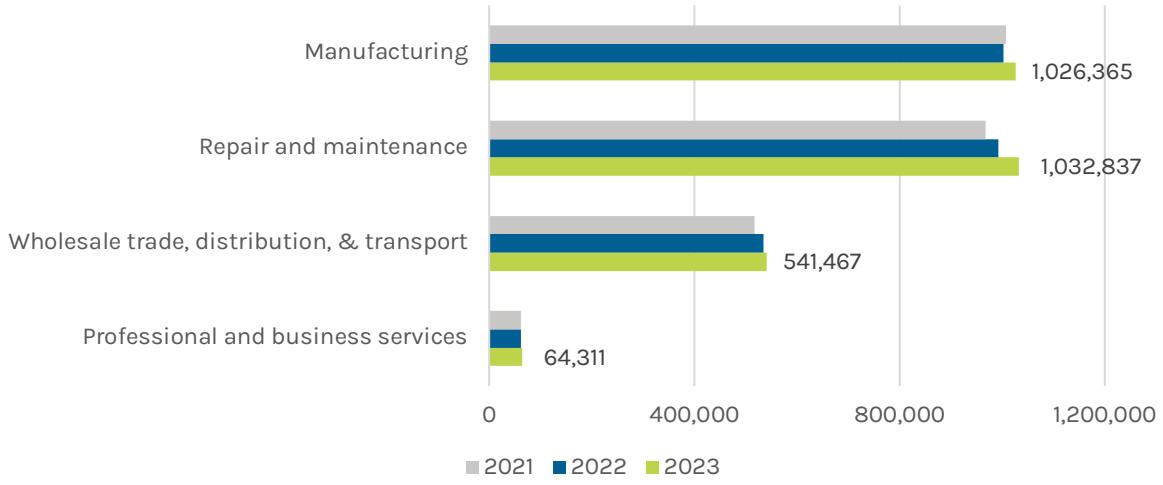
Battery electric vehicles +17,064 (12.9%)

Figure 116. Motor Vehicles and Component Parts Employment by Activity



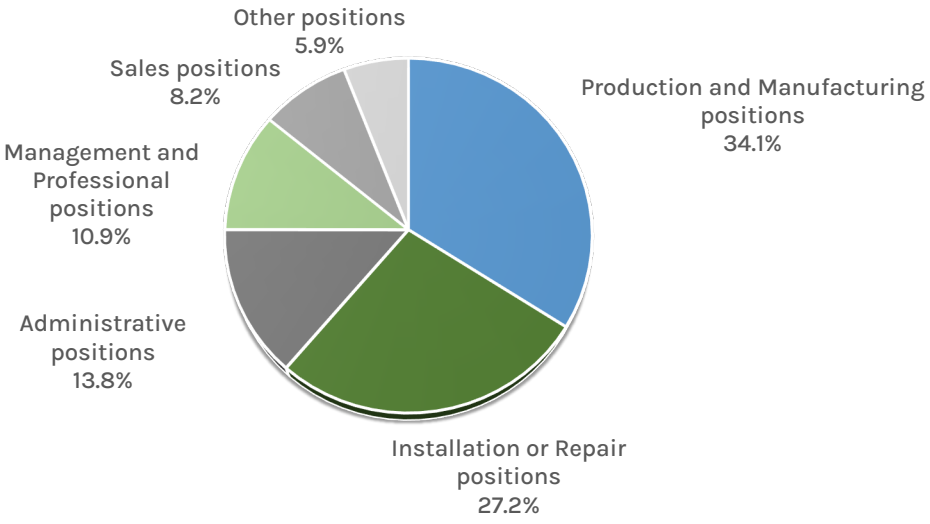
MV & CP employment and growth was concentrated in the repair and maintenance industry, which accounted for 1,032,837 workers in 2023, up 39,892 jobs from 2022, or 40% (Figure 117). Repair and maintenance added the most workers amongst industries in 2023, after adding the most from 2021 to 2022 (25,570 jobs). Manufacturing added the second largest number of jobs in 2023, increasing by 23,594 workers, or 2.4%.

Figure 117. Motor Vehicles Employment by Industry, 2021-2023



Workers with the same occupation can work in different industries. For example, the manufacturing industry includes many production and manufacturing positions, but vehicle repair and maintenance and other industries also employ people in these occupations. The largest occupation group within MV & CP was production and manufacturing positions, which accounted for 34.1% of jobs (Figure 118), followed by installation or repair positions (27.2%) and administrative positions (13.8%).

Figure 118. Motor Vehicles and Component Parts Employment by Occupation

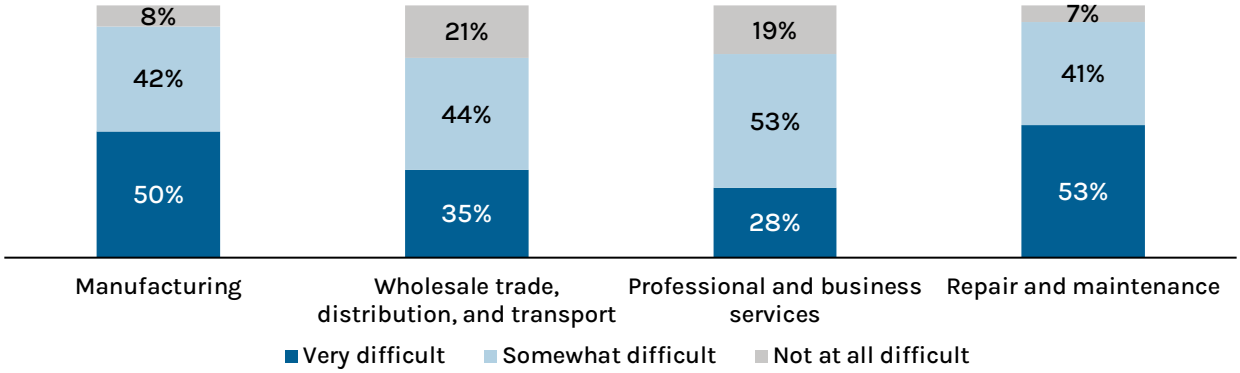


Employer Perspective on Workforce Issues

Current Hiring Difficulty

More than 90% of employers across manufacturing and repair and maintenance in MV & CP reported at least some difficulty hiring workers (Figure 119). Repair and maintenance had the highest percentage of employers reporting that hiring was "very difficult" (53%), followed by manufacturing (50%).

Figure 119. Motor Vehicles and Component Parts Employers' Perceived Hiring Difficulty



Lack of experience, training, or technical skills was the primary driver of hiring difficulty, according to employers (Table 36). Insufficient qualifications (certifications or education) were cited by employers in two out of four industries within MV & CP.

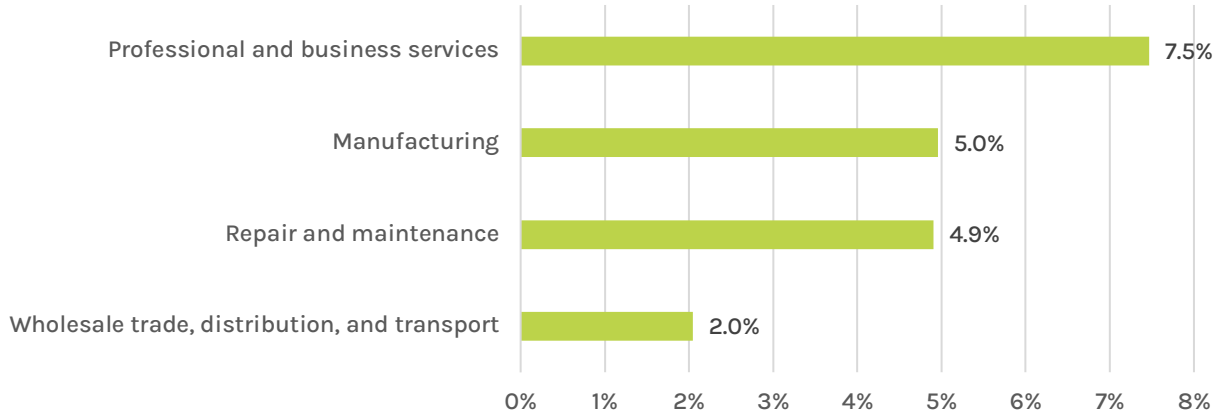
Table 36. Motor Vehicles and Component Parts Employers' Hiring Difficulty Reasons

Industry	Most Common Reason	Second Most Common Reason	Third Most Common Reason
Manufacturing	Lack of experience, training, or technical skills (50%)	Insufficient non-technical skills (work ethic, dependability, critical thinking) (27%)	Difficulty finding industry-specific knowledge, skills, and interest (23%)
Wholesale Trade, Distribution, and Transport	Insufficient qualifications (certifications or education) (47%)	Competition/small applicant pool (34%)	Lack of experience, training, or technical skills (31%)
Professional and Business Services	Lack of experience, training, or technical skills (52%)	Competition/small applicant pool (31%)	Cannot provide competitive wages (24%)
Repair and Maintenance	Lack of experience, training, or technical skills (30%)	Insufficient qualifications (certifications or education) (28%)	Difficulty finding industry-specific knowledge, skills, and interest (25%)

Employment Change by Industry

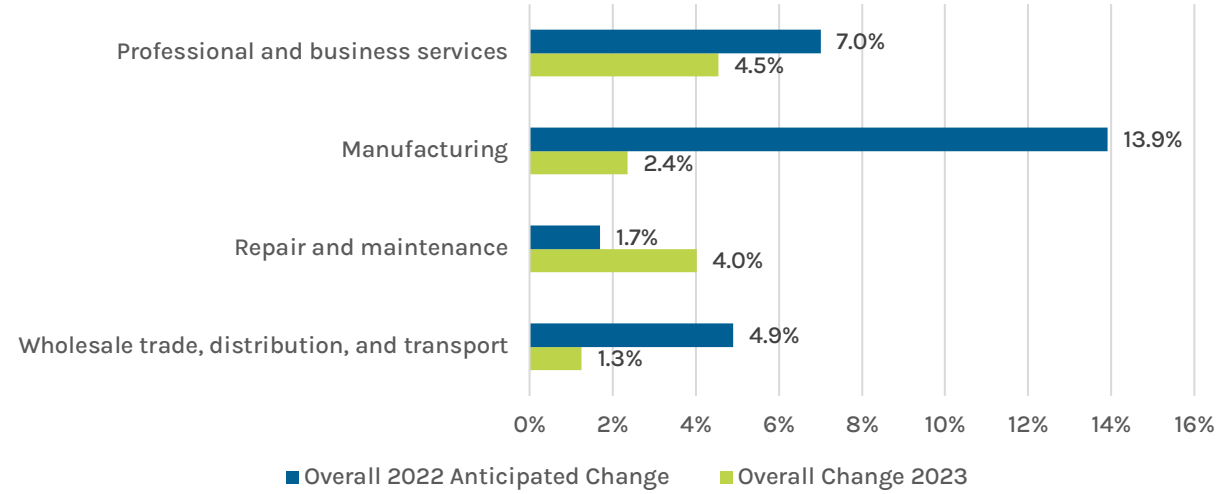
The previous section highlighted employers' current hiring difficulty across industry, whereas this section focuses on anticipated employment change by industry. This section also compares anticipated employment change in 2022 to the actual employment change over the last year. Employers across all MV & CP industries anticipate growth in 2024 (Figure 120). Expected growth across specific industries within MV & CP ranges from 2.0% in wholesale trade, distribution, and transport to 7.5% in professional and business services.

Figure 120. Motor Vehicles and Component Parts Anticipated Change in Employment, 2023-2024



Employers in professional and business services; wholesale trade, distribution, and transport; and manufacturing anticipated higher growth than what materialized in 2023, while repair and maintenance employment grew faster than expected in 2023 (Figure 121).

Figure 121. Motor Vehicles and Component Parts Actual Employment Change 2022-2023 vs. Anticipated Employment Change 2022



Motor Vehicles and Component Parts Workforce Demographics

MV & CP demographics were largely unchanged when compared to the previous year. Male workers made up 74% of the MV & CP workforce, higher than the 73% energy workforce average and the 53% national workforce average (Table 37). Female workers constituted 25% of the MV & CP workforce which was lower than both the energy workforce average (26%) and the national workforce average (47%).

The proportion of non-white workers in the MV & CP workforce (24%), was lower than the overall energy workforce average (26%) but similar to the 24% national workforce average. The percentage of Black or African American workers in the MV & CP workforce (8%) was lower than the energy workforce average (9%) and the national workforce average (13%). The proportion of workers of two or more races in MV & CP (6%) was approximately double the national workforce average (3%).

The proportion of the MV & CP workforce made up of Hispanic or Latino workers (20%) was higher than the energy workforce average (18%) and the national workforce average (19%).

The proportion of veterans in the MV & CP workforce (10%) was slightly higher than the energy workforce average (9%) and double the national workforce average (5%). The concentration of formerly incarcerated workers in the MV & CP workforce (1%) was in line with the energy workforce average (1%) but lower than the national workforce average (2%). Workers requesting accommodations for disabilities in MV & CP (2%) were represented at a similar rate to the energy workforce average (2%) but were represented at a lower rate compared to the national workforce average (5%). The proportion of workers aged 18 to 29 in MV & CP (30%) was higher than the national workforce average (22%).

The share of workers represented by a union or covered under a project labor or collective bargaining agreement in the MV & CP workforce (6%) was lower than the overall energy workforce average (11%) and the national private industry workforce average (7%).

Table 37. Motor Vehicles and Component Parts Workforce Demographics and Characteristics

	Number of Workers	Motor Vehicles Average	Energy Workforce Average	National Workforce Average
Male	1,900,305	74%	73%	53%
Female	627,193	25%	26%	47%
Gender Nonbinary	24,724	<1%	<1%	n/a
Hispanic or Latino	505,300	20%	18%	19%
Not Hispanic or Latino	2,046,922	80%	82%	81%
American Indian or Alaska Native	47,768	2%	2%	1%
Asian	132,206	5%	7%	7%
Black or African American	211,378	8%	9%	13%
Native Hawaiian or Other Pacific Islander	26,838	1%	1%	<1%
White	1,932,481	76%	74%	76%
Two or More Races	151,109	6%	5%	3%
Unknown Race	50,952	2%	2%	n/a
Veterans	259,400	10%	9%	5%
18 to 29	757,009	30%	29%	22%
30 to 54	1,240,136	49%	52%	53%
55 and Over	555,077	22%	18%	23%
Disability	44,101	2%	2%	5%
Formerly Incarcerated	31,451	1%	1%	2%
Represented by Unions, Collective Bargaining Agreements, and/or Project Labor Agreements	158,406	6%[101]	11%	7%

National sources: BLS (2023a, 2023b, 2023c, 2023d), Jobs EQ (2023), Prison Policy (2018)

[101] Unionization rates vary by state.